

# **Coordination Failure Avoided: The Role of the Treaty Port in Japan's Integration into the International Economy in the Late 19<sup>th</sup> Century**

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## **Introduction**

The long-held view that the traditional industry first grows in response to local or regional demand, and then gradually develops into the modern factory industry has been challenged for some time. One influential criticism of this view can be found in the literature on proto-industrialization. According to this literature, the principal demand for proto-industry generally came from outside the region where the industry was located, in fact it frequently came from abroad. While proto-industry is held to expand with the use of slack labour in the region, in response to the growth of demand, it does not necessarily entail the increase of productivity.<sup>1</sup> In some cases, it was not just the demand but the supply of raw material that came from outside the region.<sup>2</sup> This emphasis on the role of demand from outside the region echoes the findings of the more recent literature on the industrial revolution in England. The principal demand for the English cotton industry during the period of the industrial revolution was foreign, while its raw material, raw cotton, came entirely from overseas.<sup>3</sup> A simple message from these arguments is that the demand for the product from outside, the procurement of raw material from outside, and, after the modern industry develops, the procurement of labour from outside the region matter, and that they need to be linked to the regional market for the development of a modern industry.

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<sup>1</sup> Mendels [1972].

<sup>2</sup> Hudson [1986].

<sup>3</sup> Crafts [1986].

It is easy to see that regional and inter-regional markets can be potentially complementary to each other. In order for the proto-industry to develop into the modern industry, however, the both markets have to be *coordinated*, that is, the price changes must be adjusted simultaneously in both markets. This does not occur easily. Given that the transaction costs, for example the cost of acquiring information about the price in the respective factor market, can be high, those markets are not necessarily arbitrated at the same time. If they are not organized well and if they are not arbitrated simultaneously, it may affect the growth and development of the proto-industry. Indeed the paths of “proto-industry” regions had not been the monotone. In the case of Europe, some regions were de-industrialized, while others were industrialized within a short space of time after proto-industries had grown.<sup>4</sup> Among the possible reasons for the different outcomes seems to be coordination failure of the potentially complementary markets. In other words, if there is an efficient instrument to synchronize related markets, it could accelerate the development of the modern industry.

The hypothesis of this paper is that the treaty port of Yokohama took this coordinating role in late 19<sup>th</sup> century Japan, resulting in the development of the silk reeling industry. The Japanese modern silk reeling industry emerged in the mid-1880s and thereafter the exports of raw silk to the U.S. rose dramatically. The Japanese share in the U.S. raw silk market exceeded 50% at the end of the late 1880s, 60% in the late 1900s, 70% in the 1910s, and 80% in the 1920s.<sup>5</sup> Indeed it was in the mid-1880s that the Japanese economy started modern economic growth.<sup>6</sup> The development of the modern silk reeling industry was the first experience in Japan of a strong export industry leading economic

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<sup>4</sup> Ogilvie and Cerman [1996].

<sup>5</sup> Appendix 1. Nakabayashi [2003], pp. 473-477, Appendix: Table 5-1, 5-2.

<sup>6</sup> Minami [1994].

development, a pattern later followed by many other manufacturing industries.

As soon as Japan began to trade with Western countries under commercial treaties in 1859, traditional raw silk (Hanks: hand reeled raw silk) was exported to Europe, especially to France.<sup>7</sup> However, it had lost its competitive edge over Chinese traditional raw silk during the 1870s, and had further suffered the adverse effects of the depression in France in the mid-1880s. By contrast, the development of the American modern silk fabric industry since the late 1870s created a new international demand. This change in the structure of international demand urged the Japanese silk reeling industry to modernize itself, since the American modern fabric industry, in contrast to the French traditional one, used machine-reeled raw silk (Filature), and it would therefore be necessary to produce what was in demand in the U.S. if Japan was to switch its export destination.

At the same time, the development of the modern silk reeling industry required an efficient market of cocoon, its raw material. Railway lines were constructed in Eastern Japan from the 1880s to the 1900s, and it promoted the convergence of local cocoon markets. This convergence prompted the reorganization of sericulture, where farmers, who had been engaged both in sericulture and in hand reeling of raw silk, stopped the latter and came to supply cocoon to the modern silk reeling manufacturers.

Interestingly, this reorganization of sericulture progressed in the mid-1880s, at a time when international demand shifted from France to the U.S. There are several factors that helped boost modern industrial development at this critical moment. One of them was the falling exchange rate in the mid-1880s. The value of the yen was linked to that

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<sup>7</sup> Appendix 2. Nakabayashi [2003], pp. 478-483, Appendix: Table 6-1, 6-2.

of silver in those days, hence the falling price of silver in the mid-1880s meant the devaluation of the yen.

The conventional view of the effects of falling exchange rate has been that yen's fall depressed the price of Japanese commodities in the international market, thereby contributing to the growth of exports. This view assumes that there was a significant delay in the arbitrage of the product market. The reasoning behind this view is not difficult to see: the adjustment of price in the product market is usually substantially delayed after the exchange rate change occurs in the financial market. This view supposes that the product market is not efficient enough to immediately arbitrage price changes as a result of exchange rate fluctuations. If it had been true, however, we should also expect a delay in the inflow of information about the structural change of international market since the change of relative prices of Filature to the US and Hanks to France in the international market could not be immediately reflected in the product market within Japan, in which case the knowledge that modern silk reeling should replace traditional silk reeling would not be transmitted. Therefore, if the market had not been efficient enough, traditional raw silk manufacturers should have increased its exports by taking advantage of its devaluated price. Thus the reorganization of the silk reeling industry should have been delayed rather than prompted by the falling value of silver.

Nothing is further from what actually happened. The devaluation was immediately arbitrated by an increase of the product price, so much so that the price of Japanese raw silk in the New York market even rose in the mid-1880s. Of course, it did not mean that the entire Japanese market was efficient. The arbitrage of prices for non-tradable goods, for example, was delayed for about a few years. But, as far as the product of the modern silk reeling manufacturer is concerned, its price in the international market did not fall, and his real income rose during the fall of

the exchange rate. Therefore, reflecting the structural change of international market, the price of Filature rose more than that of Hanks, and the falling exchange rate increased the real income of the modern silk reeling manufacturers, which prompted the reorganization of sericulture.

Why did such a thing happen? The answer is simple. The market in the treaty port of Yokohama was super efficient, while the Japanese domestic market was not necessarily so. By the prescription of the treaty, all trades with foreign countries were conducted within the treaty ports, each of which consisted of a very small area. Therefore, any information about foreign trade tended to be shared by every player right away, so that the commodity price was adjusted to the change of exchange rate immediately. The domestic market was generally less efficient. However, the construction of railways integrated local cocoon markets, hence made the cocoon market more efficient. Both the integration of the market for raw materials and the changing international market were successfully communicated through the efficient treaty port market. Thus sericultural farmers near the trunk lines abolished hand silk reeling and began to supply cocoons to modern silk reeling manufacturers, responding to the increase of relative price of Filature to Hanks at Yokohama.

As Sugihara pointed out, East Asia increased the amount of trade since the 1880s and successfully utilized resources within the region after it was incorporated into the system of free trade, created and dominated by Western countries.<sup>8</sup> While the most important reason behind this success was the capabilities East Asians possessed themselves, it can be suggested that there was another factor that boosted its development, at least in Japan; the treaty port system was extremely efficient in contrast to the domestic market; hence it prompted export-oriented development.

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<sup>8</sup> Sugihara [1996].

In Section 1, the structural change of the international market will be discussed. In Section 2, the impact of change in exchange rate will be inquired. In Section 3, the convergence of cocoon market as a result of the construction of trunk lines will be examined.

## 1. The change of the international market

### 1.1 Lost comparative advantage and the French depression

Before the middle 1880s, most of Japanese raw silk was exported to France by the way of the U.K. in the early 1860s, and directly from the late 1860s. Japanese exports of raw silk increased from 548 tons in 1860 to 1,253 tons in 1862. However, it almost stopped growing around 1863, and stayed between 400 tons and 1,100 tons during the 1860s and the 1870s,<sup>9</sup> when the total raw silk imports into France increased. And this trend became even stronger in the 1870s, when the price level generally fell in the Western world. While imports to France from China rapidly increased from 801 tons in 1870 to 2,665 tons in 1880, imports from Japan, which was 399 tons in 1870, rose to 839 tons in 1880 (Appendix 2). In fact the comparative advantage of Japanese traditional raw silk over Chinese one was being lost during the 1870s, when the price level was decreasing,<sup>10</sup> though previous research had emphasized the advantage of

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<sup>9</sup> About the statistics of production, see Nakabayashi [2003], pp. 461-463, Appendix: Table 1. Sugiyama [1988] and Hunter [2003] also give good overviews.

