

KEO Discussion Paper No. 170

Colonial Impact on Japan's Economy:
Dynamics of the Rice Market during the Interwar Period

Kiyotaka Maeda

Colonial Impact on Japan's Economy: Dynamics of the Rice Market during the Interwar Period*

Kiyotaka Maeda[†]

Keio University

June 2022

Abstract

This study analyzes the change in the pricing of domestic and colonial rice in Japan during the interwar period. Japan was an empire that had thriving colonial trades to procure primary products. Colonial rice differed in quality from domestic rice because of climate conditions, and the government promoted homogenizing various types of rice. Consequently, colonial rice consumption expanded in Japan, and the pricing of each heterogeneous rice partially influenced the others after the mid-1930s. The forging of a closer relationship among the regions within the empire structurally transformed not only colonial economies but also the metropole's economy.

Keywords: imperialism, Japanese Empire, primary product, colony, pricing, rice

JEL classification codes: N25, N75

* We acknowledge the Japan Society for the Promotion of Science for its financial assistance as provided through the Grants-in-Aid for Scientific Research (nos. 21K01617; 20KK0029; 20K01795) and financial support received from the Takahashi Industrial and Economic Research Foundation (project title: Consumption and Distribution of Foods in Modern East Asia and the Japanese Empire).

[†] Department of Japanese History, Faculty of Letters, Keio University, 2-15-45 Mita, Minato-ku, Tokyo 108-8345, Japan; E-mail: k-maeda@keio.jp

1 Introduction

Imperialism cast a shadow across the globe in the nineteenth and twentieth centuries. Under this cutthroat regime, the colonizers transformed the economic institutions of their colonies in different ways, and the institutional distinction caused differences in prosperity within the former colonies (Acemoglu, Johnson, and Robinson. 2001). As a result, colonization cemented the legacy of economic disparity, which unfortunately remained into the twenty-first century. Japan, the only East Asian country that built an empire in the modern period, also enlarged economic disparities with its colonies. However, the Japanese Empire had an intriguing feature in that the metropole had a mutual economic dependence on the colonies based on geographical proximity.

The Japanese colonization did not fit the Western model (Duus 1995, p. 434). Japan did not have sufficient economic and military capacity to colonize distant locations and so took possession of its adjacent foreign regions: Taiwan (Formosa) in 1895, Southern Sakhalin in 1905, and Korea in 1910 (Beasley 1987, p. 253). This geographical proximity characterized the economic nature of the Japanese Empire.

During the interwar period, Japan overwhelmed the Western countries in the component ratio of colonial trade to the total volume of imports and exports, and the Japanese Empire rose to become “the world’s largest empire” at the end of the 1930s (Hori 2004, p. 14; 2011). Japan’s bloc-border effect on the commodity trade surged after the First World War (WWI), and the degree of colonial trade linkage within the Japanese Empire sustained a high level during the same period (Okubo 2007). Through this unique colonial trade, Japan utilized its colonies as key suppliers of primary products.

Western European countries also traded with their Asian colonies, and their exports were higher in the degree of trade linkage than their imports during the interwar period. In brief, Western powers mainly utilized their Asian colonies as export destinations. By contrast, in Japan, the linkage degree of both types of trade were almost equal, and primary products held about 70 percent of the commodities transported from the colonies to Japan (Hori 2009, p. 238; Matsumoto 1996). That is, Japan economically forged and deepened closer mutual relations with its colonies after WWI (Wilson and Cribb 2018). However, the previous literature does not clarify how the change in the colonial economies affected the metropole’s economy since it tends to focus only on the one-way relationship that the metropole’s activity acted on the colonial societies.

Hori (2004; 2009; 2011), Matsumoto (1996), and Okubo (2007), as we quoted above, scrutinize the trade statistics within the Japanese Empire. Along with these studies, Japanese scholars explore how an increase in the production of colonial commodities for export to Japan affected the structure of production and distribution in the colonies (Wakimura 2018). Although they shed light on the flow of commodities from the colonies as the production areas to the metropole as the destination for consumption, they do not grasp the change in the metropole’s economy caused by the development of closer relationships within the empire.

Nakajima and Okazaki (2018) reveal that the domestic population moved geographically to reflect the economic integration between Japan and Korea after the annexation. This case suggests that the influence of colonies on the metropole surely existed, and we should consider this influence in the

historical study of imperialism. The increase in the influx of colonial commodities might have altered the commodity market in the metropole, and this change might have triggered the further revisions of colonial trade and the production in the colonies. That is, we need to analyze the historical changes in the commodity market structure in the metropole to capture the mutual relationships among each area within the empire as a cyclic structure. This attempt leads us to understand the influence of the imperialism on the East Asian economy. Based on these discussions, we focus on rice as a primary product in the Japanese market which was supplied by the colonies.

