Listing Policy and Development of the Tokyo Stock Exchange in the Pre-War Period[*]

May 2007

Yasushi Hamao[**]
Takeo Hoshi[***]
Tetsuji Okazaki[****]

Abstract

Recent studies have established that the Japanese stock market was quite large in the pre-war period, and played an important role in financing the economic development. The pre-war stock market in Japan, however, did not achieve its size and status quickly. Indeed, the market capitalization stayed relatively small during the early years of the stock market development in Japan. This paper studies the pre-war development of the Tokyo Stock Exchange, which eventually grew to be one of the two largest stock exchanges in the pre-war Japan, and examines why the development was rather stagnant since its establishment in 1878 to the 1910s and what led to its take-off in the late 1910s. The paper argues that the TSE stayed small because the low liquidity discouraged the new companies from listing their stocks. The lack of growth in new listed stocks meant the liquidity continued to be low until 1918, when the TSE changed its listing policy to start listing companies without waiting for their listing applications. The provides empirical evidence from listing behavior of cotton spinning firms that shows the size of the market indeed mattered for their listing decision before 1918.

---

[*] An earlier version of the paper was circulated under the title "The Genesis and Development of the Capital Market in Pre-War Japan." We would like to thank Yutaka Arimoto, Stefano Battilossi, Luis Cabral, Yun Jeong Choi, Joe Chen, Leslie Hannah, Masanao Ito, Michihiro Kandori, Taku Kurosaki, Akihiko Matsui, Hitoshi Matsushima, Yoshiro Miwa, Tamaki Sano-Morita, Kiyoshi Nikami, Hiroyuki Odagiri, Hiroshi Ohashi, Makoto Saito, Osamu Saito, Yasuyuki Sawada, Catherine Schenk, Juro Teranishi, Yasushi Tsuru, Noriyuki Yanagawa, and the other participants who attended the seminars at Hitotsubashi University, Northwestern University, and the University of Tokyo, the conference on the history of capital markets at the University of Tokyo, and the New York University conference in December 2004 for providing valuable comments on the earlier version. All errors are, of course, the authors' responsibility. Financial support from the Ministry of Education and Science is gratefully acknowledged.
[**] University of Southern California (hamao@usc.edu)
[***] University of California, San Diego, NBER, and TCER (thoshi@ucsd.edu)
[****] The University of Tokyo (okazaki@e.u-tokyo.ac.jp)

1. Introduction

The post-war Japanese financial system has been known as a bank-centered system, in which banks played a central role in corporate finance and governance. The mainstream view in the literature on economic history argued that the bank-centered system has a long history in Japan with its origin dating all the way back to the late nineteenth century, when Japan embarked upon its modern economic development (Bank of Japan (Institute for Monetary and Economic Studies) 1986, 1995; Ishii 1997, 1999). Recent empirical studies have established, however, that the pre-war Japanese economic system in general was substantially different from the post-war system, and in particular the financial system was characterized by large and active securities market with shareholders (not bankers) playing the central role in corporate finance and governance (Fujino and Teranishi 2000; Miwa and Ramseyer 2002; Okazaki 1995, 1999a, 1999b, 2000; Okazaki et al. 2005 ; Hoshi and Kashyap 2001; Teranishi 2003).

The empirical evidence to support the importance of the stock market in the pre-war Japan mostly comes from the data from the 1920s and the 1930s. Although the data constraint becomes more severe as we move back the time, a closer look at the earlier period reveals that the size of the Japanese stock market was relatively small during the first 40 years of its existence. Then, it took off to be a very active and important source of industrial funds. It is not surprising that the stock market started small, but it continued to be (relatively) small for the next 40 years and then started to grow rather suddenly.

This paper asks why the Japanese stock market developed in the way it did in the pre-war period. To do this, we examine the development of the Tokyo Stock Exchange (*Tokyo Kabushiki Torihikijo*, TSE hereafter), which was established as the first stock exchange in Japan

in 1878 and grew to be the largest stock exchange in pre-war Japan.[1] Although the TSE was the first formal exchange in Japan and continued its dominance (except for a brief period in the late 1890s when many new stock exchanges were established), its absolute size was relatively small in the first 40 years. Moreover, most of the companies listed in the TSE operated locally in Tokyo and nearby areas. We ask why the TSE stayed small and local for substantial time after its establishment in 1878 and why it rather suddenly started to grow in the late 1910s to eventually become a sizable stock exchange with the nationwide scope in the following decade.

There has been little research on the pre-war Japanese stock exchanges, especially for the period before the 1920s.[2] The main impediment has been the difficulty of obtaining data. Thus, one contribution of this paper is the compilation of relevant data that used to be scattered around in various places. For example, we have constructed a comprehensive list of the companies listed on the TSE for each year from 1878 to 1936 from internal documents at the TSE and various other supplementary materials. The database has been augmented by adding company attributes such as industry classification, size, and the year of establishment.

We have also built another panel database, which contains basic financial information for all the cotton spinning companies that include both listed and non-listed companies. The database contains 142 companies for the period of 1905-1936. This database allows us to examine the listing decision of each firm on the TSE.

The paper is organized as follows. The next section presents an overview of financial system and stock market in the pre-war Japan, and confirms the importance of the stock market in the pre-war financial system. Section 3 examines the development of the TSE in the pre-war

[1] When the exchange was reorganized and re-opened under the occupation of the Allied Forces in 1949, the Japanese name was changed to Tokyo Shōken Torihikijo (literally meaning Tokyo Securities Exchange). The English name, however, continued to be Tokyo Stock Exchange.
[2] The important exceptions that we are aware of are Shimura (1970), Noda(1980), and Kataoka(1987).

period. We will find that the market was initially small and the listed companies are predominantly those in Tokyo area. Section 4 studies the changes in the listing requirements in the TSE over time to see how the growth of the TSE was influenced by changes in its listing criteria and listing policy. Section 5 proposes a theoretical argument that can explain the development path of the TSE in the pre-war period. The explanation focuses on an externality in a company's decision to list on a stock exchange: one company's decision to list on a stock exchange may increase the attractiveness of the stock exchange to other companies by increasing the size of the market. Section 6 uses the database for cotton spinning firms and analyze their listing decisions, and obtains the result that is consistent with the argument in Section 5. Section 7 concludes.

2. Japanese stock market in the pre-war financial system: An overview

The size of the stock market in pre-war Japan was substantial. Figure 1 shows the total market value of the stocks listed on all the stock exchanges in Japan divided by GNP (GDP in the post-war period). In the pre-war period, this ratio was around 1.0, which is substantially higher than that in the post-war period, except during the stock market boom in the late 1980s. In particular, the ratio was consistently lower than 0.3 in the post-war high growth period (1951 – 1973). The pre-war stock market was large also in terms of the transaction volume. Just before the start of Sino-Japanese War in 1937, the total volume of the shares traded on all the exchanges was 2 to 2.5 times greater than GNP. On the other hand, the ratio was only 0.1 to 0.6 in the high growth period, and it was lower than 1.0 even in the stock market boom of the late 1980s.

Figures 2 compare the size of the pre-war Japanese stock market to that of the pre-war stock market in the U.S. and those of the stock markets in various countries (including Japan and the U.S.) in the early 1990s. The international data for the 1990s come from Demirguc-Kunt and Levine (2001), which reports three measures of the stock market size for 61 countries: total market value of the listed stocks divided by GDP, the total value of the stocks traded in a year divided by GDP, and the latter divided by the former (turnover ratio). The two panels in Figure 2 show the first two measures of the stock market size plotted against the GDP per capita. In both panels, we see a loose inverse relationship between the stock market size and the GDP per capita. The figure suggests that the stock market in Japan in 1936 was more developed than that in the U.S. in 1936 and even compared with most of the countries (including Japan itself) in the 1990s. Given its low income per capita in the pre-war period, Japan in 1936 stands out as a clear outlier in the figure.

Another way to see the importance of the stock market in the pre-war Japan is to examine the sources of fund for corporations. Table 1, which reproduces Table 2.3 in Hoshi and Kashyap (2001, p.36), shows the sources of funds for the private non-financial corporate sector in the pre-war Japan. The original source of the data is Fujino and Teranishi (2000), which is considered to be the definitive work on the prewar pattern of corporate financing. The table shows the average proportion of each source of funds calculated from the levels of claims for three (overlapping) sub-periods: 1902-15, 1914-29, and 1928-40. Each sub-period uses a different primary data source for estimation.[3]

Table 1 shows that the shareholders contributed the majority of funds in each of the three sub-periods. The proportion of paid-in capital and reserves was about 60% to 80% of the total capital and liabilities. In contrast, the proportion of the bank borrowings was small. Even if we

[3] See the note for Table 2.3 in Hoshi and Kashyap (2001, p.36) for more details on the primary sources of data.

assume all the borrowings come from banks and interpret all the bills payable as disguised bank borrowings (because some firms had their own bills discounted by banks), the amount of bank borrowings was never higher than 20% of the total funds in the corporate sector.

Having confirmed the importance of the stock market in the pre-war Japanese financial system, let us now look at how it all started. Following the enactment of the Stock Exchange Act (*Kabushiki Torihikijo Jōrei*) in 1878 (ten years after the Meiji Restoration), the TSE was established as the first stock exchange in Japan. The Stock Exchange Act prescribed that a stock exchange must obtain a license from the government and that it must be organized as a joint-stock company with capital of 100,000 yen or larger (approximately 567 million yen in 2005 prices)[4] . The Osaka Stock Exchange (*Osaka Kabushiki Torihikijo*, OSE) followed the TSE in the same year. Although the Ministry of Finance initially intended to license only the two stock exchanges, it changed the policy in 1880 and allowed new exchanges to be established, including Yokohama (1880), Kobe (1883), Kyoto (1884), and Nagoya (1886) (TSE 2002, p.7).

In 1887 the Exchange Act (*Torihikijo Jōrei*, also known as Bourse Act) was passed, which prescribed that all the exchanges, including the stock exchanges, must be membership organizations, not joint-stock companies. The existing stock exchanges were to be abolished when their current licenses expire and to restart as a new membership organization (TSE 2002, p.16). The new regulation met strong resistance from the industry and was replaced by the new Exchange Act (*Torihikijo Hō*) in 1893. The new Exchange Act allowed each exchange to choose between a membership organization and a joint-stock company organization. The law continued to provide the legal basis of the exchanges throughout the rest of the pre-war period.

[4] Inflated by CPI. We linked CPI of Ohkawa et al 1967 (p.134) with CPI by the Statistics Bureau of Ministry of Internal Affairs and Communications at 1955.

The Exchange Act of 1893 also reduced the minimum capital of an exchange (that chose to organize as a joint-stock company) to 30,000 yen. The reduction of the minimum capital level led to the establishment of many new stock exchanges during the economic boom in the late 1890s. Some of the newly established exchanges, however, failed to generate active trading, which convinced the government to shut down small stock exchanges in rural areas (TSE 1928, pp.6-8; TSE 2002, pp.16-18; Noda 1980, pp.240-242).

The bar graph in Figure 3 shows the evolution of the number of stock exchanges during this period. The number of stock exchanges began with two (Tokyo and Osaka) in 1878. While it increased to five in 1886, it decreased to three in 1891. Then a rapid increase in the number of exchanges began in 1894 as the new Exchange Act with a lower minimum capital standard took effect, and reached a peak of 46 in 1897. After that it declined again, and has remained around 10 throughout the rest of the pre-war period.

Figure 3 also shows how the share of the TSE in all the stock exchanges fluctuated. As long-term data on the volume of stocks traded at all the exchanges are not available, we use the revenues (a major part was from trade commissions) as a proxy of activities in the stock exchanges. The figure shows the total revenues of stock exchanges experienced two significant upward jumps: once in 1904-1906 and again from 1918 to 1922. The TSE continued to have the largest revenue throughout these years, except in 1922 when the OSE topped the rankings[5]. The share of the TSE started around 60-70%, but declined to 20-30% in the late 1890s, when the number of stock exchanges increased sharply, and then returned to 40-50% after that. Thus, we can say the TSE was the largest stock exchange in Japan during the most of pre-war period.

[5] The extraordinarily large revenue of the OSE in 1922 resulted from an acquisition of another company. Thus, we can safely say that the TSE had the largest revenue from transaction commissions throughout the pre-war period.