<sup>10</sup> Suppose  $p_n^n$ : average nominal price of raw silk imported to France in year n.  $M_c^n$ : amount of raw silk imported from China to France,  $M_j^n$ : amount of raw silk imported from Japan to France, s: price index of silver in London market, and  $p_r^n = p_n/s$ : average real price of raw silk imported to France in year n. Then,

$$\begin{aligned} \log(M_c^{1872-1882}) &= -1.202 \log(p_n^{1872-1882}) + 5.287 \\ &\quad (-1.820)*** \quad R^2 : 0.269. \\ \log(M_j^{1872-1882}) &= 0.033 \log(p_n^{1872-1882}) + 2.771. \\ &\quad (0.049) \quad R^2 : 0.000. \end{aligned}$$

Japanese traditional raw silk.<sup>11</sup> Especially, the fall of price and stagnation for a few years after 1882 severely affected sericultural farmers who were engaged in hand reeling.<sup>12</sup>

Meanwhile, the price of Filature (machine reeled raw silk) in the New York market rose relative to that of Hanks (hand reeled raw silk) in the Lyon market in the 1880s, because the demand from American silk fabric industry for Filature exhibited a strong growth (Figure 1).

## 1.2 Mass production in the American silk fabric industry

The silk fabric industry in Lyon highly developed in the early 19th century and it retained the feature of “flexible specialization” as an industry for luxurious fashions using hand looms until the 1900s.<sup>13</sup> Thus, France needed various kinds of raw silk as raw materials for the silk fabric industry, ranging from Italian Filature of high quality to Asian hand reeled raw silk of low quality.

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$$\begin{aligned}\log(M_c^{1872-1882}) &= -0.809 \log(p_r^{1872-1882}) + 4.654. \\ &\quad (-0.941) \quad R^2 : 0.090. \\ \log(M_j^{1872-1882}) &= -0.071 \log(p_r^{1872-1882}) + 2.951. \\ &\quad (-0.089) \quad R^2 : 0.001.\end{aligned}$$

where between parentheses are t value and \*\*\* shows that it is significant at 5%. Thus, the nominal price elasticity of import of Chinese raw silk was negative, that is, China increased the supply of raw silk during the fall of price from 1872 to 1882. Generally speaking, it can be thought that China increased export of raw silk at decreasing price and Japan could not compete with that in the 1870s. Data source of  $p_n$ ,  $M_c$  and  $M_j$  is Appendix 2. Data source of  $s$  is “Commercial history and review of 1882”, The Economist, no. 2061, Feb 24, 1883, p.7.

<sup>11</sup> See Huber [1971] and Federico [1997].

<sup>12</sup> Nakabayashi [2003]. The financial crisis in 1882 heavily affected the trade of raw silk in Europe (“Commercial history and review of 1882”, The Economist, no. 2,061, Feb 24, 1883, p.26.), and then French economy entered the depression until 1886 (Levy-Leboyer and Bourguignon [1990], pp. 1-13.). The silk fabric industry in Lyon was also stagnant during the depression (Bouvier [1960], pp. 235-249.).

<sup>13</sup> Duran [1913], pp. 72-77. Rawlley, Ratan C., The silk industry and trade, London, P. S. King & Son, Ltd., 1919, pp. 66-73. Piore and Sable [1984], pp. 28-35. Cottureau [1997]. Federico [1997], p. 77. In France, there were 100,000 handlooms and 18,230 power looms in 1880, and 56,000 handlooms and 30,000 power looms in 1900. Federico [1994], p.474.

The American fabric industry, by contrast, began to produce goods for mass consumption in earnest in the late 1870s. As power throwing machines and power looms rapidly prevailed, the factory system equipped for mass production was established.<sup>14</sup> The American silk fabric industry kept up with the fashion in New York, as the French counterpart worked with the fashion in Paris. The American modern silk fabric industry, however, responded to new modes of fashion by creating a basic combination of colours and textures, which could be manufactured by the factory system. It was thus not necessary to resort to the putting-out system, with the use of hand-weavers, as was the case in France.<sup>15</sup> In addition, the industry pursued “the uniformity of goods” for mass consumption,<sup>16</sup> and low-skilled male workers were replaced by unskilled female workers.<sup>17</sup> Therefore, the American silk fabric manufacturers did not value hand-reeled Hanks, which was not suitable for power throwing machines and power looms, and actively sought less expensive Filature with even threads.<sup>18</sup>

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<sup>14</sup> Wyckoff, WM. C., *The silk goods of America: a brief account of the recent improvements and advances of silk manufacture in the United States*, published under the auspices of the Silk Association of America, New York, D. Van Nostrand, Publisher, 1879, pp. 8, 29-30. In the U.S., there were 5,321 power looms and 3,153 handlooms in 1880, and 44,257 power looms and 173 handlooms in 1900. Department of the Interior, Census Office, *Report on the manufacturers in the United States at the tenth Census (June 1, 1880)*, Washington, Government Printing Office, 1883, pp. 928-929. Department of the Interior, Census Office, *Twelfth Census of the United States, taken in the year 1900, manufacturers part 3, special reports on selected industries*, Washington, Government Printing Office, 1902, 206.

<sup>15</sup> Wyckoff, *The silk goods of America*, pp. 8-9. D. George Dery, “Silk: a fabric of general use”, *The American silk journal*, vol. 37, no. 8, Aug 1918, p. 40.

<sup>16</sup> Wyckoff, *The silk goods of America*, p. 8.

<sup>17</sup> The Senate of the United States, *Report on condition of woman and child wage-earners in the United States*, vol. 9: history of women in industry in the United States, Washington, Government Printing Office, 1910, p.10. Mason [1910], pp. 130-131. Clark [1929], pp. 210-215. Matsui [1930], pp. 131-153. On differentiation of wages between female and male workers in the American silk fabric industry in the 1900s, see Aldrich and Albelda [1980], pp. 329-340.

<sup>18</sup> Wyckoff, *The silk goods of America*, pp. 25-27. WM. C. Wyckoff, “Report on the silk manufacturing industry of the United States”, Department of the Interior, Census Office, *Report on the manufactures of the United States at the tenth Census (June 1, 1880)*, Washington, Government Printing Office, 1883, p.18.



### 1.3 The rise of a modern silk reeling industry and the reorganization of sericulture

This increase of demand for even Filature led to a sharp rise of its relative price in 1885-1886 (Figure 1). It shows there was a gap between the sharply increasing demand and the supply, which meant an opportunity for suppliers to acquire some rent. This gap was accurately found in the Yokohama market. The behaviour of prices in New York and Lyon meant a sharp rise in the relative price of Filature to Hanks in 1885-1886. Accordingly, price of Filature relative to Hanks in the Yokohama market rose (Figure 2).

Grasping the increase of demand in the U.S., the modern silk reeling industry developed in Suwa County of Nagano Prefecture in Central Japan from the mid-1880s. Though respective reeling factories were equipped with only a few dozens of basins,<sup>19</sup> the silk reeling manufacturers organized cooperatives and established re-reeling factories. They cooperatively re-reeled raw silk, systematically inspected its quality, put the chop (trademark) of the cooperative on it, and shipped it to Yokohama. They guaranteed a particular quality by putting their chops, to acquire the quality premium. In 1884, exports of raw silk from Japan to the U.S. exceeded exports to France, and production and exports of Filature increased rapidly since.<sup>20</sup> The Japanese share of the U.S. raw silk market reached over 50% in 1887 (Appendix 1). The opportunity to take rent clearly prompted the rapid development of the modern silk reeling industry.

Meanwhile, sericultural farmers, engaged in hand reeling, suffered from the French depression and the deflationary policy by the government, which coincided it.<sup>21</sup> They then stopped hand-reeling, and began to supply

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<sup>19</sup> One basin was operated by one reeling worker.

<sup>20</sup> Filature amounted to 31 % of total export of raw silk in 1880, and 50 % in 1889. Nakabayashi [2003], pp. 96-97.

<sup>21</sup> The Japanese government had adopted deflationary policy, that is, decreasing base money and increasing tax, for the transfer of income to the government sector. Patrick

cocoons as raw materials for the modern silk reeling industry.

Interestingly, a considerable portion of rent from a sharp increase of demand for Filature was shared by sericultural farmers. In the mid-1880s, the supply of cocoons became more profitable than the supply of traditional raw silk after hand reeling, and the gap in profits between the supply of cocoons and the hand reeling became significant enough to be widely noticed by the end of 1886 (Table 3). This rent encouraged sericultural farmers to switch quickly from hand reeling to the supply of cocoons in the areas where the modern silk reeling manufacturers could reach and buy cocoons.<sup>22</sup> The development of the modern silk reeling industry coincided with the reorganization.

This reorganization appears to have been accelerated by two conditions. The first was obviously the rent from the gap between the prices of Filature and Hanks in the international market or, more correctly, the relative price of Filature to Hanks in the international market being immediately reflected in the Yokohama market. Otherwise, the Japanese silk manufacturers and sericultural farmers would not have recognized the structural change of the international market, and would have failed to acquire the rent from the change. Hence the reorganization would have been delayed. The second condition was the fall of the price of silver in the international market, which has not been discussed so far. Japan was effectively under the silver standard from 1871 to 1897, and thus the fall of the price of silver meant the fall of the exchange rate against the U.S. and European countries, most of which were under the gold standard by that time. This fall of the exchange rate resulted in inflation, led by

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[1965], pp.202-205.