East and Southeast Asia have a strong food culture that relies on rice as a staple food, and this region has been the largest rice exporter in the world (Fabiosa 2011; Latham 2022). Japan suffered from a food shortage because of the early phase of industrialization and began to import rice in the 1890s. However, imported rice, both from foreign countries and the Japanese colonies, tended to be consumed only in the poorer areas of the large cities and coal mines until the 1910s (Mochida 1970, pp. 135–37). The Japanese Empire was shaped narrow and long in a north-south direction and spread across three climate zones: subarctic, temperate, and tropical. Hence, the botanical variety differed by region, and imported rice had a different texture and taste from the domestic product (Maeda 2022, pp. 423–25; Verschuer 2016, pp. 2–4). This situation changed drastically after WWI.

Industrialization changed the pattern of food consumption through a rise in income levels, and the per-capita rice consumption grew in Japan after WWI (Fukao and Settsu 2021; Kaneda 1970). In response to this problem, the Japanese government promoted an increase in colonial rice imports, and the colonial authorities forced farmers to raise their rice production for export (Omameuda 1993, pp. 181–261; Yi 2015, pp. 124–43; Seth 2020, pp. 310–12). Korea and Taiwan exported about 40 percent of their rice crops to Japan and became suppliers of primary products (Basu and Miroshnik 2020, p. 168). While the aforementioned literature reveals this growth of trade and production of colonial rice, it does not explore how the expansion of colonial rice imports altered the metropole's rice market. Accordingly, we focus on the pricing of domestic and colonial rice in Tokyo to capture the structure of the rice market and the changes it underwent after WWI.

Although the literature analyzing the pricing in the rice futures market paying attention to Fama's (1970) market efficiency exists, it does not explore the pricing of colonial rice (Ito, Maeda, and Noda 2017; 2018; Shizume 2011; Taketoshi 1999). The trading rule of rice exchanges stipulated that colonial rice was more of a deliverable good than anything, and the dealers could trade only domestic rice in the futures markets. Therefore, the previous studies do not need to mention colonial rice pricing when they analyze the market efficiency of rice futures trade. By contrast, we broaden our scopes to include not only domestic rice, but also colonial rice in the spot and futures markets by employing econometric techniques to examine the change in the rice pricing during the interwar period. This case study contributes to both Japanese economic history and the history of imperialism.

Not only Japan but also Western European countries depended on primary products for imports (Radetzki 1990, pp. 16–19). These imports determined market and industry structures, and the structural alteration of the economy caused social change. For instance, Western Europe had experienced an expansion of food imports, which altered its food culture since the advent of imperialism in the late nineteenth century (Stearns 2017, pp. 112–13). Considering this flow of socio-economic

history, our investigation reveals the origin of the social changes by focusing on the central commodity market in the imperial country.

The rest of this study is organized as follows. Sections 2 through 4 provide the preliminary examinations. Sections 2 and 3 explain the Japanese government's rice policy and the colonial authorities' measures to expand the colonial rice consumption in Japan. Section 4 traces the rice prices to explore the traders' evaluation of colonial rice. Section 5 shows the econometric methodology and data on rice prices, and Section 6 employs the time-series analysis to investigate the changes in the structure of the rice market from 1917 to 1939. Finally, Section 7 presents the conclusion.

2 Tightening Restrictions on Rice Trading

2.1 Rice as a Central Part of Commodity Trading

Rice was a central part of commodity trade in Japan until the end of the 1930s. It was listed in more than 80 percent of exchanges and held about 60 percent of the trading amount in futures during the interwar period. In particular, the Tokyo Rice and Merchandise Exchange (TRME) and the Osaka-Dojima Rice Exchange accounted for approximately half of the total volume (see Appendix Figure 1). The trading methods of rice in exchanges were as follows.

Every rice exchange traded a single standard brand of domestic rice with respect to three different contract months: a nearby contract (one month), a second-nearest contract (two months), and a deferred contract (three months). The sellers chose settlement on balance or delivery of physical rice when they cleared their transactions of the nearby contract in these exchanges, and the average ratio of delivery volume to trading volume in the TRME was six percent from 1912 to 1931 (Ministry of Agriculture and Forestry, Rice Bureau 1935b). These exchanges allowed the sellers to utilize not only domestic rice but also Korean rice from 1913 (Ito, Maeda, and Noda 2017).

The brokers used this sophisticated system to forecast the future of the rice market, and rice exchanges generated the futures price of domestic rice as an index of the spot market. However, the Japanese government began to suppress rice exchanges to control rice prices at the beginning of the 1920s.

2.2 Rice Policies After the Rice Riots

In July 1918, *kome-sōdō* (the rice riots), a momentous event in the modern history of Japan, occurred because the rice prices skyrocketed. The wholesale rice prices increased by 1.9 times from the beginning of 1917 to July 1918 (Bank of Japan 1987, p. 28). This surge arose due to multiple factors. In 1918, the Japanese government sent its troops to Siberia and bought a tremendous volume of rice for the military. It caused a rice shortage and triggered speculation, causing traders to hoard their rice in the expectation of higher prices. This situation tormented the masses and generated nationwide riots (Francks 2015, pp. 158–161; Kawahigashi 1990, pp. 68–72). Accordingly, the government was forced to dramatically change the rice policy in 1921.