3. Development of the Tokyo Stock Exchange

This section examines the development of the Tokyo Stock Exchange in more details. The stock market at the TSE was divided into two divisions. The Stock Exchange Act of 1878 classified stock transactions into spot transactions (*genba torihiki*) and futures transactions (*teiki torihiki*). Each spot contract resulted in delivery of the transacted stocks. *Teiki torihiki* was similar to "time bargains," which were also observed in the financial centers in more advanced economies, such as London and New York.[6] In a *Teiki torihiki*, a buyer (seller) could resell (repurchase) the stocks as many times as he wished, until the delivery date, and at the delivery date only the difference between the sell and the purchase was settled in cash (TSE 1928, p.454). In the futures market, net cash settlement was the normal settlement method.

The Japanese name for spot transaction was changed three times during the pre-war period. The Exchange Act of 1893 called it *jiki torihiki*. The organizational reform of the TSE in 1918 discussed below introduced the name *genbutsu torihiki*. Finally the 1922 revision of the Exchange Act used *jitsubutsu torihiki*.

Before the revision of the Exchange Act in 1922, the futures market traded contracts with three different settlement days for each share.[7] The shares sold had to be delivered before the settlement day, which is one day before the last trading day of the month (called *tōgiri*), one day before the last trading day of the next month (called *nakagiri*), or one day before the last trading day of the month after the next month (called *sakigiri*). Thus, the settlement period (the period between the start date of a transaction and the delivery date) never exceeded three months.

[6] For a brief description of "time bargains" in London, see Michie (1999), pp.48-49. For New York, see Geisst (1997), p.14.

[7] Tokyo Stock Exchange (1932, pp.70-96) contains a detailed discussion of various transactions in the Tokyo Stock Exchange. Other sources for the discussion here include Osaka Stock Exchange (1928), TSE (1928), and Kuwata (1940).

The 1922 revision of the Exchange Act ordered the exchanges to develop another type of future contracts with settlement period no longer than seven days. Following this legal change, the Tokyo Stock Exchange introduced a new market for the type of transactions called the short-term futures transaction (*tanki seisan torihiki*) in 1924.[8] In the short-term futures, the deliveries of all the transactions that took place in the morning session of a day and in the afternoon session of the previous day had to happen by 2:00 PM of the day. The traders were allowed to postpone the deliveries up to a month, but in that case they were required to pay a deferment fee.

The new Exchange Act also shortened the maximum settlement period of any futures transaction from three months to two months. The old futures market of the Tokyo Stock Exchange, which is now renamed the long-term futures transactions (*chōki seisan torihiki*), continued to use the system of three settlement days by changing those to the 15th of odd month, and the 5th and the 25th of even month.

Figure 4a shows the evolution of the number of stocks listed on each market of the TSE. Note that it is distinct "stocks" not companies that are counted here. Large companies in pre-war Japan often ended up issuing more than one class of shares. As a result of this, while the number of listed stock names was 206, the number of listed companies was 160, which means one company issued 1.29 classes of shares on average. For a concrete example, consider a company that had issued 20,000 shares, whose face value was 50 yen each, and the capital was all paid-in. The total paid-in capital of the company is 1 million yen. Now suppose this company issues another 20,000 shares with face value of 50 yen each. Under the pre-war practice of installment payment of capital, the company collects only a portion of the face value from the shareholders at the issuance. If the company collects 50%, the paid-in face value of the new stocks is 25 yen

[8] The Osaka Stock Exchange introduced the short-term futures in 1922 immediately following the enactment of the 1922 Exchange Act.

each, and the new total paid-in capital of the company becomes 1.5 million yen. This creates two distinct classes of stocks of the same company, which will be listed as two different stocks on an exchange.

Note also that all the stocks listed on the short-term futures market (after 1924) were also listed on the long-term futures market, and all the stocks listed on the long-term futures market were also listed on the spot market. Thus, the number of the stocks on the spot market is always larger than the number of the stocks on the long-term futures market, which in turn is larger than the number of the stocks on the short-term futures market. Finally, the number of stocks listed in the futures market is missing for the period between 1918 and 1922, presumably lost in the fire that completely destroyed the Tokyo Stock Exchange building during the Great Kanto Earthquake of 1923.

The number of the listed stocks, which began with four (First National Bank, Tokyo Kabutocho Rice Exchange, Tokyo Kakigaracho Rice Exchange, and Tokyo Stock Exchange itself) in 1878. Until 1896, all of the listed stocks were listed on both the spot market and the (long-term) futures market, and after that a small number of stocks emerged which were listed only on the spot market.

Figure 4a shows that there was a small upward in the number of listed shares in 1897, which followed by a slight increase in the trend growth rate of the listed shares. A bigger jump and a more drastic change in the trend growth happened in 1918. The number of listed stocks increased sharply from 233 to 402 in one year, and then continued to grow. In the ten years from 1918 to 1927, the number of listed stocks increased each year by 78 on average. The growth is compared to a little less than 6 per year during the previous 40 years. The short-term futures

market started in 1924, but the number of stocks listed on the short-term futures market was very small. It was just 36 in 1936.

Figure 4b shows the total amount of (the book value of) paid-in capital of the stocks listed on the Tokyo Stock Exchange. Figure 4c plots the same series divided by the nominal GDP of each year. Both figures are qualitatively similar to Figure 4a. The only notable exception is that the series start to decline after 1932 in Figure 4c, which suggests the growth of the book value of the listed companies started to fall behind the growth of GDP in the 1930s.

In Figures 1 and 2, we saw that the Japanese stock market in the 1920s and the 1930s was very large compared to the size of the economy. Figures 4a, 4b, and 4c suggest, however, the Tokyo Stock Exchange was relatively small before the 1920s. Before 1920, the size of the market measured in the total book value of listed firms divided by GDP increased steadily to from less than 5% in 1885 to around 20% (Figure 4c). The size during this period increased only by 0.5 percentage point every year on average. In the next three years, the size of the market jumped to 50% of GDP and continued to grow. In the twelve years from 1919 to 1931, the proportion of the Tokyo Stock Exchange to GDP increased by 4.2 percentage point every year on average.

Although the data constraints prevent us from extend the Figure 1 back to the period before the 1920s, what happened in the Tokyo Stock Exchange, the largest stock market in Japan, suggests that the size of the Japanese stock market as a whole was also relatively small before the 1920s. The growth rate of the market (measured in the book value of listed stocks) was rather small before the late 1910s, and then the market suddenly took off during the 1920s.

Before the 1920s, the Tokyo Stock Exchange was also limited in its regional coverage: the listed companies were mostly from the Eastern part of Japan. Overtime, however, the TSE

attracted companies from all over Japan and eventually became a nationwide stock market. Let us briefly trace changes in the regional distribution of the listed companies. Appendix 1 explains the sources of the data that we use here.

Table 2 shows the regional distribution of the headquarters of listed companies. All the four listed companies in 1878 were located in Tokyo. Although the proportion of the companies in Tokyo declined to 50% by 1885, the share for the eastern Japan was still higher than 90%. The share of companies in the eastern Japan remained high around 80% in 1900 and 1915, but started to fall after that. The timing coincides of the acceleration of the number of listed stocks at the Tokyo Stock Exchange that we saw above. By 1935, the proportion of the listed companies in the eastern Japan declined to 72%, while the proportion of the listed companies in the western part increased to 15%. Thus, over time, the TSE became the exchange with nationwide coverage.

4. Listing Criteria and Growth of the TSE

The TSE grew to become the largest stock exchange in Japan with nationwide coverage, but the growth was rather slow and the listed firms were skewed to the eastern Japan during the first 40 years of its existence. Why did the TSE list relatively small number of stocks but rather suddenly start to list increasing number (and amount) of stocks? This section tries to answer this question.

One possible explanation of the pattern of the growth of listed companies on the Tokyo Stock Exchange is relaxation of listing criteria over time. When a stock exchange starts its operation, it may want to restrict the companies that are listed to be only those which have high profitability and/or sizable assets to establish the reputation that the exchange deals with quality

companies. As the exchange accumulates the reputation over time, it may be able to relax the tight listing regulation marginally, allowing more companies to be listed on the exchange. If we find that the TSE indeed relaxed the listing criteria around 1918, then it could explain the sudden growth of the TSE after that time.

This turns out not to be the case, however. The long-term futures market indeed had listing criteria which were relaxed over time, but there was no important change in 1918 (or nearby years). Perhaps more importantly, in the spot market, where most of rapid growth after 1918 took place, the TSE does not seem to have imposed any listing restrictions.

Let us first look at the changes in the listing criteria to the futures market. We are not aware of any document that summarizes the listing criteria at the TSE for the whole pre-war period. Thus, we need to put together the relevant information scattered in various places.

The earliest mention of the listing restriction that we can find is in TSE (1928):

> "When the Exchange Act was passed in 1893, the government instructed the TSE to increase the number of stocks traded as much as possible. Consequently, the TSE replaced the existing listing criteria (number of stocks no fewer than 4,000, total face value not less than 200,000 yen, and total paid-in face value not less than 100,000 yen) with the new criteria (number of stocks no fewer than 3,000, total face value not less than 150,000 yen, and total paid-in face value not less than 75,000 yen). The TSE decided that the stocks that do not satisfy the new criteria should be traded only on the spot market. The new criteria were used from May 1894." (pp.33-34)

Then, following the 1914 revision of the Exchange Act, listing of securities on the futures market required an approval from the Minister of Agriculture and Commerce (MAC). Accordingly, the MAC set the following listing criteria for the futures market.

(i) Issuer company must have been established more than 2 years ago.

(ii) Total paid-in face value (of the newly listing class of stocks) must not be less than 1,000,000 yen to be listed on the Tokyo or Osaka stock exchange.

(iii)Total paid-in face value (of the newly listing class of stocks) must not be less than 500,000 yen to be listed on a stock exchange other than Tokyo and Osaka. **(**TSE 1963, Part on Institutions and Organizations, p.3**)**.

Compared with the 1894 TSE rule that we saw earlier (75,000 yen minimum paid-in face value), the new MAC rule tightened the listing standard by increasing the minimum paid-in face value by more than 1,300% while the general price level only doubled over the 20 years.

In 1915, the MAC added the following criteria for newly listing class of shares in a company which had already listed shares on the futures market (TSE 1963, Part on Institutions and Organizations, p.3).

(i) Total paid-in face value (of the newly listing class of stocks) must not be less than 500,000 yen to be listed on the Tokyo or Osaka stock exchange.

(ii) Total paid-in face value (of the newly listing class of stocks) must not be less than 250,000 yen to be listed on a stock exchange other than Tokyo and Osaka.

These criteria set by the MAC provided the minimum requirement that a company that wants to list its stocks had to satisfy. The TSE seems to have evaluated some additional aspects which were not explicitly stated as well. The internal rules of the TSE enacted in 1915 prescribed as follows (Research Bureau of the Bank of Japan 1916, p.93).

"When a joint-stock company requests the TSE to start trading its stocks or debentures, the TSE should examine its articles of incorporation as well as its assets and business status to decide whether the request should be approved or not (Article 1)."

Moreover, the revised Exchange Act of 1922 obliged the exchange to set up a council to decide on when a stock or a bond could be listed or delisted.

In May 1921, the listing criteria of the TSE were revised to be the following.

(i) Issuer company must have been established more than 2 years ago.

(ii) Total face value (of the newly listing class of stocks) must be more than 3,000,000 yen, of which more than 1,000,000 yen already paid in; The number of shares must be greater than 60,000.

(iii)For anew class stocks of a company which had already listed shares in the futures market, total face value (of the newly listing class of stocks) must be more than 2,000,000 yen, of which more than 500 thousand yen already paid in; The number of shares must be greater than 40,000.

These new criteria were used at least until the beginning of the Sino-Japanese War in 1937 (The Research Section of the TSE 1932; Hatano 1938).

In contrast to the futures market, the spot market of the TSE does not seem to have imposed any explicit listing criteria. TSE (1932) stated "we do not impose any condition on the listing" in the spot market. Although we find several documents that spell out the listing criteria for futures market as we saw above, we are now aware of any documents that specify the listing criteria for the spot market. Thus, it seems safe to conclude that the TSE did not have explicit listing criteria for the spot market.

The companies that wished to be listed on the spot market were still required to apply for that. Even this requirement to apply for the listing, however, was eliminated in 1918, and the TSE decided that they can start transaction of a stock and quoting its price without the company's application to be listed on the exchange. (TSE 1928, p.88)

The graphs in Figure 4 suggest that the change in 1918 has a major impact on the subsequent increase of the size of the TSE. The number and amount of shares listed on the TSE increased rapidly after 1918 especially in the spot market.