<sup>22</sup> In Chubu/Nishi Kanto area, which is neighboring to Nagano Prefecture, the production of cocoons dropped to 32,165 kiloliter and the production of raw silk dropped to 728 tons in 1885 affected by the French depression. In 1889, though the production of raw silk recovered to 60,388 kiloliter, which was 188% of the production in 1885, the production of raw silk was 1,182 ton, 162% of the production in 1885 (Appendix II). The reorganization began in this area and farmers came to supply cocoons to the silk reeling manufacturers outside of their region.

tradable goods represented by raw silk. It is important to recognize, however, that the main effect of the falling Yen was not a depreciated price of Japanese raw silk in the international market, which has been asserted by those who hold conventional views. In fact the fall of Yen was immediately arbitrated by a rise of raw silk price in the treaty port of Yokohama. The positive effect of falling Yen, therefore, was the price of raw silk sharply rising against the non-tradable goods in the Japanese domestic market, which meant the increase in the real income of silk reeling manufacturers and sericultural farmers. In addition, this super efficiency of the treaty port market, which brought about the immediate arbitrage, was a necessary condition for the first condition that the relative price in the international market was simultaneously reflected in the Yokohama market. The next section deals with this issue.

## **2. An influence of inflation**

### **2.1 Structure of a treaty port**

Almost all of raw silk exports were traded in a treaty port, Yokohama. As prescribed in the treaty between Japan and Western countries, foreign people were prohibited from doing any business outside the concessions. Therefore, Japanese wholesale merchants and Western trading companies gathered inside a very small space of the concessions in Yokohama. Silk reeling manufacturers shipped their products to wholesale merchants there, and they in turn sold them to Western trading companies in the concessions. In addition, the ten big Japanese wholesale merchants and the ten big Western trading companies dealt with 90% of all the raw silk exported to Western countries.<sup>23</sup>

Thus, the number of players gathered in a very small space was small, and they dealt with almost all raw silk exported from Japan. It

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<sup>23</sup> Ikawa [1991].

meant information about the raw silk trade came to be immediately possessed in common among all the players. In other words, the raw silk market of Yokohama was extremely efficient under the treaty port system.

## 2.2 Immediate arbitrage of fluctuating exchange rate

Because of the fall in the price of silver, the exchange rate dropped for the period of about 1885-1886 and also for 1893-1894 (Figure 4). The fall in 1885-1886 is especially important for the understanding of how it effected the rise of modern industries after 1887. Researchers have previously assumed that the falling price of silver depressed the relative price of Japanese exports in the international market, and this prompted the growth of Japanese exports, which in turn inspired the modern economic growth. They have thought that the arbitrage by the price in the market of real commodities was delayed for a considerable period after a change in the foreign exchange market took place.<sup>24</sup> However, they have not presented any quantitative evidence based on data of the price of exports and exchange rate to prove this hypothesis of “the relative price lowered by the falling exchange rate”.

In the long term, this hypothesis obviously does not hold. For instance, the terms of trade had improved from the 1880s to the 1890s, while it deteriorated in the 1900s, when Japan was under the gold standard.<sup>25</sup> Moreover, the world prices of raw silk converged during the period from the late 1860s to the late 1930s, which meant the prices of raw silk from Japan and China, both of which were under the silver standard, did not deviate from the international price in the 1880s and the 1890s.<sup>26</sup> Those evidences show that the export price was adjusted to the change in the foreign exchange market in the long term.

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<sup>24</sup> Nugent [1973], pp. 1122-1129. Nakamura [1971], pp. .

<sup>25</sup> Shinohara [1961], pp. 275-351. Yamazawa and Yamamoto [1979], pp. 85-89. Japan joined the gold standard in October, 1897.

<sup>26</sup> Ma [1996], pp. 347-352.

Therefore, what remains to be clarified is whether the change in the foreign exchange market was arbitrated by the change of the price of exports or not in the short term. If it was delayed, the hypothesis that falling exchange rate did depress the relative price of exports from Japan can be thought of as true. If, on the other hand, arbitrage was sufficiently rapid, the hypothesis can be considered as fault, hence the only effect of the change in the exchange rate would have been the inflation led by exportable goods in the domestic market.<sup>27</sup> Since raw silk was the most important export of Japan, an examination of the short-term effect of exchange rate on the price of raw silk is essential for the understanding not only of the development of the modern silk reeling industry but also of the beginning of modern economic growth of Japan.

Now suppose  $E^t$ : the foreign exchange rate of Japanese Yen against the US dollar (dollar par 100 yen) in time  $t$ ;  $P_j^t(E^t)$ : the price of Japanese raw silk as a function of  $E^t$ ;  $P_w^t$ : the level of the price of raw silk in the international market, independent from  $E^t$ . Then,  $P_r^t(E^t)$ : the relative price of Japanese raw silk in the international market, is defined as follows:

$$P_r^t(E^t) = E^t P_j^t(E^t) / P_w^t \quad (1)$$

And  $e^t(E^t)$ : the exchange rate elasticity of  $P_r^t(E^t)$  as a function of, is defined as follows:

$$e^t(E^t) = \left[ \partial P_j^t(E^t) / \partial E^t \right] / \left[ E^t / P_j^t(E^t) \right] \quad (2)$$

When  $E^t$  changes, the direction of change of  $P_r^t(E^t)$  can be shown from (1) as follows,

$$\begin{aligned} \partial P_r^t(E^t) / \partial E^t &= \left[ P_j^t(E^t) + E^t \left[ \partial P_j^t(E^t) / \partial E^t \right] \right] / P_w^t \\ &= [1 + e^t] \left[ P_j^t(E^t) / P_w^t \right] \end{aligned} \quad (3)$$

Therefore, if and only if arbitrage of change of  $E^t P_j^t(E^t)$  is sufficiently slow, or equivalently, the value of (3) is negative, thus,

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<sup>27</sup> Nugent [1973], p. 1113.

$$-1 < e^t \quad (4)$$

then the direction of change of  $P_r^t(E^t)$  coincides with the direction of change of  $E^t$ . That is, the relative price of Japanese raw silk in the international market  $P_r^t$  also decreases when  $E^t$  decreases, and thus does hold the hypothesis of “the relative price lowered by the falling exchange rate”.

If  $e^t > 0$ , then  $P_j^t$  would fall when  $E^t$  falls. The hypothesis of “the relative price lowered by the falling exchange rate”, however, does not think about such a dumping. Thus, in order for the hypothesis to hold,  $e^t$  must satisfy

$$-1 < e^t < 0 \quad (5)$$

Now we show whether (5) holds or not, by using the weekly data of price of raw silk and exchange rate.

The trend of the foreign exchange rate from January 1880 to September 1897, when Japan was under the silver standard, can be separated into nine terms below. In addition, the relationship between the foreign exchange rate and the price of raw silk during the term from October 1897 to December 1903, when Japan was under the gold standard, is examined to compare with the term under the silver standard.

**1<sup>st</sup> January 1880 to December 1880: sharply fluctuating.**

**2<sup>nd</sup> January 1881 to December 1881: stable.** Because trade of raw silk was almost stopped by the dispute about Niazukarisho (Trading and Inspection House of Raw Silk in Yokohama),<sup>28</sup> this term should be separated from the period before and after.

**3<sup>rd</sup> January 1882 to December 1884: stable.**

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<sup>28</sup> The trade association of Japanese wholesale merchants, backed by the Japanese government, required that all trade of raw silk be dealt in “Niazukarisho”, a Conditioning House established by the association. Western trading companies and consuls of Western countries opposed to that because they thought it violated the principle of free trade under the trade. At last, the opposition by Western trading companies succeeded and Niazukarisho was abolished.

- 4<sup>th</sup> January 1885 to August 1886: falling.**
- 5<sup>th</sup> September 1886 to March 1890: stable.**
- 6<sup>th</sup> April 1890 to December 12: sharply fluctuating** (because of the U.S. Sherman Silver Purchase Act).
- 7<sup>th</sup> January 1891 to December 1893: falling.**
- 8<sup>th</sup> January 1894 to December 1895: sharply fluctuating.**
- 9<sup>th</sup> January 1896 to September 1897: falling.**
- 10<sup>th</sup> October 1897 to December 1900: stable under the gold standard.** In order to limit the effect of fluctuating raw silk price during the recession of the U.S. economy in 1900, it is best for this term to be separated from the next term.
- 11<sup>th</sup> January 1901 to December 1903: stable under the gold standard.**

Table 1 shows elasticity  $e^t$  given by regression of  $\log(P_j^t)$  to

$\log(E^t)$ .

During terms 1, 6, 8, when the exchange rate was sharply fluctuating, the price of raw silk and the exchange rate were not correlated. In term 2, when the raw silk trade was almost stopped, there was no correlation between them either.

On the other hand, in terms 4, 7, 9, when the exchange rate was falling,  $e^t < -1$ . Thus, (4) and (5) did not hold when the exchange rate fell, which means the change in the foreign exchange market was followed by the price of raw silk within a week. However,  $e^t$  should satisfy  $e^t = 1$  in case of just arbitrage. Thus  $e^t < -1$  means that  $P_j^t$  even overshoot.