According to TSE (1928, p.88, and other relevant references), the change in 1918 was motivated by the TSE's attempt to bring the spot exchanges that took place outside the exchange into the exchange. Since the late nineteenth century, stock trading outside the exchanges was quite active (Kataoka 1983). A large number of stocks were traded over the counters of spot market brokers (*Genbutsu don'ya*), and *Saitori* brokers intermediated between those brokers. In 1906, these brokers outside the exchange filed an application to the local government of Tokyo to establish a new stock exchange specialized in spot trading. This attempt was not realized mainly due to strong opposition by the TSE.

As the outside trading increased, the TSE started to try integrating those trades inside the exchange. The spot market brokers also came to consider that it was convenient to interlink their trading with the trading inside the TSE. Thus, in 1918, the TSE invited *saitori* brokers, who intermediated spot transactions outside the TSE, to trade only in the exchange (Association of the TSE *Saitori* Members 1975, p.65, 72). The TSE also set up the Monitoring Department (*Kansatsu-bu*) to ensure that spot transactions were conducted within the exchange and following the TSE rules (TSE 1928. p.46; TSE 2002, p.30; Association of the TSE *Saitori* Members 1975, p.72). This change made it difficult for investors to trade shares outside the exchange.

The rapid increase of listed shares in the TSE after this 1918 reform may not be surprising if it was just a result of the TSE's newly listing the stocks that had been traded outside the exchange by the spot traders. If this was the only reason for the rapid expansion of the TSE, the growth would level off after a while, when most of the outside trading has already brought

inside the exchange. Figure 4 shows the TSE continued to grow well into the late 1920s. As we see below, the integration of the outside trading happened rather quickly.

To study how the outside trading was absorbed into the TSE following the 1918 reform, we have collected the advertisement that a major spot broker, Momijiya, ran in *Tokyo Asahi Shimbun*, a major newspaper in Tokyo. We have collected the first advertisement of Momijiya in June and December of each year from 1916 to 1921. Then we compared the stocks on the Momijiya advertisement to the listed stocks on the TSE as of the end of March of that year published in *Kin'yū Jikō Sankōsho*. The result is summarized in Table 3.

Since the new listing policy of the TSE was implemented in September 1918 (TSE 1928, p.88), the first time we would observe that impact in Table 3 is the June 1919 column which compares the stocks advertised by Momijiya in June 1919 to the stocks listed on the TSE in March 1919. We find the number of stocks advertised by Momijiya but not listed on the TSE, which was around 20 before the change, fell to six by June 1919 and to zero by Dec. 1921. Thus, we can conclude that all the major stocks in the outside market were quickly listed on the TSE following the change in 1918. The outside market was completely absorbed by the TSE by 1921.

The TSE continued to grow even after 1921. This implies that the impact of the policy change in 1918 was more than just absorbing the outside market into the TSE. In this section, we examined if the changes in listing rules on the TSE can explain the pattern of its growth. The listing criteria on the futures market went through several changes, but those are not closely related to the changes in the growth rate of the TSE that we see in the graphs in Figure 4. Moreover, the growth spurt in the 1920s, which is the most prominent change, was mostly due to the expansion of the spot market. The TSE does not seem to have explicit listing restrictions on the spot market. The companies, however, had to apply to the TSE to be listed. The rule

changed in 1918, which led to the sustained growth of the spot market. Then, why did many companies fail to list before 1918? Since they did not seem to have faced any listing criteria, this suggests they did not find the benefit of being listed. Why? The next section builds an explanation this based on the recent literature on initial public offerings.

5. Market Liquidity and IPO Decision

There have been large and growing literature on IPO and listing decisions of firms, but we find the results of two recent papers especially relevant for our purpose. Those are Ellul and Pagano (2006) and Baruch and Saar (2007).

First, Ellul and Pagano (2006) shows that the extent of IPO under-pricing is high when the (expected) liquidity of the stock after the IPO is low. Thus, under-pricing, which constitutes an important part of the cost of IPO, is decreasing in the expected aftermarket liquidity. Assuming there is some variation in the benefit of IPO, so that only those firms whose benefits are higher than the costs decide to be listed on the stock exchange, we can argue that the number of firms which decide to be listed is a increasing function of the expected liquidity.

Second, Baruch and Saar (2007) provides an example that shows (among other things) that the liquidity of an individual stock is an increasing function of the number of firms listed in the market. Using an example which is slightly different from Baruch and Saar (2007), we show this is indeed the case in Appendix 2.

Combining these two arguments, we can now establish that the number of listed stocks is an increasing function of the market liquidity, which in turn is an increasing function of the number of listed stocks. This implies a possibility of multiple equilibria. In one equilibrium, the market liquidity is expected to be high, which encourages many firms to be listed and makes the

market liquidity indeed high. In another equilibrium, the market liquidity is expected to be low, which leads to a low number of listed firms and low liquidity.

Applying this argument to the TSE in the pre-war period, we argue that the TSE before 1918 may have been in the low market liquidity equilibrium. It was in equilibrium in the sense that that the firms who were not listed did not have incentive to be listed *given* the existing level of market liquidity. From this point of view, the listing policy change in 1918 can be viewed as an exogenous shock that increased the market liquidity. This led to the listings of many companies which were previously not listed. More importantly, the increased market liquidity should have convinced some firms that they would be better off if their shares are listed. Thus, the 1918 policy reform may have shifted the equilibrium from the low liquidity one to the high liquidity one.

The explanation here assumes that listing on the TSE during the prewar period was very much like IPO today. We can find evidence that suggests this characterization of listings is reasonable.

First, there are some anecdotes that show the companies decided to list their stocks to increase the capital by attracting new shareholders. For example, Noda (1980, pp.70-73) reports an example of Kyushu Railroad (*Kyushu Tetsudo*). The Kyushu Railroad was established in 1888 with official capital of ¥11 million, of which ¥7.5 million was planned to be funded initially. Since the financial market condition was rather tight in 1888, the shareholders were required to pay only ¥5 per share (for the par value of ¥50 per share) as the first installment to acquire shares, but collecting such a small portion was already difficult. Only 38.0% of the shareholders made the first installment payment by the due date. For the second installment of ¥5 per share that was due in March 1989, only 11.6% of the shareholders met the due date.

At this point, Seinosuke Imamura, a director of the Kyushu Railroad advised the president to list the Kyushu Railroad stock on a stock exchange to facilitate the trades of the stock and to encourage the future installment payments.[9] Following this advice, the Kyushu Railroad listed shares on the Tokyo Stock Exchange and the Osaka Stock Exchange in 1989. The strategy was successful. The stock price quickly rose above the par (paid-in) value and the Kyushu Railroad did not have trouble collecting installment payments in time (at least until the financial panic of 1890).

The example of Kyushu Railroad shows that the company consciously decided to list their stock on the stock exchange to broaden the shareholder base and to increase the (paid-in) capital. The listing on the stock exchanges indeed made it easier for the company to increase the capital.

Additional evidence that shows that listing on the stock exchange broadened the shareholder base and made it easier for the company to raise capital comes from a database of 46 major joint stock companies in Tokyo during the 1890s. We divide the 39 firms into three groups. The stocks of eleven companies were already listed on the TSE before 1890. Five companies are newly listed on the TSE between 1890 and 1899 (four in 1893 and one in 1894). The remaining 23 companies were not listed on the TSE (at least until 1900). Figure 5 shows the average number of shareholders and the average amount of paid-in capital for each of the three groups. The figure clearly shows the already listed firms and the newly listed firms increased the number of shareholders and the amount of paid-in capital during the 1890s, although the already listed companies were much bigger and had more shareholders than the newly listed firms (note that the scale for the already listed firms in the figures is different from the scale for the other

[9] Seinosuke Imamura was also one of the founders of the Tokyo Stock Exchange and a large securities broker.

groups). The unlisted firm, on the other hand, did not increase the number of shareholders very much and continued to be small.

6. Listing Decisions of Cotton Spinning Firms

In this section, we use the data from cotton spinning industry to test a key implication of our argument that implies a listing decision depends on the size of the stock exchange. If the stock market is large and has large liquidity, the potential underpricing problem is mitigated, and the net benefit of listing increases. Thus, as a market expands, the likelihood of new listings tends to go up. This section estimates a simple probit model that explains new listing decisions of cotton spinning firms.

Cotton spinning was a leading industry in pre-war Japan, and many of these companies were eventually listed on the TSE. More importantly, consistent data are available on both unlisted and listed companies, which allow us to analyze what factors influenced the decision to be listed. The data on cotton spinning firms are taken from the various issues of the *Menshi Bōseki Jijō Sankōsho* (*Reference Book on the Cotton Spinning Industry*) published by the Japan Cotton Spinning Association. The sample covers the period between 1905 and 1936.

We take all the companies whose financial data are available in the *Menshi Bōseki Jijō Sankōsho*, and checked whether they were listed on the TSE or not at the end of each year by referring to the materials used in Section 3. Figure 6a presents an overview of the sample. The number of firms in each year was 25 to 35 until the late 1910s, and 50 to 70 after that. Of these, the number of firms listed on the TSE was 5 to 6 until the late 1910s, and it increased to more than 20 in the late 1920s and 1930s. The number of firms listed on the long-term futures market

was nine at the peak (1933 to 35). Until 1932, the only firm listed on the short-term futures market was Kanegafuchi Bōseki. Nisshin Bōseki was added in 1933.

The cotton spinning industry in Japan was geographically concentrated in Osaka area (Takamura 1971). Reflecting this, the proportion of companies located in the eastern regions (Hokkaido, Tohoku, Kanto and Chubu) was 42% at the peak (1936) and 14% at the bottom (1914) (Figure 6b). Companies from the eastern regions nevertheless represented a higher proportion of listed companies on the TSE. This suggests that there was home bias with respect to listing on the TSE. The magnitude of the bias substantially declined after the late 1910s.

To examine the determinants of listing on the TSE by cotton spinning firms, we estimate a regression model similar to those estimated by Pagano et al. (1998) to study the IPOs in Italiy. They analyzed the determinants of IPOs by using panel data of Italian firms in 1982-1992. Using the firms that conformed to the listing criteria for the Milan Stock Exchange but were not listed, they regressed the dummy variable denoting IPO to several explanatory variables on corporate attributes and the environment. They found that a firm is more likely to decide to go public if the amount of sales is high, the sales growth is high, it has high ROA, and the firms in the same industry that are already listed show high market-to-book ratio.

The probit model that we estimate is the following:

$$\Pr(L_{it}=1)=\Phi(\beta_0+\beta_1\log(CAP_{it-1})+\beta_2 Age_{it-1}+\beta_3 ROE_{it-1}+\beta_4 East_i+\beta_5\log(TSE_{t-1})),$$

where L_{it} is the dummy variable that takes 0 if firm i has never listed on the TSE as of year t. It takes 1 if the firm was newly listed on the spot market of the TSE in year t. The companies that were newly listed on the TSE in year t are dropped from the sample in year $t+1$ on. Thus, we try

to estimate the factors that influence the new listings. $\Phi(\cdot)$ refers to a cumulative Normal distribution function. *Cap* is the paid-in capital normalized by the average paid-in capital of the total joint-stock companies in Japan. *Age* is the years from the foundation of the firm. *East* is the dummy variable which takes 1 if the headquarter of the firm was located in the eastern regions of Japan, and 0 otherwise. Finally, TSE_t is the total amount of capital of the stocks listed on the spot market of the TSE in year t. If the market size is the important determinant of listing decision of individual firms, we expect to find the coefficient of *TSE* to be positive.

We estimate the regression separately for two sub-periods: the period before 1918 and the period after 1918. The listing policy change in 1918 suggests that the listings before 1918 were initiated by the firms. They had to apply to be listed. Thus, by looking at the listing events, we can study what factors influenced the firm's decision to seek listing. After 1918, the TSE was able to initiate the listing without any requests from the firms. Thus, we can consider some listing events after 1918 continued to be the firms' decision while some listing decisions were done solely by the TSE.

Table 4 reports the result. The first column shows the estimation result for the period before the 1918 change. The coefficient on *Cap* is positive though statistically significant only at 10% level, suggesting that the probability of listing was higher for large firms. The coefficient on *East* is positive and statistically significant at 5% level, suggesting that there was a home bias in listing on the TSE. The coefficient on *TSE* is positive though it is statistically significant only at 10% level.