In terms 3, 5, when the exchange rate was stable, and in terms 10, 11 when the exchange rate was stable under the gold standard,  $0 < e^t$ , which does not satisfy (5) at all. This means that  $P_j^t$  and  $E^t$  moved in the

same direction. When the trade of raw silk is active, the amount of trade increases and the price rises. The Yokohama financial market, however, was not efficient enough to absorb this rapid increase of drawing documentary bills for exports in this period. Thus, when the silver price in the international market was stable, the foreign exchange rate rose with the raw silk price. This can be seen in the 3<sup>rd</sup> term January 1882 to December 1884 and the 5<sup>th</sup> term September 1886 to March 1890 in the Figure 5. In the 3<sup>rd</sup> term  $E^t$  rose by the rise of  $P_j^t$  with elasticity  $l^t = 1/e^t = 0.502$ , and in the 5<sup>th</sup> term with  $l^t = 0.320$  (Table 1).

The fall of foreign exchange rate was immediately arbitrated by the rise of raw silk price, and a new equilibrium was soon reached. We can find such a dynamic arbitrage taking place, for instance, during the 4<sup>th</sup> term, moving an equilibrium from the area prevalent in the 3<sup>rd</sup> term to another area which prevailed in the 5<sup>th</sup> term (Figure 5). In contrast to the assumption behind the conventional ideas, the arbitrage by the price of goods was sufficiently fast, because of the efficiency in the price mechanism within the treaty port.

On the other hand, in contrast also to the conventional ideas, the foreign exchange market was not efficient enough to arbitrage the rapid increase of trade in upbeats. In fact arbitrage in the international financial market was slower than that in the market of real exports. This inefficiency was gradually overcome by the development of the international financial market, centred on London, and the participation of the Yokohama Specie Bank, which was a huge foreign exchange bank invested by the Japanese government, in this market.<sup>29</sup> Thus the elasticity  $l^t$  became smaller (Table 1), which suggests the foreign exchange market gradually became more efficient.

Therefore, the hypothesis of “the relative price lowered by the lowering exchange rate” no longer holds, and the only effect from the fall

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<sup>29</sup> Saul [1960]. Ishii [1994].



of the foreign exchange rate in the 1880s was the inflation led by export commodities. This effect was important for the reorganization of sericulture.

### 2.3 An influence of the inflation led by export sectors

The domestic market outside the treaty port was not so efficient, while the treaty port market was extremely efficient. It is easy to see that it could result in inflation led by the tradable goods, if the exchange rate falls. It indeed did. The Japanese economy experienced the inflation affected by the falling exchange rate; The price of Filature led consumer prices with the lag of a few years (Figure 6). It follows that silk reeling manufacturers and sericultural farmers enjoyed the increased real income. Given that the relative price of Filature proper rose in Yokohama (Figure 2) and sericultural farmers who supplied cocoons to silk reeling manufacturers shared some portion of the rent from the change of relative price (Figure 3), the inflation should indeed have boosted not just the expansion of sericulture, but should have accelerated the reorganization of sericulture.

## **3. The integration of cocoon markets**

### 3.1 Convergence of prices

Exactly since the late 1880s, local cocoon markets in Eastern Japan converged (Figure 7). The rise of modern silk reeling industry entailed the integration of cocoon markets. It was related to a unique aspect of Japanese sericulture. In Italy, silk reeling factories were dispersed and silk reeling manufacturers procured cocoons from markets close by. In Japan, by contrast, silk reeling factories were concentrated in areas such as Suwa, while sericulture prevailed across the whole of Eastern Japan. In other words, the Japanese silk reeling industry was based on the mass procurement of material and on the mass production of raw silk, while the

Italian counterpart retained a more moderate rural industry.<sup>30</sup> This had been the case in Japan since the late 1880s, when the modern silk reeling industry began to develop.

### 3.2 Construction of railway lines

A necessary condition for the integration of local cocoon markets was the construction of trunk lines by a private company, Japan Railways Ltd. and the government in Eastern Japan since the 1880s. The integration there did not mean that the trunk lines of Japan Railways and the National Railways connected local markets themselves. Rather, local markets of cocoons were linked to silk reeling districts outside their regions. Links to Suwa County of Nagano prefecture were especially important. In every section of Japan Railways Line and the National Railways Line Eastern Japan, except for Nagano, shipment of cocoons exceeded their arrival, and this trade gap expanded in the 1900s. The trunk lines became channels for cocoons to flow from rural areas to Suwa.<sup>31</sup>

### 3.3 Reorganization of sericulture districts

Those distribution channels shaped the geographical structure of sericulture. In the early 1880s, facing with the depression of France, production of cocoons and raw silk decreased in all areas. Since the mid 1880s, however, production of raw silk had exceeded that of cocoons in Nagano prefecture, while production of cocoons had surpassed that of raw silk in growth in other areas, which came to be specialized in the supply of material rather than modern silk reeling (Appendix III). Building railways clearly progressed the integration and specialization of Japanese sericulture.

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<sup>30</sup> Federico [1997].

<sup>31</sup> Nakabayashi [2003], pp. 124-134.

## Conclusion

It is worth noting that all relevant factors discussed above, that is, the rise of modern silk reeling industry, reorganization of sericulture, and the integration of local cocoon markets coincided with the period, the mid-1880s, when the structure of international market changed in earnest. Each phenomenon was not particularly surprising, but it is impressive that their simultaneous emergence was well coordinated. The Japanese raw silk reached the 50% share in the US market within the space of a few years. For this marvellous experiment to materialize, an excellent processing of information in the treaty market, the crossroad of silk trade, was critical.

North and Thomas [1973] emphasized the importance of institutions, which enables the “invisible hand” to work. They argued that in order for the market, which is close to perfection assumed by Adam Smith, to work, institution matters, and that if an institution does not work properly, the rent-seeking behaviour could bias the direction of growth. The market, however, is always imperfect, and there exists an opportunity to seek rent everywhere, even in the modern economy. Indeed, rent-seeking behaviour always determines the direction of development, not only in unsuccessful economies, but also in successful ones. The difference between them lies in that rent-seekers are properly coordinated in the latter.<sup>32</sup> In other words, in order to avoid coordination failure, there needs to be some place where the rent is efficiently allocated. As Hudson [1896] pointed out, a well organized regional community could satisfy this necessity, and proto-industrial areas without such a function might lead to coordination failure and underdevelopment. In the case of Japan, a well established institution of the treaty port imposed by Westerners took this role, and it probably worked better than they had expected.

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<sup>32</sup> Aoki [2001].

## Bibliography

### Statistics

Direction generale des douanes et des contribution indirects, *Tableau general du commerce de la France avec ses colonies et les puissances etrangeres*, Paris, Imprimerie Nationale.

Teishinsho Tetsudokyoku (Agency of railways, Ministry of Transportation and Telegram), *Tetsudokyoku nenpo* (Annual report of Agency of Railways), Tokyo, Tetsudokyoku.

Yamazawa, Ippei and Yuzo Yamamoto, *Choki keizai tokei 14: boeki to kokusaishushi* (Long term economic statistics 14: trade and international balance of payments), Toyo Keizai Shinposha, 1979.

### Serials and newspapers

*The Economist*, London.

### Reports

Department of the Interior, Census Office, *Report on the manufacturers in the United States at the tenth Census (June 1, 1880)*, Washington, Government Printing Office, 1883.

Department of the Interior, Census Office, *Twelfth Census of the United States, taken in the year 1900, manufacturers part 3, special reports on selected industries*, Washington, Government Printing Office, 1902.

Minami, Ryoshin, translated by Ralph Thompson, Kumie Fujimori and Ryoshin Minami with assistance from David Merriman, *The economic development of Japan: a quantitative study*, 2nd ed., Basingstoke, Macmillan, 1994.

Rawley, Ratan C., *The silk industry and trade*, London, P. S. King & Son, Ltd., 1919.

Wyckoff, WM. C., *The silk goods of America: a brief account of the recent improvements and advances of silk manufacture in the United States*, published under the auspices of the Silk Association of America, New York, D. Van Nostrand, Publisher, 1879. Entered according to Act of Congress, in the year 1879, by WM. C. Wyckoff, in the Office of the Librarian of Congress at Washington.

### Research works

Aldrich, Mark and Albelda, Randy, "Determinants of working women's wage during the progressive era", *Explorations in economic history*, vol. 17, no. 4, pp. 323-341, 1980.

Ashton, T. S., *The industrial revolution 1760-1830*, Oxford, Oxford University Press, 1996.

Bell, Lynda S., *One industry, two Chinas: silk filatures and peasant-family production in Wuxi County, 1865-1937*, Stanford, Stanford University Press, 1999.

Berg, Maxine and Pat Hudson, "Rehabilitating the industrial revolution", *Economic history review*, vol. 45, no. 1, pp. 24-50, 1992.

Bouvier, Jean, *Le Krach de L'union Générale 1878-1885*, Presses universitaires de France, Paris, 1960.

Clark, Victor S., *History of manufactures in the United States*, volume 3 1893-1928, McGraw-Hill, New York, 1929.

Cottureau, Alain, "The fate of collective manufactures in the industrial world: the silk industries of Lyons and London, 1800-1850", translated by Cyprian Blamires Charles F. Sable and Jonathan Zeitlin, *World of possibilities: flexibility and mass production in western industrialization*, Cambridge, Cambridge University Press, pp. 75-152, 1997.

Crafts, N. F. R., *British economic growth during the industrial revolution*, Oxford, Oxford University Press, 1985.