Thus, the result from the period 1918 suggests that large firms in the eastern part of Japan were more likely to be listed on the TSE. It also suggests larger market size of the TSE encouraged the firms to be listed on the market, consistent with the key implication of our model.

The second column of Table 4 reports the results from the period after 1918. Here the only statistically significant coefficient is *Cap*, which suggests the TSE started to list large firms.

7. Concluding remarks

The size of the stock market relative to the size of national economy was large in the late 1920s and 1930s Japan. During the first 40 years since the establishment of the Tokyo Stock Exchange in 1878, however, the market was relatively small and the listed firms were concentrated in the areas close to Tokyo. This paper examined why the TSE stayed relatively stagnant during the first 40 years and why it suddenly took off in the late 1910s.

We have found an important change in the TSE's policy toward listing in its spot market in 1918. Before 1918, the firms had to apply to the TSE to be listed. After 1918, the TSE started trading some stocks without explicit applications from those firms. We argue that this policy change allowed the TSE to escape from the low liquidity equilibrium and to take off.

The argument that we advanced to explain the existence of the low liquidity equilibrium in the pre-war stock market in Japan can be generalized to consider stock market development in other parts of the world in other times. The possibility that low expected liquidity discourages firms from listing their stocks in the market and justifies the expectation may be quite general.

The self confirming nature of the expectation about the market liquidity implies several interventions that may be necessary for stock exchanges in developing economies to develop. The TSE solved the problem by listing major companies without waiting for their applications to be listed. Alternatively, a stock exchange (or the government) may be able to subsidize new companies to be listed on the stock exchange. Finally, there may be ways to attract more traders to the stock exchange to increase the market liquidity in general. In this case, what is more

important for the liquidity (in the sense that large transactions can take place without changing the market price very much) is the presence of noise traders, as is shown by the models of stock market microstructure (see, for example, Kyle (1985)).

References

Anderson, Brian D. O. and John B. Moore (1979). *Optima Filtering.* Englewood Cliffs, NJ: Prentice-Hall.

Bank of Japan (Institute for Monetary and Economic Studies) (1986). Wagakuni no Kin'yu Seido (Financial System in Japan), Tokyo: The Bank of Japan

Bank of Japan (Institute for Monetary and Economic Studies) (1995). Wagakuni no Kin'yu Seido (Financial System in Japan), Tokyo: The Bank of Japan

Baruch, Shmuel, and Gideon Saar (2007). "Asset Returns and the Listing Choice of Firms," *Review of Financial Studies*, forthcoming.

Ellul, Andrew, and Marco Pagano (2006). "IPO Underpricing and After-Market Liquidity," *Review of Financial Studies*, 19, 381-421.

Fujino, Shōzaburo, and Jūrō Teranishi (2000). *Nihon Kin'yu no Sūryō Bunseki (Quantitative Analysis of Japan's Finance).* Tokyo: Tōyō Keizai Shimpō-sha.

Geisst, Charles R. (1997). *Wall Street: A History.* New York, NY: Oxford University Press.

Hoshi, Takeo, and Anil Kashyap (2001). *Corporate Financing and Governance in Japan: The Road to the Future.* Cambridge, MA: MIT Press.

Ishii, Kanji (1997). *Nihon no Sangyo Kakumei* (*Industrial Revolution in Japan*) , Tokyo: Asahi Sensho

Ishii, Kanji (1999). *Kindai Nohon Kin'yushi Josetsu* (*Towards the Financial History of Modern Japan*, " Tokyo: The University of Tokyo Press

Kataoka, Yutaka (1987). "Meijiki no Kabushiki Shijo to Kakaku Keisei" (The Stock Market and Price Formation in Meiji Japan," *Shakai Keizai Shigaku* 53(2): 159-181

Kuwata, Yuzo (1940). *Wagakuni Torihikijo no Riron to Jissai* (*Theory and Practice of the Japanese Exchanges*," Toyko: Yuhikaku

Kyle, Albert S. (1985). "Continuous Auctions and Insider Trading," *Econometrica*, 53, 1315-1335.

Michie, Ranald (1999). *The London Stock Exchange: A History*. Oxford, UK: Oxford University Press.

Miwa, Yoshiro, and Mark Ramseyer (2002). "Banks and Economic Growth: Implications from Japanese History", *Journal of Law and Economics*, April 2002: 127-164

Noda, Masao (1980). *Nihon Shōken Shijō Seiritsu-shi: Meiji-ki no Tetsudō to Kabushiki Kaisha Kin'yu. (History of the Formation of Japanese Securities Market: Railroads and Joint Stock Company Financing in Meiji).* Tokyo, Japan: Yūhikaku.

Okazaki, Tetsuji (1995). "Nihon niokeru Koporeito Gabanansu no Hatten) "Evolution of Corporate Governance in Japan: An Historical Perspective," in Masahiko Aoki and Ronald Dore eds. *Shisutemu toshite no Nihon Kigyo* (*The Japanese Firm as a System*), Tokyo: NTT Shuppan

Okazaki, Tetsuji (1999a). "Corporate Governance" in Tetsuji Okazaki and Masahiro Okuno-Fujiwara eds. *The Japanese Economic System and Its Origins*, New York: Oxford University Press

Okazaki, Tetsuji (1999b). *Mochikabu Gaisha no Rekishi: Zaibatsu to Kigyo Tochi* (*History of Holding Companies in Japan: Zaibastu in Perspective of Corporate Governance*), Tokyo: Chikuma Shinsho

Okazaki, Tetsuji (2000). "Mochikabu Gaisha to Ginko: Koporeito Gabanansu kara Mita 1920 Nendai to Gendai (Holding Companies and Banks: The 1920s and the Present in Perspective of Corporate Governance), Hitotsubashi Business Review, 48(3): 38-50

Okazaki, T., Michiru Sawada and Kazuki Yokoyama (2005) "Measuring the Extent and Implications of Director Interlocking in Pre-war Japanese Banking Industry," The Journal of Economic History, 65(4): 1082-1115

Osaka Stock Exchange (1928). *Daikabu 50 Nenshi* (*50 Years History of the Osaka Stock Exchange*), Osaka: the Osaka Stock Exchange

Pagano, M., F. Panetta and Zingales[1998] "Why Do Companies Go Public ?: An Empirical Analysis, *The Journal of Finance*, vol.53(1): 27-64

Shimura, Kaichi (1970). *Nihon Shihonshijo Bunseki* (*Analysis of the Japanese Capital Market*), Tokyo: The University of Tokyo Press

Teranishi, Juro (2003). *Nihon no Keizai Shisutemu* (*The Economic System in Japan*), Tokyo: Iwanami Shoten

Tokyo Stock Exchange (1928). *Tokyo Kabushiki Torihikijo Gojū-nenshi (Fifty Year History of the Tokyo Stock Exchange.* Tokyo, Japan: Tokyo Stock Exchange.

Tokyo Stock Exchange, Research Division (Chōsa-ka) (1932). *Tokyo Kabushiki Torihikijo (Tokyo Stock Exchange)*. Tokyo, Japan: Tokyo Stock Exchange.

Tokyo Stock Exchange (2002). *Tokyo Shoken Torihikijo 50 Nenshi* (*50 Years History of the Tokyo Stock Exchange*), Tokyo, Japan: The Tokyo Stock Exchange

Appendix 1. Compilation of listing data

We have compiled the list of all the listed stocks in 1878, 1885, 1900, 1915, 1925 and 1935.

The information for 1878 and 1885 was taken from the TSE (1928). The TSE (1928) reports the listing (and delisting) dates for all the stocks on the futures market. Similar information is not available for the stocks listed only on the spot market, but this is not a problem for the period before 1896, when all the stocks on the spot market were also listed in the futures market. Thus, we can use the data to create a complete list of listed stocks for 1878 and 1885.

A complete list of the listed stocks and their face values is available in the business reports of the TSE each year from 1900 to 1918. So, we take the information for the years 1900 and 1915 from this source. With respect to 1925 and 1935, we take the data on the listed stocks and their face value from the unpublished version of TSE business reports, held at the TSE.

The information on the capital of each company was taken from various government reports, including *Ginkō-ka Hōkoku* (*The Report of the Banking Section of the Ministry of Finance*), *Ginkō-kyoku Nenpō* (*Annual Report of the Banking Bureau of the Ministry of Finance*), *Teikoku Tōkei Nenkan* (*The Imperial Statistical Year Book*), and *Nōshōmu Tōkei Hyō* (*The Statistics of Agriculture and Commerce*).

In addition to these government reports, we used *Zenkoku Shogaisha Yakuinroku* (*Directory of Corporate Directors*), 1900 and 1912 issues, *Ginkō Kaisha Yōroku* (*Directory of Banks and Companies*) 1925 and 1935 issues, *Teikoku Ginkō Kaisha Yōroku* (*Imperial Directory of Banks and Companies*) 1925 issue, and *Kabushiki Nenkan* (*Year Book of Corporate Stocks*) 1926 and 1936 issues to collect the location, establishment year, and industry of each listed firm. We use the industry classification employed by the TSE (1938).

The data shows interesting changes of industrial composition of listed firms over time. Of the 24 companies that had been listed before 1885, we see twenty of them were banks (and nineteen of them national banks). The concentration of listed companies in banking is understandable because the National Bank Act was the only law that defined joint stock companies and the limited liability of shareholders (Miyamoto 1990, Takamura 1996; Yoshida 1998, p.28). Legislation for joint stock companies in other industries had to wait till the Commercial Code of 1893.

By 1890, the number of listed companies increased to 96. The number of listed banks declined as the National Bank Act was phased out, but many railway companies were newly listed. Companies in other industries, including coal and petroleum, cotton spinning, other textiles and foods, were also listed during this period.

By 1915, the number of listed companies increased further, and the industries represented became more diversified. There were 160 listed companies. We can identify the industries for 151 of them. The share of the railway companies declined to 21.2%. While new companies running electric railways in the urban areas emerged, large railway companies disappeared due to the nationalization of the main lines in 1906 (Noda 1980, pp.310-313). The electricity industry saw its share go up sharply from 1900 to 1915. The electricity companies, which were in the early stages of development and needed large-scale investment, actively raised funds from the stock market (Kikkawa 1995, chapter 1). Besides electricity, the shares of such industries as coal and petroleum, sugar, and gas, also went up in this period.

By 1925, the number of listed companies reached 712, following the expansion of the spot market after 1918. The industries became even more diverse. The share of the railways, which still had the largest share, was only 8.3%. The shares of such industries as insurance,

machinery, chemistry and metal, which developed during World War I, went up. In 1935, 919 companies were listed, and the industrial composition was similar to that in 1925.

Appendix 2.

This appendix shows that the market liquidity is an increasing function of the number of firms listed in the market using a standard model of stock market microstructure. Baruch and Saar (2007) considers a special case of this model and obtains a similar result.

Consider k listed stocks, whose fundamental values depend on n ($\leq$ k) signals:

$$V = M + FS + \Theta \qquad (1)$$

where V is (kx1) vector of the fundamental values, M is (kx1) vector of the mean fundamental values, S is (nx1) vector of signals, F is (kxn) matrix whose i-j element shows how the fundamental value of stock i is influenced by the signal j, and Θ is (kx1) vector of idiosyncratic shocks. F is assumed to have rank k.

We assume the signals are distributed normally and the covariance matrix of S is given by $\sigma^2 I$, where I is the identity matrix. The idiosyncratic shocks follow the standard normal distribution and are assumed to be independent with each other and with S.

Following Kyle (1985) and the related literature, we assume the market price of a stock is determined by the market maker so that the price is equal to the expected fundamental value of the stock given the order flows the market maker observes. Let Q be (kx1) vector of the orders by the informed traders, who observe the values of S before they submit the orders. The informed traders decide their position to maximize the expected profit from trading, given the pricing rule of the market maker. The market also has noise traders, whose orders are denoted by (kx1) vector X. We assume X follows a normal distribution with mean zero and variance $\sigma_x^2 I$. The market maker and both types of traders are assumed to be risk neutral.

Under the assumption of normal distributions, the equilibrium pricing rule and hence the optimal trading strategy for the informed traders become linear functions. Let us denote these as follows.

$$Q = BS \qquad (2)$$

$$P = \mathrm{M} + \Lambda(Q + X) \qquad (3)$$

where B is (kxn) matrix whose i-j element shows how the informed traders adjust their order of stock i responding to signal j, P is (kx1) vector of the market prices of the stocks, and Λ is (kxk) matrix whose i-j element shows how the market maker adjust the price of stock i when the order flow for stock j changes. Note that the price cannot respond to Q and X differently because the market maker cannot distinguish which orders come from the informed traders.