- Federico, Giovanni, *Il filo d'oro: L'industria mondiale della seta dalla restaurazione alla grande crisi*, Venezia, Marsilio, 1994.
- Federico, Giovanni, *An economic history of the silk industry, 1830-1930*, Cambridge, Cambridge University Press, 1997.
- Huber, J. Richard, "Effect on prices of Japan's entry into world commerce after 1858", *Journal of political economy*, vol. 79, no. 3, pp. 614-628, 1971.
- Hudson, Pat, *The genesis of industrial capital: a study of the West Riding wool textile industry c. 1750-1850*, Cambridge, Cambridge University Press, 1986.
- Hunter, Jannet, *Women and the labour market in Japan's industrialising economy: the textile industry before the Pacific War*, London, Routledge, 2003.
- Ishii, Kanji, "Japanese trade and the Yokohama Specie Bank," Olive Chekcland, Shizuya Nishimura, Norio Tamaki, eds. *Pacific Banking, 1859-1959*, London, St. Martin's Press., 1994.
- Ikawa Katsuhiko, "1880 nendai no kiitourikomisho: kiitourikomikiji shuukei kekka kara" (Wholesale merchants of raw silk in the 1880s: from adding up trades on newspapers), *Yokohama kaiko shiryō kan kiyo* (Journal of Yokohama City Archive), Yokohama City Archive, no. 9, 1991.
- Levy-Leboyer, Maurice and Francois Bourguignon, translated by Jesse Bryant and Virginie Perotin, *The French economy in the nineteenth century: an essay in econometric analysis*, Cambridge, Cambridge University Press, 1990.
- Ma, Debin, "The modern silk road: the global raw-silk market, 1850-1930", *The journal of economic history*, vol. 56, no. 2, pp. 330-355, 1996.
- Mason, Frank R., *The American silk industry and the tariff*, Cambridge, MA., American Economic Association, 1910.

- Matsui, Shichiro, *The history of the silk industry in the United States*, New York, Howes, 1930.
- Mendels, Franklin F., "Proto-industrialization: the first phase of the industrialization process", *The journal of economic history*, vol. 42, no. 1, pp. 241-261, 1972.
- Nakabayashi, Masaki, *Kindai shihonshugi no soshiki: seishigyo no hatten ni okeru torihiki no tochi to seisan no kozo* (An organization in the modern capitalism: the governance of trade and the structure of production in the silk reeling industry), Tokyo, University of Tokyo Press, 2003.
- Nakabayashi, Masaki, "The rise of a factory industry: silk reeling in Suwa district", Masayuki Tanimoto with Osamu Saito ed., *The role of traditional factors in Japanese industrialisation 1880-1920*, Oxford, Oxford University Press, forthcoming.
- North, Douglass C. and Robert Paul Thomas, *The rise of the western world*, Cambridge, Cambridge University Press, 1973.
- Nugent, Jeffrey B., "Exchange-rate movements and economic development in the late nineteenth century", *The Journal of political economy*, vol. 81, no. 5, pp. 1110-1135, 1973.
- Ogilvie, Sheilagh C. and Markus Cerman, eds, *European proto-industrialization*, Cambridge, Cambridge University Press, 1996.
- Patrick, Hugh T., "External equilibrium and internal convertibility: financial policy in Meiji Japan", *The journal of economic history*, vol. 25, no. 2, pp. 187-213, 1965.
- Piore, Michael J. and Charles F. Sable, *The second industrial divide: possibilities for prosperity*, Basic Books, 1984.
- Saul, S.B., *Studies in British overseas trade, 1870-1914*, Liverpool, Liverpool University Press, 1960.

Shinohara, Miyoei, *Nihonkeizai no seicho to junkan*( The growth and cycle of Japanese economy), Sobunsha, 1961.

Sugiyama, Shinya, *Japan's industrialization in the world economy, 1859-1899: export trade and overseas competition*, London, The Athlone Press, 1988.



## Tables and Figures

Figure 1 Relative Price of *Filature* :  
(Japan *Filature* No.1 in New York) / (Japan *Hanks* in Lyon)

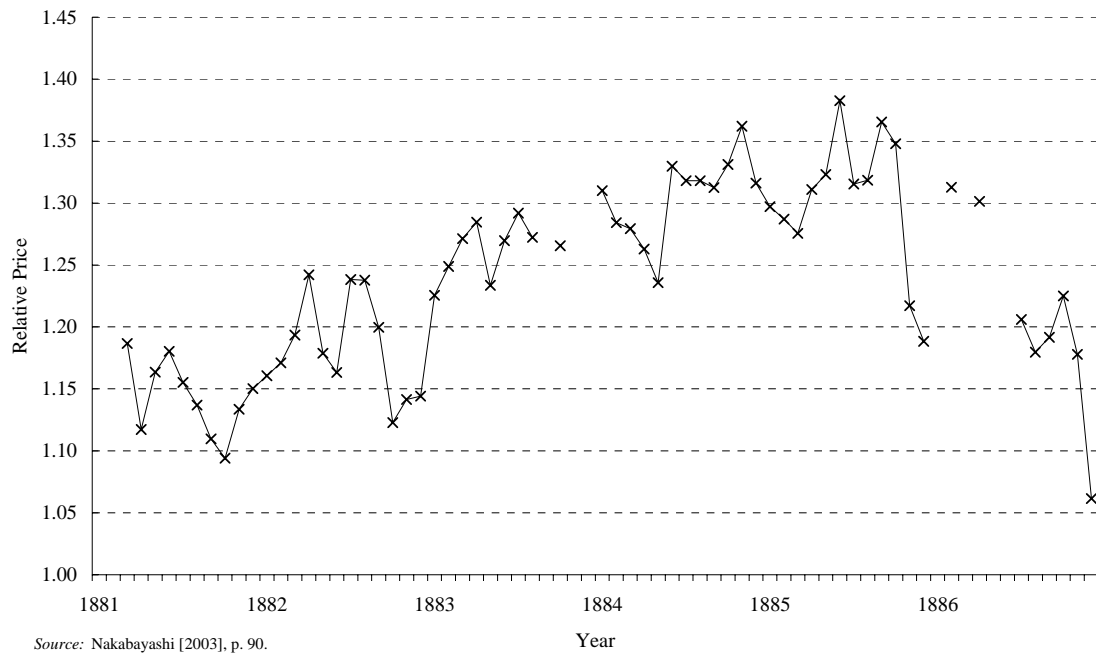


Figure 2 Relative Price of *Filature* : (Filature in Yokohama) / (Hanks in Yokohama)

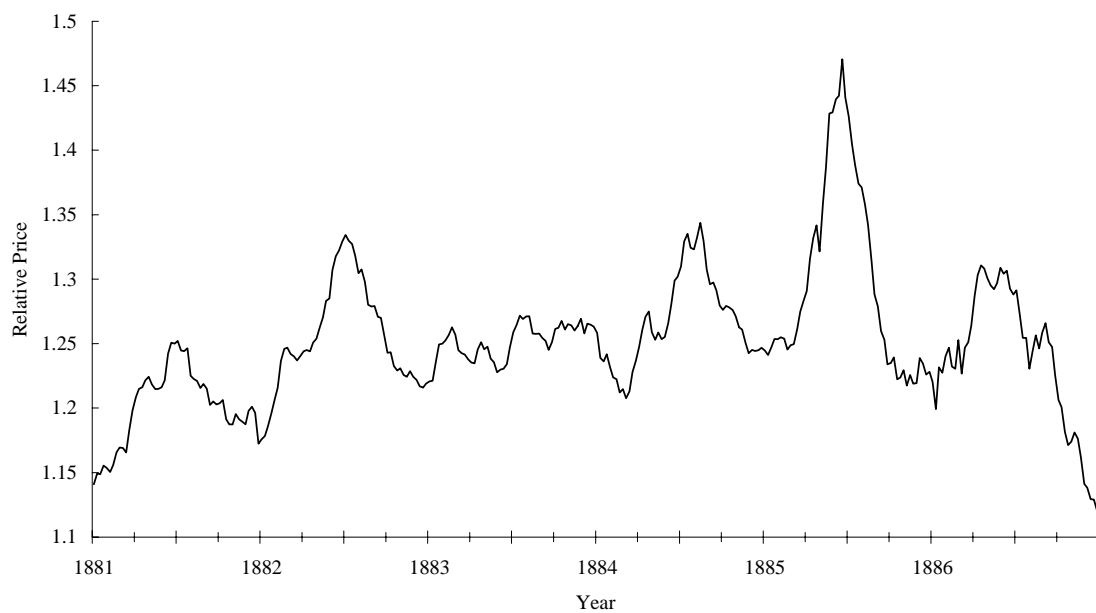
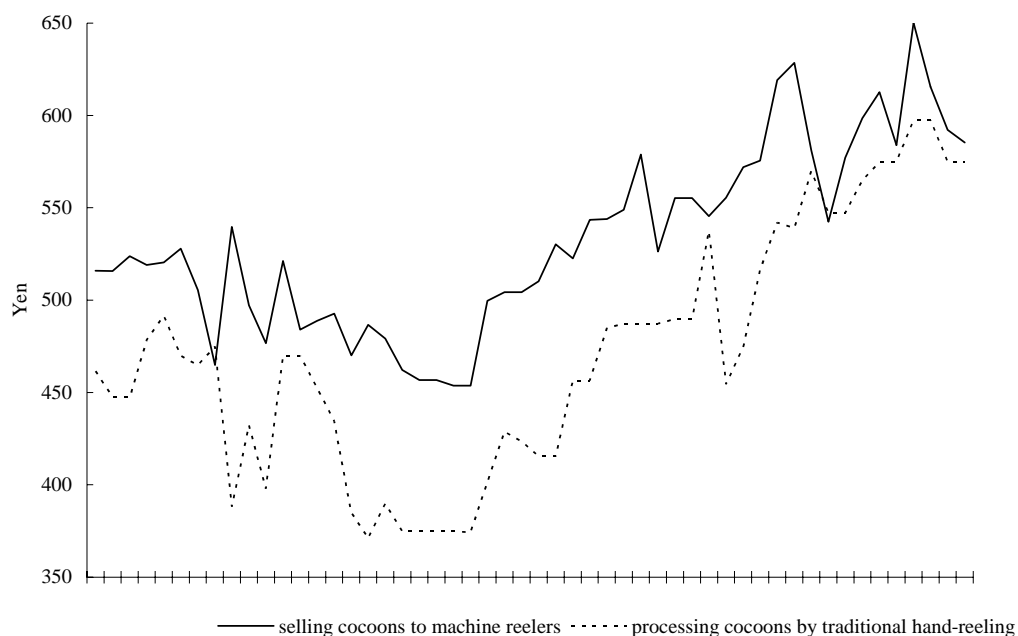