The informed traders maximize their expected profits from trading:

$$E\pi = E\left[(V - P)^T Q\right] = (FS - \Lambda Q)^T Q$$

where the superscript T denotes the transpose of the matrix. The first order condition is given by:

$$FS - \Lambda Q - \Lambda^T Q = 0$$

Thus,

$Q = (\Lambda + \Lambda^T)^{-1} FS$, which implies:

$$B = (\Lambda + \Lambda^T)^{-1} F \qquad (4)$$

If we divide the variance-covariance matrix of the vector $(V^T, Q^T + X^T)^T$ into sub-matrices as follows,

$$Var\begin{pmatrix} V \\ Q + X \end{pmatrix} = \begin{pmatrix} \Sigma_{VV} & \Sigma_{VQ} \\ \Sigma_{QV} & \Sigma_{QQ} \end{pmatrix}$$

Then, one can show:[10]

$$P = E\left[V \middle| Q + X\right] = \mathrm{M} + \Sigma_{VQ}\Sigma_{QQ}^{-1}(Q + X) \qquad (5)$$

From the equations (1) and (2), we can calculate:

$$\begin{aligned} \Sigma_{VQ} &= \sigma^2 FB^T \\ \Sigma_{QQ} &= \sigma_x^2 I + \sigma^2 BB^T \end{aligned} \qquad (6)$$

Substituting (6) into (5) and comparing the result with (3), it is straightforward to see:

$$\Lambda = \sigma^2 FB^T\left[\sigma_x^2 I + \sigma^2 BB^T\right]^{-1} = FB^T\left[\frac{1}{h^2} I + BB^T\right]^{-1} \qquad (7)$$

where *h* denotes the square root of the signal to noise ratio ($\sqrt{\sigma_2 / \sigma_x^2}$), which shows up repeatedly in the calculation below.

If Λ is symmetric (which can be confirmed), we can rewrite (4) to get:[11]

$$B = \frac{1}{2}\Lambda^{-1}F \qquad (8)$$

Multiplying (7) from the left by Λ^{-1} and substituting (8), we get:

$$I = 2BB^T\left[\frac{1}{h^2} I + BB^T\right]^{-1}$$

Multiplying both side by $\frac{1}{h^2} I + BB^T$:

$$\frac{1}{h^2} I + BB^T = 2BB^T$$

Thus, $I = h^2 BB^T$.

Substituting (8) into this, we get

---

[10] See, for example, Anderson and Moore (1979, Theorem 3.1, pp.25-28).
[11] The algebra that are used to get to the equation (9) follow Appendix A of Baruch and Saar (2007).

$$\Lambda\Lambda^T = \frac{h^2}{4} FF^T \qquad (9)$$

The market liquidity is often defined as "depth" of the market which is "the ability of the market to absorb quantities without having a large effect on price" (Kyle, 1985, p.1330). Following this idea, we can argue the market liquidity is inversely related to the "magnitude" of Λ, because a "large" Λ implies that the prices are very sensitive to any changes in order flows. Here we focus on the "magnitude" of $\Lambda\Lambda^T$ because it moves in the same direction as the "magnitude" of Λ, and use the sum of the eigenvalues of this matrix as the measure of the "magnitude."

To consider how the market liquidity changes with the number of stocks listed (k), let us partition the matrix F into the first k-1 rows and the k-th row.

$$F = \begin{bmatrix} G \\ g \end{bmatrix} \qquad (10)$$

Now G is (k-1 x n) matrix and g is (1xn) vector. Similarly, partition Λ into a (k-1 x k-1) matrix and the remaining parts.

$$\Lambda = \begin{bmatrix} V & v^T \\ v & \lambda_{kk} \end{bmatrix} \qquad (11)$$

where V is (k-1 x k-1) matrix, v is (1 x k-1) vector, and λ_{kk} is a scalar.

Let $\Gamma(k; j)$ denote the liquidity of the first j stocks when k stocks are listed, which we measure as the sum of the eigenvalues of the submatix of $\Lambda\Lambda^T$ that contains the upper left jxj elements. Since the sum of the eigenvalues is equal to the trace of the matrix, using (9) and the partition of F and Λ, we see:

$$\Gamma(k-1; k-1) = \frac{h^2}{4} \operatorname{tr} GG^T \qquad (12)$$

where tr denotes the trace of the matrix.

To compare this to Γ(k; k-1), we first substitute (10) and (11) into (9) to get:

$$\begin{bmatrix} V & v^T \\ v & \lambda_{kk} \end{bmatrix}\begin{bmatrix} V^T & v \\ v^T & \lambda_{kk} \end{bmatrix} = \frac{h^2}{4}\begin{bmatrix} G \\ g \end{bmatrix}\begin{bmatrix} G^T & g^T \end{bmatrix}$$

Thus,

$$\begin{bmatrix} VV^T + v^T v^T & Vv + v^T \lambda_{kk} \\ vV^T + \lambda_{kk} v^T & vv + \lambda_{kk}^2 \end{bmatrix} = \frac{h^2}{4}\begin{bmatrix} GG^T & Gg^T \\ gG^T & gg^T \end{bmatrix}$$

Therefore,

$$\mathrm{tr}\, VV^T + \mathrm{tr}\, v^T v^T = \frac{h^2}{4}\mathrm{tr}\,\mathrm{GG}^T$$

Since $\mathrm{tr}\, v^T v^T$ is the sum of square of each element of v, it must be positive. Noting this, we establish:

$$\Gamma(k;k-1) = \mathrm{tr}\, VV^T = \frac{h^2}{4}\mathrm{tr}\,\mathrm{GG}^T - \mathrm{tr}\, v^T v^T < \frac{h^2}{4}\mathrm{tr}\,\mathrm{GG}^T = \Gamma(k-1;k-1)$$

Thus, the price response of a set of stocks becomes smaller when an additional stock is listed on the market. In this sense, the market liquidity is an increasing function of the number of stocks listed.[12] The result has a very intuitive interpretation. As the number of listed stocks grows, the information useful in predicting the fundamental value of a stock can be found in the order flows of many stocks, as long as their fundamental values are influenced by the same factors as well. Thus, the information revealed by the order flow of any single stock becomes smaller, leading to a smaller price response to the order flow (and hence increased liquidity).

[12] Baruch and Saar (2007) also obtains this result for a special case, although this is not the main focus of their paper.

Table 1. Funding Patterns of Japanese Corporations: 1902-1940

(percentage distribution of capital and liabilities)

Time period	Paid-in capital and reserves	Corporate bonds	Borrowings	Bills payable
1902-1915	82.3	9.5	3.2	5.1
1914-1929	74.8	14.9	4.1	6.2
1928-1940	66.4	18.5	6.7	8.4

Source: Hoshi and Kashyap (2001), p.36, Table 2.3.

Table 2. Regional Distribution of Companies Listed on the Tokyo Stock Exchange: 1887-1935

	1878	1885	1900	1915	1925	1935
Total	4	24	96	151	695	899
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
East	4	22	77	121	536	650
	(100.0)	(91.7)	(80.2)	(80.7)	(77.1)	(72.3)
Hokkaido	0	0	4	2	7	9
	(0.0)	(0.0)	(4.2)	(1.3)	(1.0)	(1.0)
Tohoku	0	2	0	0	8	16
	(0.0)	(8.3)	(0.0)	(0.0)	(1.2)	(1.8)
Kanto	4	17	67	110	487	569
	(100.0)	(70.8)	(69.8)	(73.3)	(70.1)	(63.3)
Tokyo	4	12	54	89	440	506
	(100.0)	(50.0)	(56.3)	(59.3)	(63.3)	(56.3)
Chubu	0	3	6	9	34	56
	(0.0)	(12.5)	(6.3)	(6.0)	(4.9)	(6.2)
West	0	2	19	22	105	171
	(0.0)	(8.3)	(19.8)	(14.7)	(15.1)	(19.0)
Kinki	0	2	11	16	82	135
	(0.0)	(8.3)	(11.5)	(10.7)	(11.8)	(15.0)
Osaka	0	2	4	13	66	105
	(0.0)	(8.3)	(4.2)	(8.7)	(9.5)	(11.7)
Chugoku	0	0	3	2	11	17
	(0.0)	(0.0)	(3.1)	(1.3)	(1.6)	(1.9)
Shikoku	0	0	0	0	1	5
	(0.0)	(0.0)	(0.0)	(0.0)	(0.1)	(0.6)
Kyushu	0	0	5	5	11	14
	(0.0)	(0.0)	(5.2)	(2.7)	(1.6)	(1.6)
Colonies	0	0	0	7	32	42
	(0.0)	(0.0)	(0.0)	(4.7)	(4.6)	(4.7)
Foreign	0	0	0	0	22	36
	(0.0)	(0.0)	(0.0)	(0.0)	(3.2)	(4.0)

Source: Author's calculation based on the database discussed in Appendix 1.

Note: "East" includes Hokkaido, Tohoku, Kanto, and Chubu. "West" includes Kinki, Chugoku, Shikoku, Kyushu. Tokyo is included in Kanto. Osaka is included in Kinki.

Table 3. Stocks Advertised by a Spot Broker But Not Listed on the TSE

	June 1916	Dec. 1916	June 1917	Dec. 1917	June 1918	Dec. 1918	June 1919	Dec. 1919	June 1920	Dec. 1920	June 1921	Dec. 1921
# of stocks Advertised by Momijiya (a)	118	114	115	116	117	115	115	111	102	95	101	97
Of which not listed on the TSE (b)	28	27	19	28	22	22	6	5	2	1	0	0
a/b (%)	23.73	23.68	16.52	24.14	18.80	19.13	5.22	4.50	1.96	1.05	0.00	0.00

Source: Authors' calculation based on the data collected from *Tokyo Asahi Shimbun* and *Kin'yū Jikō Sankōsho.*

Table 4. Probit Model of Listing Decision

Period	1905-1917	1918-1935
log(Paid-in capital)	3.004*	0.549***
	(1.699)	(0.205)
Age	0.050	0.013
	(0.074)	(0.013)
ROE	-6.393	0.205
	(4.029)	(1.034)
East	7.099**	-0.090
	(3.512)	(0.346)
log(TSE)	3.749*	-0.318
	(2.128)	(0.382)
# of observations	296	644

Note: The dependent variable is a dummy variable that takes one if the company lists its shares on the TSE in that year. After the listing event, the company is dropped from the sample, so that all the observations with the dummy variable = 0 are the companies that have never been listed on the TSE. The model is estimated with Profit estimation. The numbers in parentheses show the standard errors of the coefficient estimates. *** (**, *) denotes that the coefficient estimate is significantly different from zero at 1% (5%, 10%) level.

Figure 1. Stock Market Development in Japan: 1928-2000

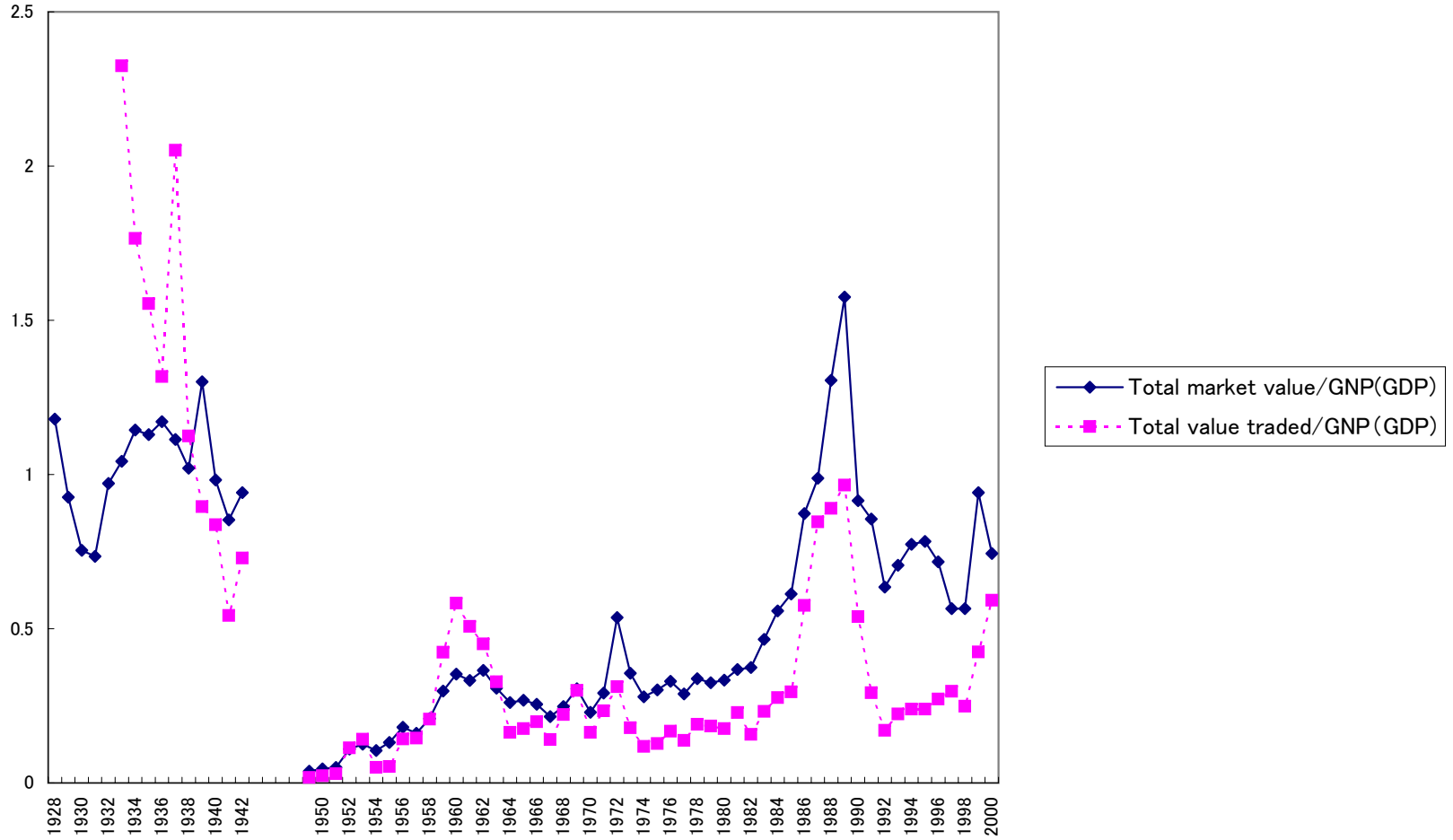


Figure 2a. Economic Growth and the Size of Stock Market

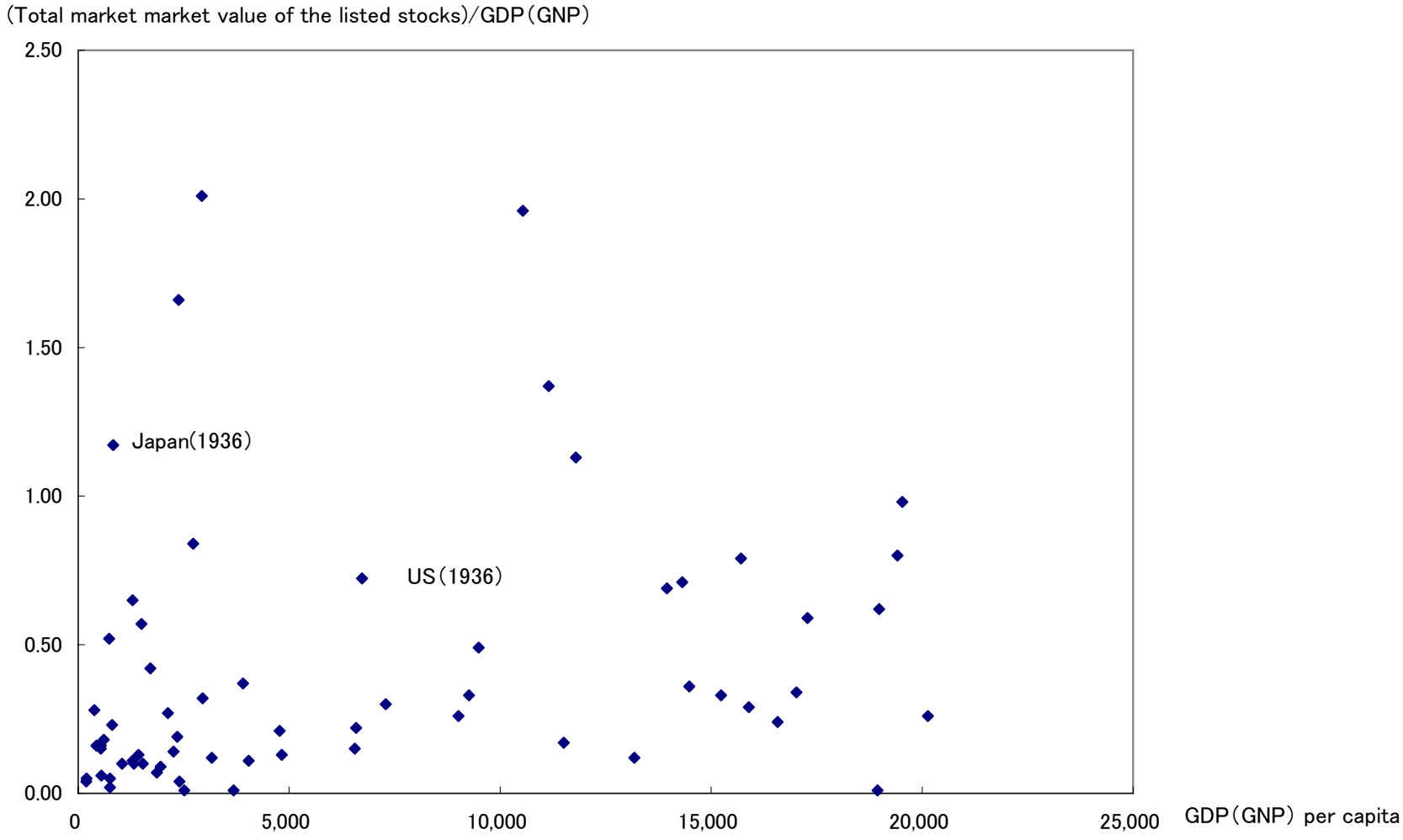


Figure 2b. Economic Growth and the Trade Volume in the Stock Market

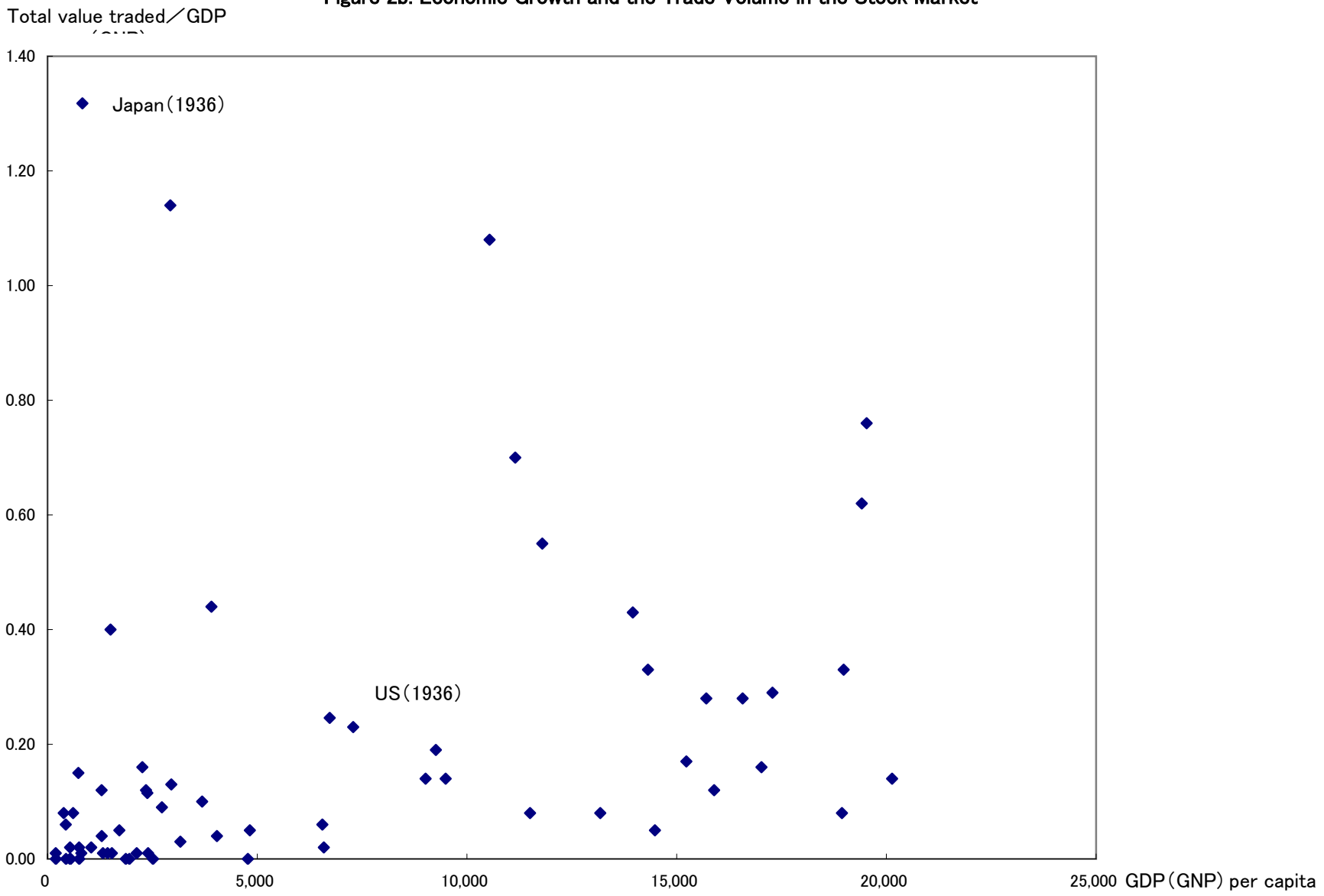
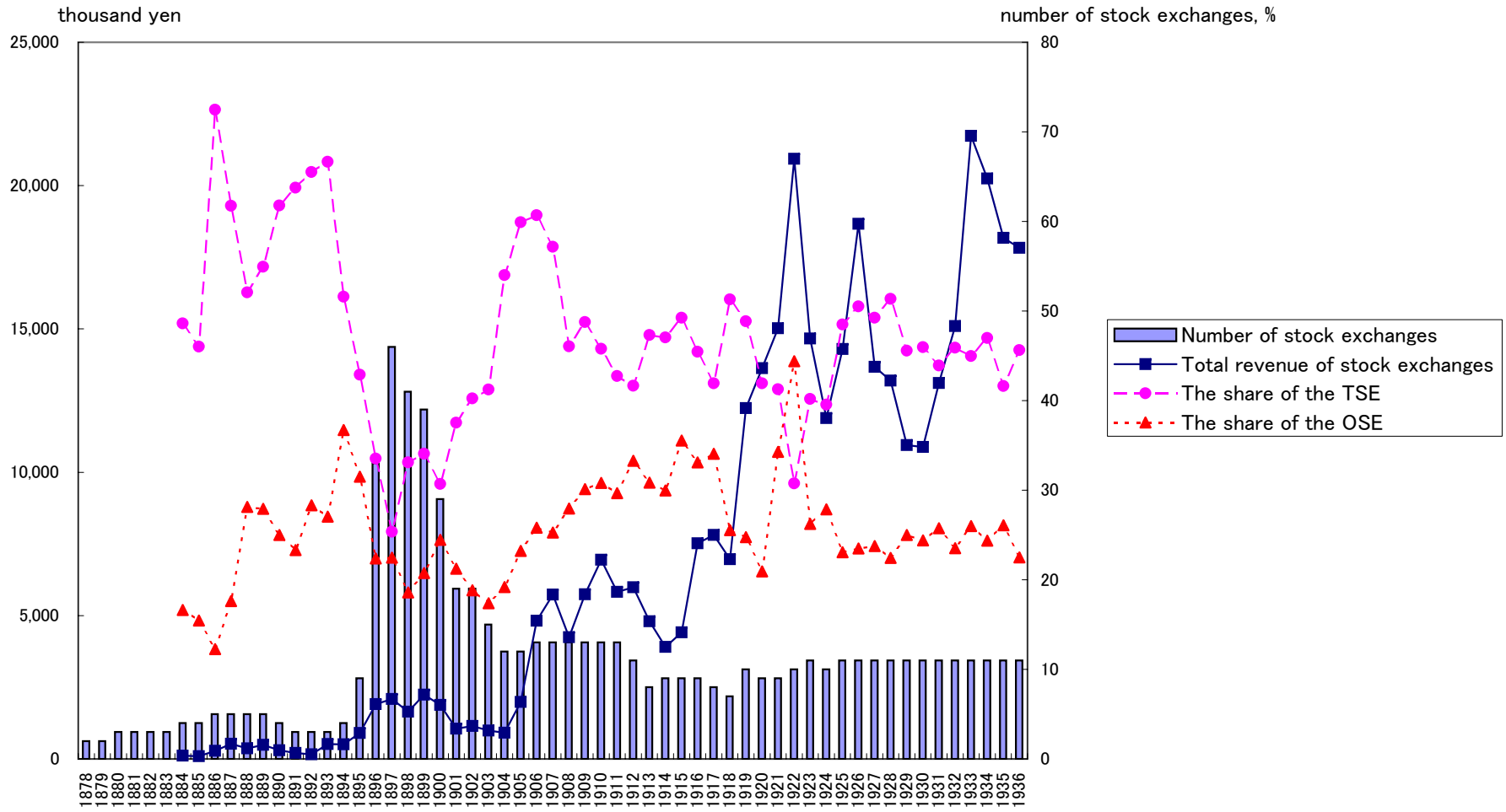
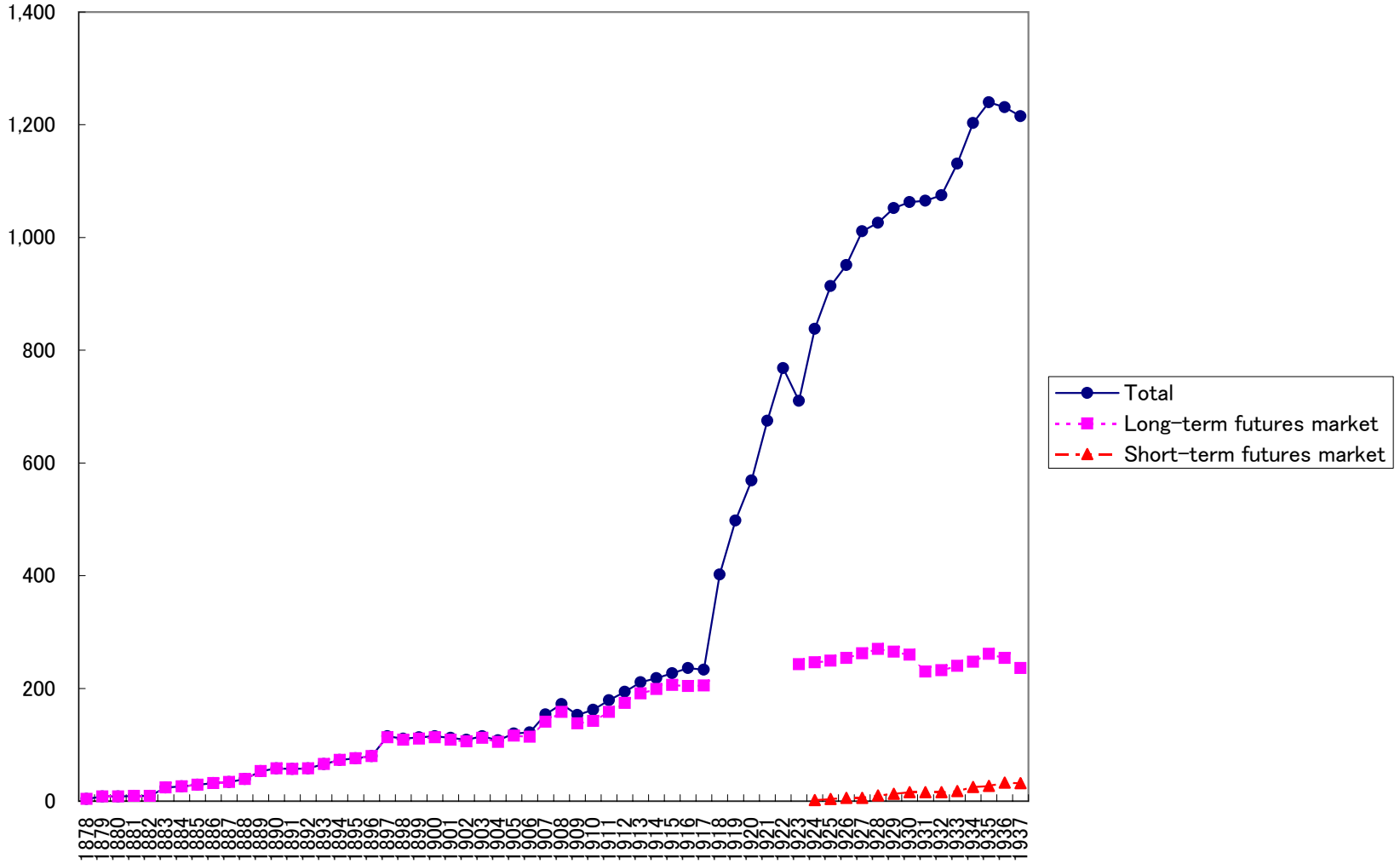