Figure 3 Gross Margins of Pesants per 1 picul (60kg) of Silk in 1886



Source: Nakabayashi 2003, p. 100.

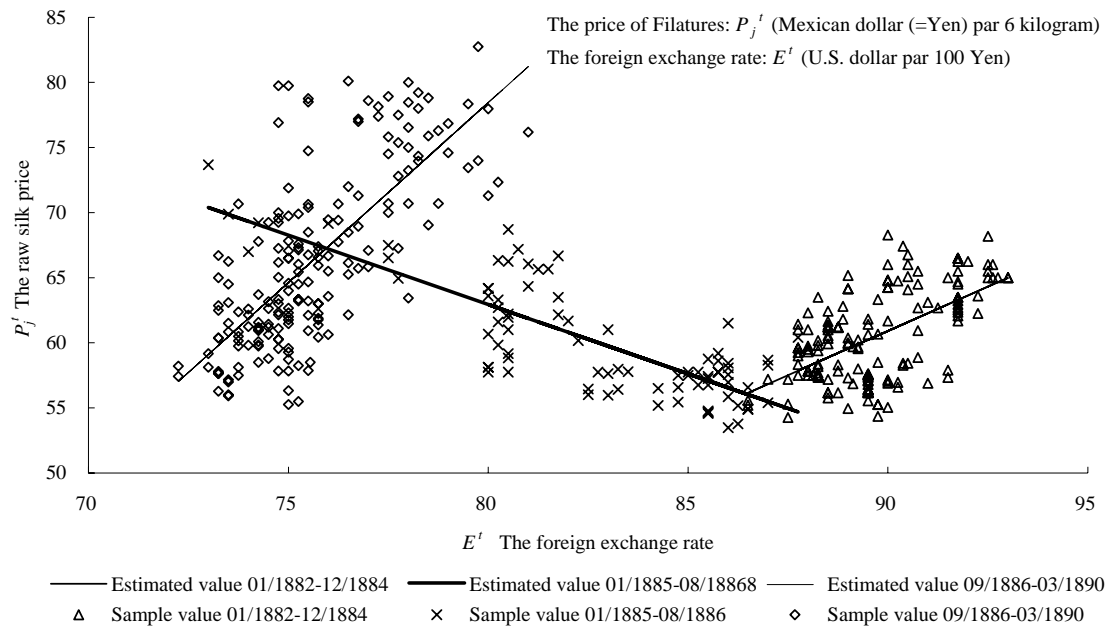
Figure 4 Foreign exchange rate in the Yokohama market (US dollar par 100 Yen, weekly data, 1880-1897)



Source : Nakabayashi [2003], p. 36.

Note : Weekly data.

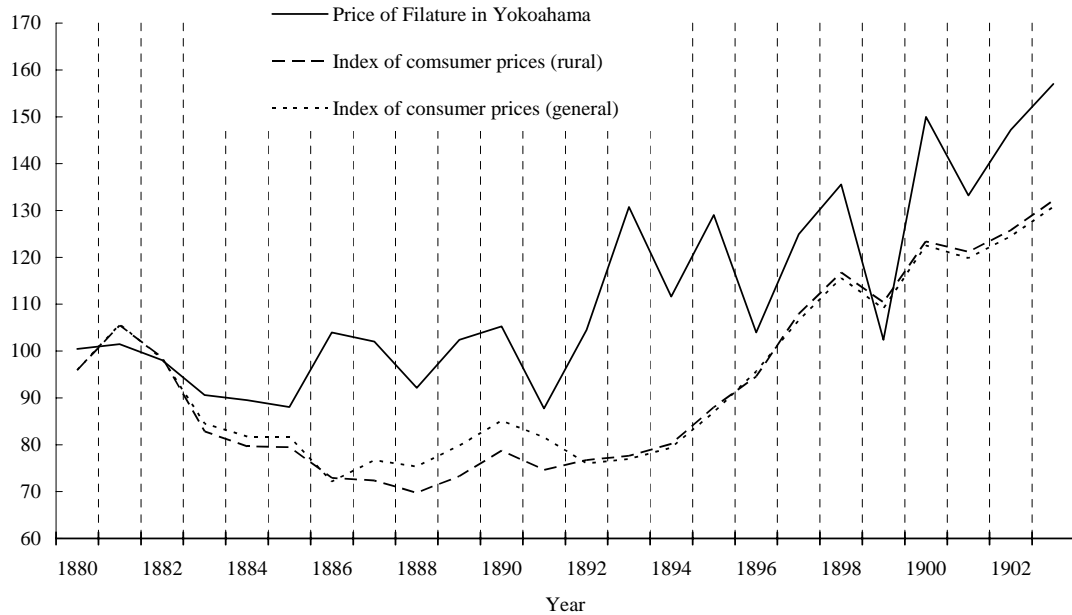
Figure 5 The correlation between the foreign exchange rate and the raw silk price in the Yokohama market



Source : Nakabayashi [2003], p. 108.

Note : Weekly data of January 1882-March 1890

Figure 6 Price of Filature and the index of consumer price average in 1880-1882=100



Source : Nakabayashi [2003], p.113.

Note : Yearly data.

Figure 7 Coefficient of variation of cocoon prices in East Japan



Source : Nakabayashi [2003], p. 135.

Note : Yearly data.

Table 1 The relationship between the price of *Filature* (machine reeled raw silk) and the foreign exchange rate in Yokohama:1880-1903  
 $\log(P_j^t) = e^t \log(E^t) + \log(a^t)$

term		$a^t$	estimated elasticity $e^t$	$l^t = 1/e^t$	Number of sample	$R^2$	Standard error	F value
1st	January 1880 - December 1880 <i>t</i> statistics	-0.237	1.558 1.717***		52	0.056	0.044	2.948
2nd	January 1881 to December 1881 <i>t</i> statistics	-0.294	1.594 1.242		52	0.030	0.025	1.542
3rd	January 1882 to December 1884 <i>t</i> statistics	-1.105	1.990 8.765*	0.502	156	0.333	0.020	76.823
4th	January 1885 to August 1886 <i>t</i> statistics	5.455	-1.397 -3.521*		86	0.646	0.019	153.579
5th	September 1886 to March 1890 <i>t</i> statistics	-3.046	3.122 14.058*	0.320	185	0.519	0.030	197.640
6th	April 1890 to December 1890 <i>t</i> statistics	3.431	-0.320 3.146*		39	0.056	0.030	2.185
7th	January 1891 to December 1893 <i>t</i> statistics	5.214	-1.290 -2.563**		154	0.462	0.063	130.271
8th	January 1894 to December 1895 <i>t</i> statistics	2.025	0.507 2.284*		101	0.050	0.039	5.217
9th	January 1896 to September 1897 <i>t</i> statistics	5.364	-1.455 -3.089*		90	0.526	0.026	97.576
10th	October 1897 to December 1900 <i>t</i> statistics	-13.917	9.982 8.057*	0.100	166	0.284	0.050	64.913
11th	January 1901 to December 1903 <i>t</i> statistics	-14.450	10.272 14.253*	0.097	153	0.574	0.023	203.162

Sources : Nakabayashi [2003], p. 106 (*Tokyo Keizai Zasshi*, *Chugai Buuka Shimpo*, *Chugai Shogyo Shimpo*).

Notes : *t* statistics : the null hypothesis is;  $e^t=0$  for the terms 1st, 2nd, 3rd, 5th, 8th, 10th, and 11th;

$e^t=-1$  for the terms 4th, 6th, 7th and 9th. \*: significant at 0.5% or less. \*\*:significant at 1%. \*\*\*: significant at 5%.