Figure 3. Number of Stock Exchanges and the Revenue Share of the TSE



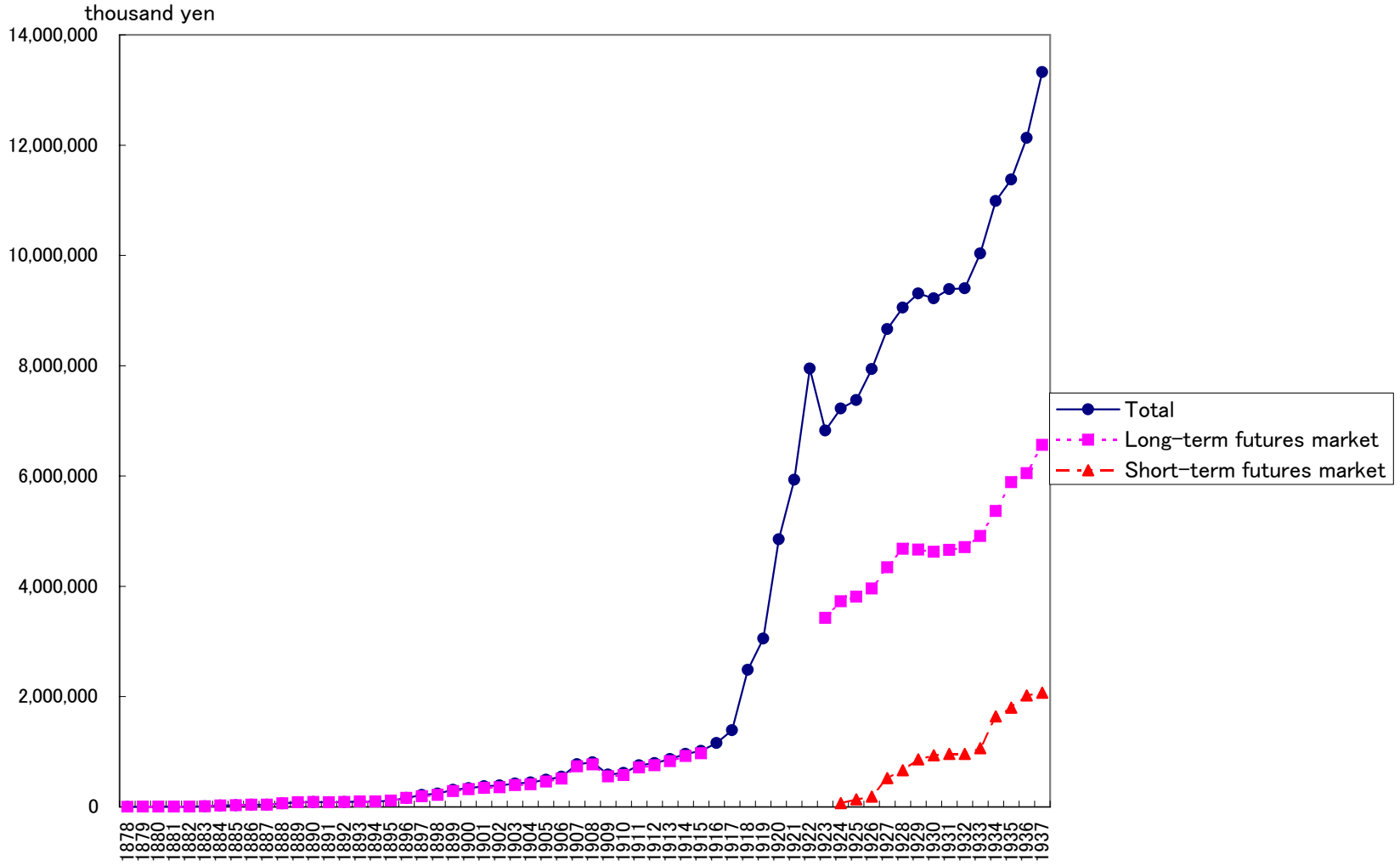
Source：Toyo Keizai Shinposha[1927]; Ministry of Commerce and Industry, *Handbook of exchanges*, various issues

Figure 4a. Number of the Listed Stocks on the TSE



Source: TSE[1938].

Figure 4b. Total Book Value of the Stocks Listed on the TSE



Source: TSE[1938].

Figure 4c. Total Face Value of the Listed Stocks on the TSE (ratio to GNP)