Appendix 1 Import of Raw Silk, the United States: 1863-1930

year	Total		from Japan		from China		from France		from Italy		from UK	
	ton	\$1,000	ton	\$1,000	ton	\$1,000	ton	\$1,000	ton	\$1,000	ton	\$1,000
1864	113	1,041	0	0	28	181	1	6	0	0	81	821
1865	258	3,438	3	85	18	194	1	9	0	0	234	3,122
1866	223	2,469	8	77	36	383	5	54	0	0	166	1,862
1867	232	2,520	11	124	41	410	8	82	0	0	121	1,345
1868	327	3,318	4	37	30	310	5	52	0	0	165	1,700
1869	265	3,018	25	287	46	433	13	152	0	0	122	1,465
1870	499	5,740	64	728	197	2,122	46	509	0	0	139	1,839
1871	483	5,626	24	214	300	3,318	24	341	2	31	91	1,256
1872	526	6,461	19	241	382	4,408	10	205	0	0	88	1,199
1873	361	3,854	4	46	206	2,027	20	299	0	0	88	1,006
1874	500	4,504	19	167	79	696	36	527	0	0	101	950
1875	615	5,424	453	3,787	10	80	77	933	0	1	71	576
1876	538	6,793	372	4,372	23	251	60	1,017	1	20	82	1,114
1877	536	5,103	78	831	350	2,994	52	721	0	0	54	526
1878	857	8,371	195	2,191	492	4,416	71	892	0	0	99	871
1879	1,162	12,025	288	3,546	743	6,971	59	825	1	7	71	665
1880	1,157	10,888	311	3,270	710	6,025	113	1,344	1	15	18	200
1881	1,306	12,890	451	4,588	569	4,948	235	2,832	5	65	38	365
1882	1,476	14,043	579	5,589	551	4,371	305	3,608	6	75	24	278
1883	1,462	12,481	626	5,065	424	3,049	161	1,735	227	2,384	6	44
1884	1,553	12,422	689	5,274	468	3,205	133	1,383	242	2,408	10	45
1885	2,157	17,233	929	7,507	676	4,485	93	896	431	4,149	25	157
1886	2,086	18,687	982	8,766	499	3,753	125	1,341	456	4,623	11	68
1887	2,346	19,151	1,270	10,278	510	3,439	120	1,190	435	4,156	4	25
1888	2,417	18,544	1,242	9,143	537	3,807	129	1,114	495	4,371	10	71
1889	2,696	23,285	1,569	13,277	533	3,860	127	1,310	413	4,397	49	406
1890	2,231	17,995	1,160	9,185	585	4,300	98	825	369	3,561	10	39
1891	3,412	24,321	1,843	13,117	837	5,088	145	1,154	578	4,912	3	12
1892	3,367	29,056	1,677	14,784	853	5,428	140	1,383	672	7,303	16	85
1893	2,248	15,628	1,199	8,025	544	3,088	96	840	402	3,629	1	6
1894	3,617	22,029	1,718	10,285	1,111	5,564	166	1,236	614	4,899	6	40
1895	3,629	26,247	1,792	12,919	1,142	7,164	173	1,465	506	4,588	8	59
1896	2,955	18,497	1,576	10,011	878	4,695	106	752	393	3,020	1	6
1897	4,679	31,447	2,402	16,453	1,323	7,507	154	1,192	791	6,227	0	2
1898	4,396	31,827	2,048	14,921	1,174	6,703	150	1,248	1,021	8,930	0	1
1899	5,107	44,550	2,161	19,688	1,751	12,188	162	1,608	1,006	10,816	3	7
1900	4,146	29,354	2,113	14,572	1,039	6,304	146	1,221	831	7,151	1	10
1901	5,725	41,714	2,811	20,702	1,373	8,308	250	1,866	1,165	9,955	0	1
1902	6,186	49,003	3,089	24,725	1,405	8,908	262	2,212	1,405	12,970	0	1
1903	5,729	44,462	3,035	24,373	1,543	9,854	172	1,216	950	8,784	1	2
1904	8,079	59,543	3,767	28,852	1,432	8,880	361	2,353	2,074	16,630	4	13
1905	6,579	52,856	3,377	27,934	1,318	8,463	251	2,081	1,583	13,973	0	0
1906	7,585	70,230	4,240	40,027	1,356	10,372	232	2,067	1,692	17,200	3	27
1907	6,996	63,666	4,366	40,678	1,082	8,276	170	1,487	1,346	12,917	0	0
1908	10,584	78,831	5,758	44,690	2,192	12,349	322	2,259	2,258	19,091	0	0
1909	9,237	65,425	5,424	40,104	1,853	9,676	267	1,612	1,598	13,269	0	2
1910	10,151	72,714	6,299	47,248	2,436	13,667	129	991	1,196	10,057	4	24

Source : Nakabayashi [2003], pp. 474-477, Appendix: Table 5-2 (1863: Treasury Department, *Commerce & navigation of the United States, 1836. Letter from the Secretary of the Treasury, in relation to the commerce and navigation of the United States.* 1866-1889: Treasury Department, *Annual report of the Director of the Bureau of Statistics, on the commerce and navigation of the United States*, Washington, Government Printing Office . 1890-1893: Treasury Department, *Annual report and statements of the Chief of the Bureau of Statistics on the foreign commerce and navigation, immigration, and tonnage of the United States*, Government Printing Office, Washington. 1894-1920: Chief of the Bureau of Statistics, Treasury Department, *The foreign commerce and navigation of the United States*, Government Printing Office).

Notes: Years are fiscal years (a fiscal year is from July of the calendar year to June of the next calendar year). The numbers do not contain "Waste" silk. "China" in 1868-1869 includes British Singapore.

Appendix 2 Import of raw silk, Organzine and Tram, France: 1829-1900

year	Raw silk							Organzine & Tram				Dyed	
	Total						Total	Total				Total	Total
	ton	from China ton	Italy ton	Japan ton	Turkey ton	UK ton	1000 franc	ton	from Italy ton	UK ton	1000 franc	ton	1000 franc
1850	1,150	0	370	0	412	211	48,869	785	678	36	52,327	6	403
1851	1,179	0	448	0	416	228	52,838	682	583	39	45,697	12	678
1852	1,920	0	716	0	802	277	87,945	877	696	130	59,645	14	782
1853	1,489	0	449	0	609	263	74,373	1,000	730	191	71,995	17	1,042
1854	1,470	0	453	0	351	609	66,055	1,144	712	300	75,471	13	763
1855	1,914	0	439	0	531	887	97,539	1,273	673	527	89,104	11	654
1856	2,398	0	378	0	647	1,302	146,115	1,426	697	630	115,530	15	1,120
1857	2,381	0	256	0	595	1,443	157,012	1,067	498	462	92,866	13	1,183
1858	2,650	0	499	0	583	1,466	140,444	1,402	658	633	99,518	8	527
1859	2,474	0	222	0	558	1,622	96,072	1,258	503	609	78,184	12	72
1860	2,942	0	454	0	616	1,785	176,420	1,096	511	488	88,785	7	549
1861	3,139	0	325	0	545	2,146	158,528	803	1	202	57,784	6	421
1862	3,653	0	377	0	486	2,591	200,912	1,002	559	344	77,617	8	566
1863	3,904	319	491	0	665	2,201	202,019	1,048	807	130	74,658	6	467
1864	3,235	278	337	3	579	1,787	189,221	1,120	896	90	95,769	8	649
1865	3,688	557	140	12	472	1,382	254,474	972	816	43	95,255	9	817
1866	3,121	523	211	74	390	1,224	210,675	935	745	36	88,837	26	2,226
1867	3,588	894	243	357	315	1,304	239,510	1,043	886	53	104,852	31	3,237
1868	4,138	1,013	232	548	323	1,503	293,777	965	783	60	108,106	23	1,866
1869	3,224	681	279	332	277	1,286	212,786	1,402	1,263	55	133,151	33	3,236
1870	3,184	801	256	399	360	1,032	197,416	692	601	40	62,967	23	1,997
1871	2,987	379	602	160	278	1,171	209,082	1,307	1,233	69	124,136	14	1,188
1872	4,062	1,248	413	495	282	1,244	284,351	1,206	1,117	78	119,423	16	1,345
1873	3,708	953	218	566	79	1,193	215,070	1,518	1,416	94	125,979	33	2,556
1874	5,133	1,554	601	1,053	362	1,094	241,234	1,335	1,213	112	89,429	21	1,292
1875	5,136	1,844	523	1,065	322	890	228,534	1,671	1,560	106	103,626	29	1,769
1876	6,183	2,248	527	1,048	357	1,214	398,790	1,754	1,628	119	140,306	54	4,149
1877	3,205	866	309	618	193	608	169,865	1,075	1,021	49	71,996	59	3,364
1878	5,192	2,501	568	693	277	675	238,833	1,552	1,499	45	93,118	36	1,877
1879	4,888	2,260	614	694	278	571	219,972	1,112	1,060	46	71,178	42	2,126
1880	5,091	2,665	839	349	242	396	218,892	1,165	1,106	53	69,871	30	1,312
1881	5,397	2,317	1,318	586	291	352	248,283	1,367	1,262	84	88,858	32	1,391
1882	4,803	2,024	872	636	303	361	211,349	1,080	1,007	57	65,893	33	1,536
1883	5,026	2,072	972	747	328	204	206,085	1,173	1,093	74	65,710	30	1,149
1884	5,379	2,598	871	684	439	92	204,399	973	842	113	50,603	39	1,220
1885	4,183	1,443	1,055	535	453	123	146,403	790	719	51	38,726	30	2,056
1886	6,136	3,288	1,022	588	415	352	233,154	739	648	40	38,443	43	2,635
1887	5,515	2,782	1,114	691	472	59	201,288	791	713	38	39,932	43	2,501
1888	4,817	2,236	933	644	410	78	170,997	535	379	33	26,495	18	1,039
1889	6,297	3,055	930	1,169	554	143	242,431	766	519	41	41,347	17	958
1890	4,880	2,137	807	833	514	205	195,205	613	430	22	33,409	24	1,501
1891	6,402	2,548	854	1,768	607	53	230,464	569	407	10	27,316	15	824
1892	6,725	3,288	959	1,292	666	106	232,020	477	348	4	23,607		
1893	5,850	2,714	1,055	903	741	71	236,940	390	319	5	21,930		
1894	6,340	2,830	925	1,136	795	51	187,021	361	313	0	14,075		
1895	6,904	3,542	895	1,191	866	45	220,915	368	329	0	15,530		
1896	5,356	2,075	988	1,266	709	69	176,745	394	363	0	17,415		
1897	7,837	3,961	1,025	1,784	766	20	250,797	395	367	0	16,966		
1898	6,309	3,344	1,021	944	755	24	212,923	480	432	0	21,439		
1899	8,358	4,937	1,001	1,310	788	0	334,319	542	462	0	27,931		
1900	5,773	3,236	747	583	801	101	213,595	521	474	0	24,972		

Source : Nakabayashi [2003], pp. 478-483, Appendix: Table 6-1, 6-2 (Direction generale des douanes et des contribution indirects, *Tableau general du commerce de la France avec ses colonies et les puissances etrangeres, Paris, Imprimerie Nationale*).

Notes : The numbers do not contain "Waste" silk. "Italy" before 1861 consists of Siciles, Sardeigne, Toscane, and Etats-Rom.

Appendix III Sericulture and Silk Reeling Industry in East Japan: 1876-1930

year	Nagano						Chubu/Nishi Kanto area			Higashi Kanto area			Minami Tohoku area			Kita Tohoku area		
							Yamanashi/ Gunma/ Saitama/ Tokyo/ Kanagawa Prefecture			Tochigi/ Ibaraki/ Saitama Prefecture			Miyagi/ Yamagata/ Fukushima Prefecture			Aomori/ Iwate/ Akita Prefecture		
	Sericulture		Silk Reeling		Equipment		Sericulture		Silk Reeling		Sericulture		Silk Reeling		Sericulture		Silk Reeling	
	Cocoons	Raw Silk					Cocoons	Raw Silk	Cocoons	Raw Silk	Cocoons	Raw Silk	Cocoons	Raw Silk	Cocoons	Raw Silk		
	kiloliter	total ton	Filature ton	Basins, total	Modern Silk reeling Basins, Factories,		kiloliter	total ton	Filature ton	kiloliter	total ton	Filature ton	kiloliter	total ton	Filature ton	kiloliter	total ton	Filature ton
1876	24,591	143				26,341	609			385	7		21,522	242		2,770	34	
1877	15,372	82				30,984	558			594	12		22,510	231		2,820	33	
1878	15,090	144				39,969	508			803	17		23,498	220		2,870	31	
1879	36,981	211				44,066	707			942	9		17,683	263		3,788	42	
1880	31,484	243				56,201	965			1,077	12		23,536	330		5,080	41	
1881	33,776	297				54,649	1,042			2,309	20		27,268	280		3,682	40	
1882	32,759	280				51,184	814			2,003	24		24,252	255		2,870	35	
1883	42,388	306				49,526	645			1,747	22		20,333	330		2,785	36	
1884	65,156	295				40,350	894			1,335	19		22,012	356		4,806	63	
1885	22,489	285				32,165	728			1,563	21		23,885	341		7,961	139	
1886	26,134	479				43,624	812			1,957	28		26,462	583		6,489	143	
1887	27,260	489				55,640	1,086			2,686	53		30,605	598		4,741	78	
1888	23,432	489				53,426	988			3,238	49		30,697	512		4,094	73	
1889	27,954	642				60,388	1,182	252		4,362	46	9	27,520	504	121	4,444	83	9
1890	24,787	688				46,877	954	197		4,797	72	10	28,895	507	106	4,214	96	17
1891	39,883	803				63,851	1,446	280		7,724	114	18	32,489	735	113	4,494	101	16
1892	41,676	931				54,339	1,221	238		8,677	114	17	28,714	699	129	4,592	86	10
1893	50,153	1,060				55,521	1,314	291		11,055	184	28	33,141	773	139	4,496	93	38
1894	51,564	1,160				68,932	1,255	392		12,814	138	53	28,967	751	119	3,943	56	19
1895	69,530	1,480				90,430	1,535	459		17,228	187	82	41,953	1,032	157	5,798	109	30
1896	41,176	1,211				54,515	1,563	474		16,204	173	74	34,061	669	151	5,560	119	30
1897	48,148	1,108				85,276	1,642	478		20,015	186	100	42,614	720	148	5,702	105	26
1898	44,553	1,069				79,415	1,590	492		19,482	196	105	35,448	663	146	4,417	115	31
1899	58,474	1,280				100,920	1,946	505		21,840	222	127	47,652	797	148	6,620	124	30
1900	58,809	1,349				664	107,741	1,718	463	27,170	252	141	53,417	846	184	7,759	168	36
1901	62,122	1,470				837	91,977	1,673	523	26,072	248	138	48,492	803	195	6,736	132	35
1902	60,395	1,437				743	90,320	1,743	565	30,045	254	149	51,593	860	247	8,430	144	39
1903	59,224	1,653				556	101,035	1,718	639	31,097	288	160	44,611	799	249	6,224	123	31
1904	64,096	1,669				562	97,246	1,751	722	32,095	210	135	62,323	887	310	9,157	141	47
1905	59,347	1,694				636	89,285	1,491	859	30,398	219	145	54,104	860	323	7,755	124	48
1906	68,326	1,960				778	103,400	1,827	941	30,380	228	162	48,252	854	338	9,119	118	50
1907	77,004	2,176				656	117,183	2,075	1,135	35,358	278	209	68,017	991	398	10,566	138	64
1908	80,590	2,485				664	114,286	2,170	1,191	36,696	285	213	66,951	1,010	401	10,704	146	66
1909	77,588	2,829				768	117,549	2,371	1,343	39,098	331	249	66,999	1,006	482	10,281	129	62
1910	84,508	3,085				829	120,550	2,437	1,344	40,103	335	257	71,496	1,138	597	11,617	135	65
1911	87,276	3,230				860	126,178	2,744	1,550	44,491	383	302	76,302	1,178	645	12,002	157	93
1912	98,372	3,886				621	140,470	2,745	1,681	45,354	413	336	69,824	1,142	687	12,358	159	111
1913	101,253	4,214				643	142,472	2,717	1,915	47,521	372	317	75,476	1,157	746	13,361	152	109
1914	97,955	4,439				603	143,380	3,146	2,043	46,188	370	316	79,419	1,179	778	15,328	150	95
1915	101,847	4,713				627	140,600	2,947	2,269	45,442	343	310	76,471	1,195	810	14,521	140	94
1916	120,549	4,959				689	182,686	3,216	2,468	57,847	368	330	91,322	1,343	919	17,348	152	107
1917	122,483	5,677				753	206,668	3,726	3,050	62,577	448	412	102,196	1,387	1,046	18,959	162	123
1918	130,063	6,062				757	222,305	3,920	3,275	64,864	532	498	110,153	1,629	1,298	20,978	168	135
1919	141,322	6,188				803	224,313	4,174	3,572	70,892	561	526	113,416	1,861	1,559	21,990	174	149
1920	128,713	6,005				770	178,945	3,789	3,253	62,778	418	386	91,702	1,503	1,274	19,366	173	146
1921	131,132	5,674				793	193,248	4,086	3,562	58,851	445	420	88,349	1,698	1,473	16,188	216	192
1922	135,273	6,295				782	197,244	4,012	3,583	58,753	485	464	99,153	1,866	1,685	21,595	236	210
1923	139,441	6,885				749	227,627	4,339	3,909	63,641	529	511	104,157	1,867	1,675	25,123	253	227
1924	141,361	7,535				718	234,854	4,862	4,364	71,951	617	599	97,324	1,983	1,808	21,379	295	273
1925	165,527	8,156				706	246,016	5,275	4,807	83,984	640	623	117,392	2,264	2,030	26,298	299	280
1926	159,646	8,999				703	254,652	5,560	5,220	86,255	714	707	116,099	2,275	2,137	25,165	293	281
1927	132,619	9,310				727	286,653	6,002	5,649	92,243	832	790	116,135	2,374	2,221	23,218	287	273
1928	161,592	9,701				802	272,224	6,656	6,265	95,438	917	872	114,204	2,553	2,403	22,599	320	306
1929	200,224	10,353				847	281,018	6,601	6,249	87,346	965	926	20,820	2,181	2,086	24,790	358	344