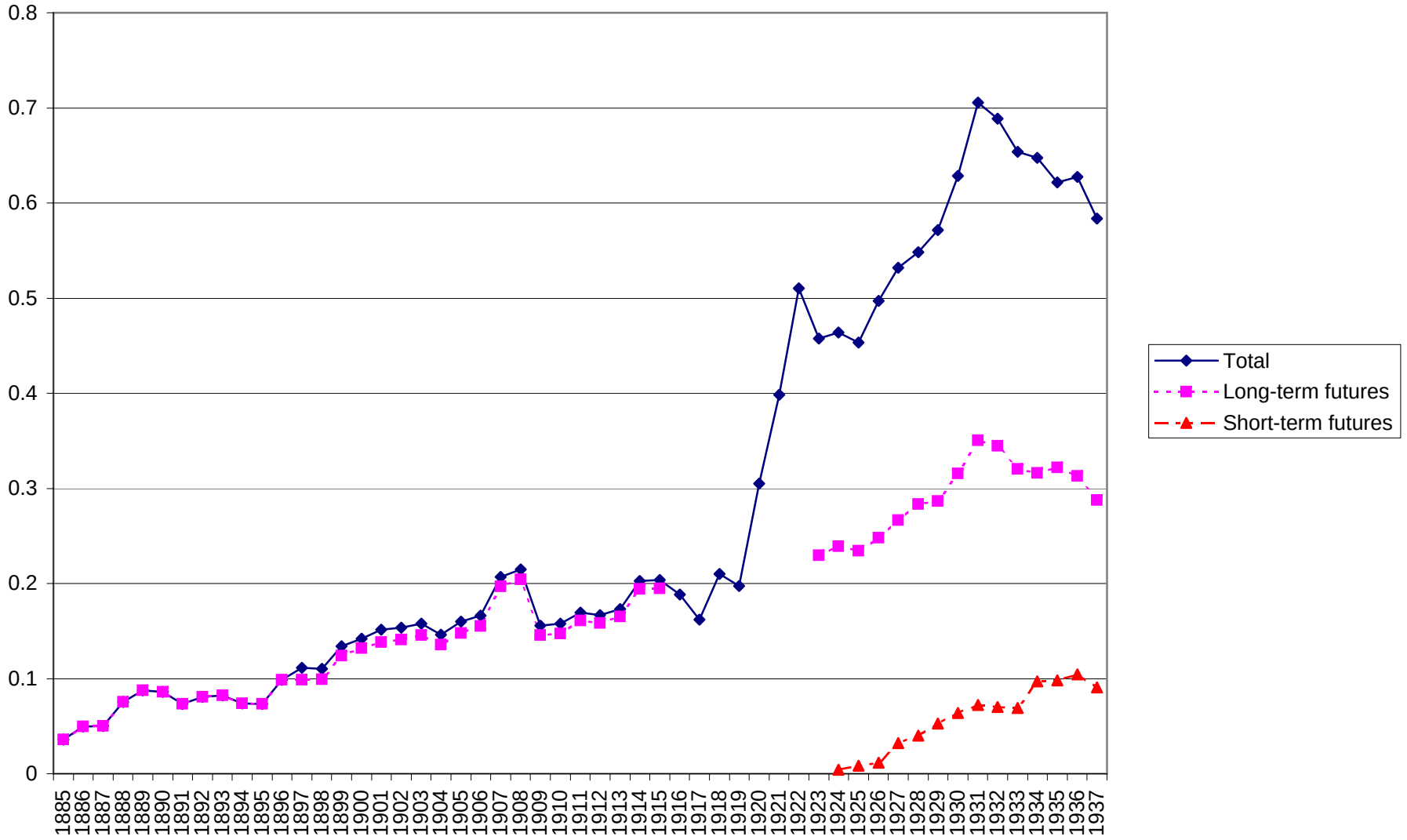


Figure 5a. Listing and the Number of Shareholders

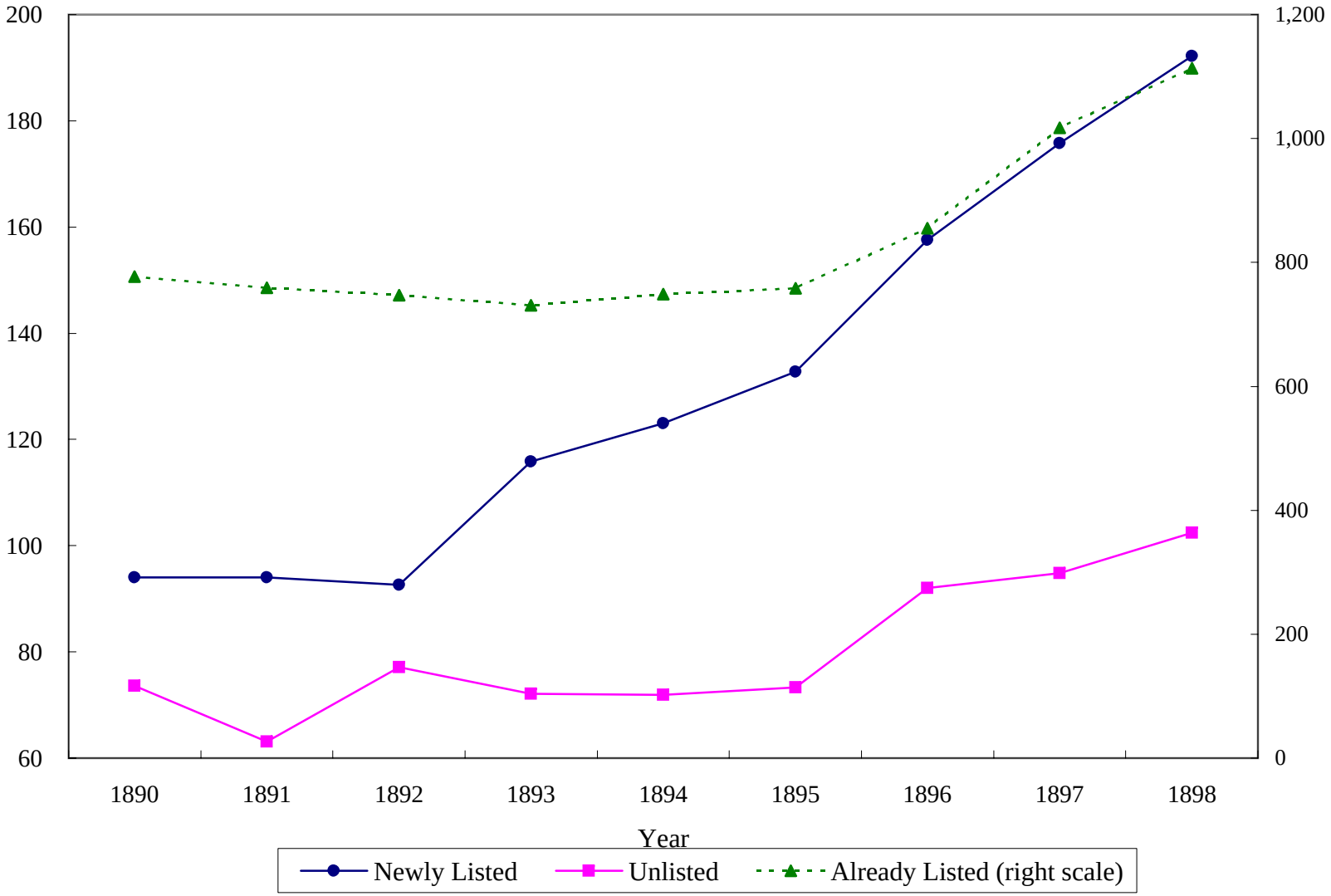


Figure 5b. Listing and the Amount of Paid-in Capital

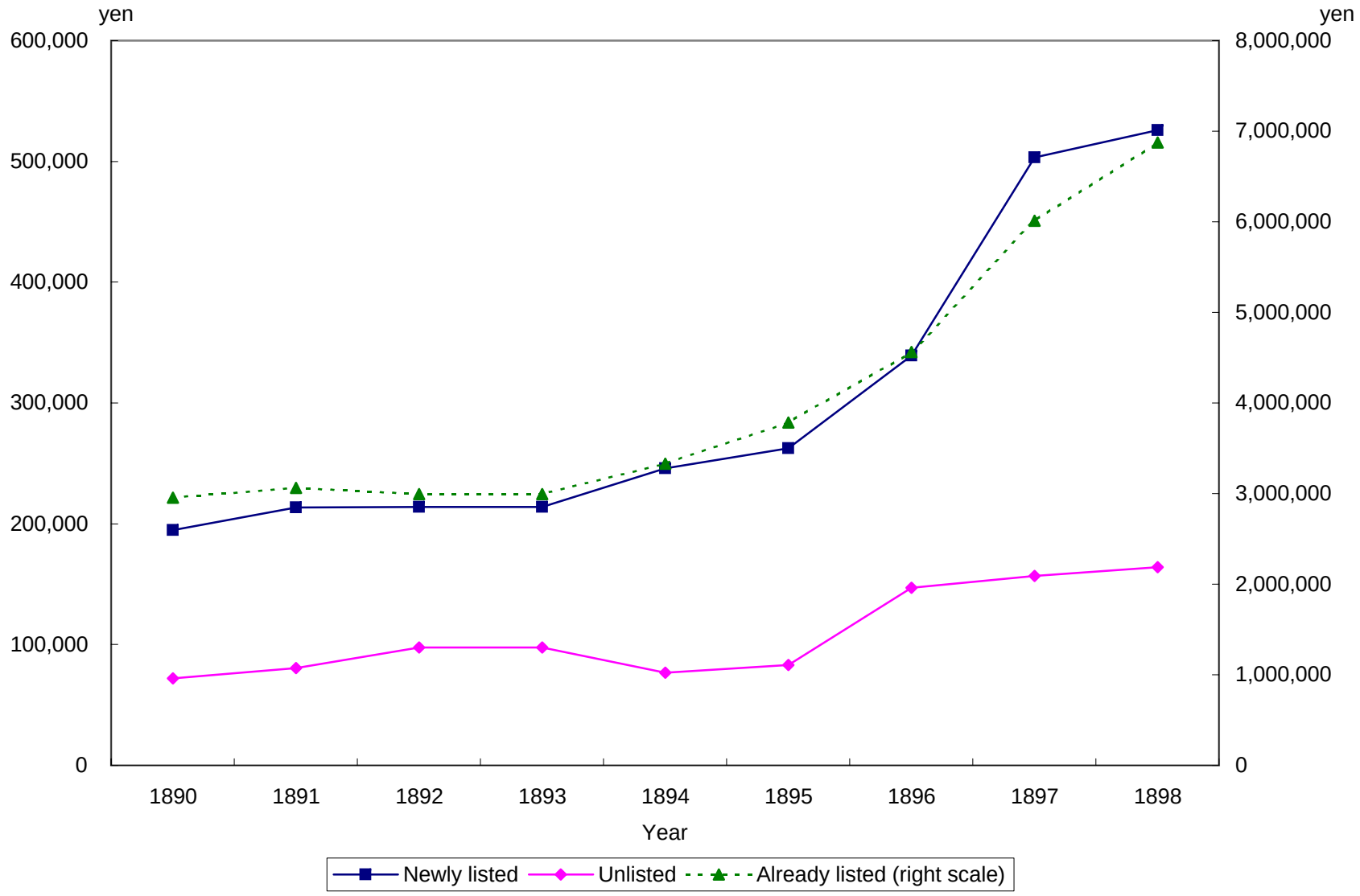


Figure 6a. Number of cotton spinning companies listed at the TSE: 1905–1936

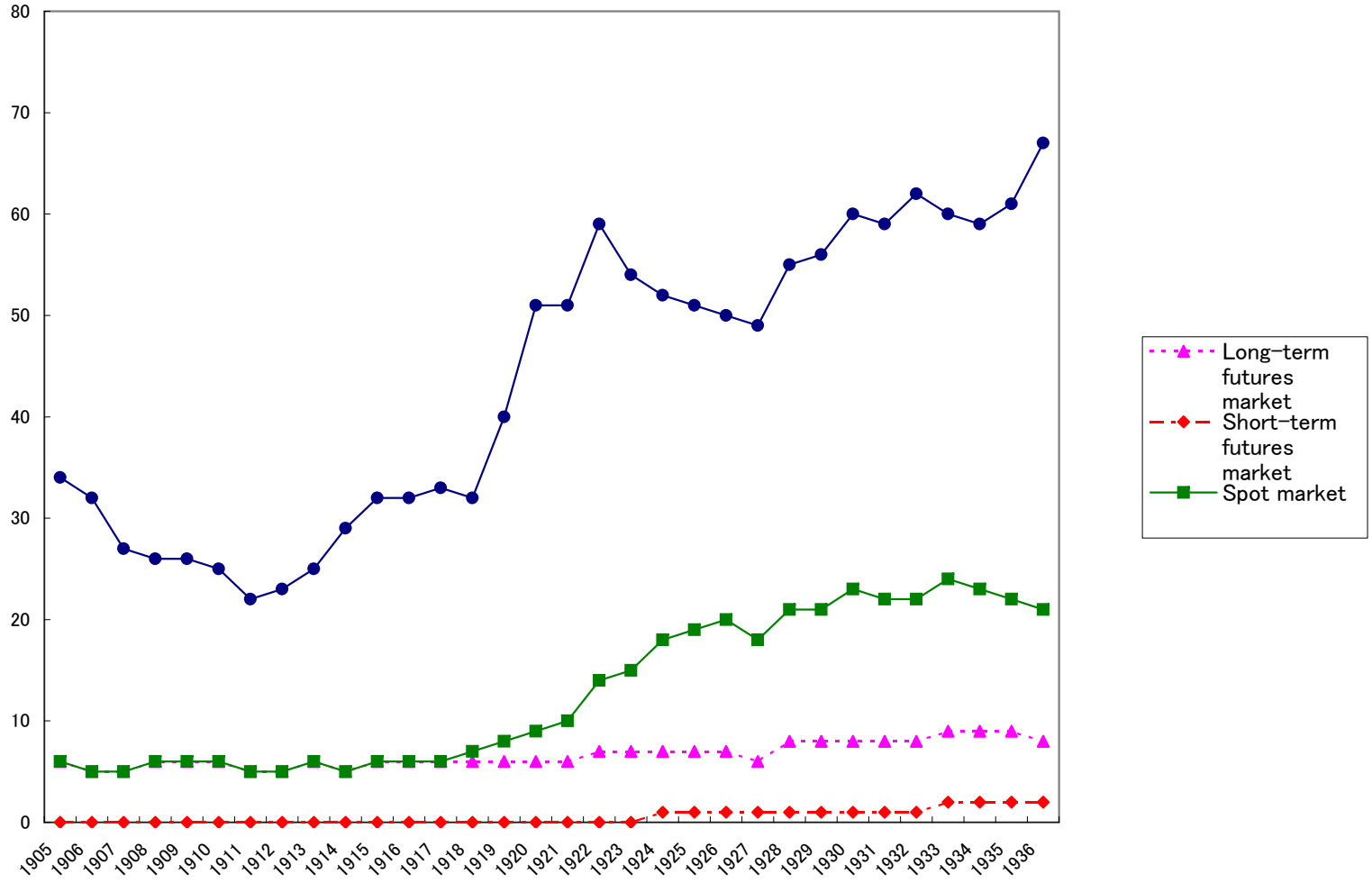


Figure 6b. Regional Bias of the Cotton Spinnig Companies Listed on the TSE