In 1921, the government established *Beikoku Hō* (the Rice Law). This law allowed the government to buy and sell physical rice in the spot market to adjust supply and demand (Ota 1938, p.

332). However, it lacked effectiveness due to delays in the government's actions. The Rice Law permitted the government to intervene in the spot market only after estimating the supply-demand balance of rice (Omameuda 1993, pp. 198–201). In response to this defect of the law, the government amended the Rice Law in 1925 to control not only the supply-demand balance but also the rice price. The government traded physical rice to stabilize the rice price fluctuations according to this amended law, and this measure stifled rice futures trading. In fact, from 1921 to 1931, the annual volume of futures rice trading in the TRME and all of Japan's exchanges decreased by 33 and 35 percent, respectively (see Appendix Figure 1).¹ Nevertheless, the government additionally tightened the rice price control after the Great Depression.

2.3 Oppressive Policies on Rice Trading After the Depressions

Japan panicked in the Great Depression from 1929 to 1930 and the Showa Depression in 1931. The Showa Depression was an agricultural crisis caused by a bumper crop of rice in Japan and Korea in 1930. Many Japanese farmers lived in dire poverty because of the plummeting rice prices, and some of them were forced into trafficking their daughters. Accordingly, the government repealed the Rice Law and enacted *Beikoku Tōsei Hō* (the Rice Control Law) in November 1933 to tighten rice price control. Under the new regime, the government created a price range by setting maximum and minimum rice prices each year and traded in physical rice to keep the price fluctuation within the set range (Ota 1938, p. 731). These measures triggered further declines in the rice futures market. From 1932 to 1937, the annual volume of futures rice trading in the TRME and all exchanges decreased by 50 and 62 percent, respectively (see Appendix Figure 1).

The Japanese government enhanced its policies to control rice prices from the beginning of the 1920s, and these measures weakened the rice futures market. In the same period, rice traders in the central cities expanded rice imports from Korea and Taiwan to mitigate the domestic rice supply shortage.

3. Expanding Colonial Rice Consumption in Central Markets

3.1 Colonial Rice Imports Under Industrialization and Urbanization

Industrialization and urbanization progressed in Japan after WWI. Japan expanded its exports of textile products to the US and European colonies in Southeast Asia during WWI. Consequently, it enjoyed an unprecedented economic boom (Flath 2014, pp. 45–48). During this boom, numerous modernized factories were established in the cities, and labor scarcity rose. Accordingly, the Japanese companies raised their wage level, and many young agricultural workers relocated from rural areas to the cities. This structural change caused a food shortage (Francks 2015, pp. 179–187).

The average growth rate of rice harvests was only 4.6 percent, whereas the population grew by 23.9 percent from 1920–24 to 1930–34. Japan faced a deficiency in domestic rice supply and

¹ The volume of futures rice trading in 1922, August–November 1923, October 1925, and June 1929 were unknown because the data sources are missing.

required expansion of colonial rice imports. The average volume of Korean and Taiwanese rice imports during this period grew by 1.5 and 3.4 times, respectively. As a result, the dependence on colonial rice increased rapidly from 6.5 to 16.5 percent (Ministry of Agriculture and Commerce, Food Control Bureau 1944, pp. 50–51). This situation escalated in the central cities rather than rural areas.

From 1920–24 to 1930–34, the average population of Tokyo increased by 72 percent, while this ratio for all of Japan was 23 percent (Management and Coordination Agency, Statistics Bureau 1987, pp. 96–100). The central cities relied on the colonial rice supply. However, the colonial rice was different in breed from the domestic one.

Domestic rice was a japonica breed, whereas Korean and Taiwanese rice were subspecific japonica and an indica breed, respectively. Hence, the colonial rice differed in texture and taste from the domestic rice. In the next subsection, we will observe the import volume in the *Tokyo Fukagawa Shōmai Shijō* (Tokyo-Fukagawa Rice Spot Market) to capture how the quality difference affected the consumption of colonial rice.

3.2 Stepwise Growth of Colonial Rice Consumption

The rice traders accumulated in the Fukagawa area at the back of the port of Tokyo to purchase various rice supplies shipped by sea from all over Japan and the Japanese colonies in the Tokyo-Fukagawa Rice Spot Market (FRSM), the largest rice spot market in Tokyo. However, rice was also traded outside the FRSM also existed, and its volume in circulation increased with the upgrading of transportation infrastructure. The rice cultivated around Tokyo was transported on the Kanda River to the Kanda River Rice Spot Market in Akihabara.

In 1890, the Akihabara Freight Station was established near the Kanda River Rice Spot Market. This station blossomed as one of the key rail freight hubs in Tokyo, and rice cultivated in eastern Japan was carried by rail to the Kanda River Rice Spot Market via the Akihabara Freight Station (Omameuda 2000, pp. 201–09). Furthermore, the Ministry of Railways improved the freight facilities, and many stations in Tokyo boosted their freight services from the 1920s. For example, the volume of rice arriving at Ikebukuro Station, the terminal in the northwest of Tokyo, increased by 2.4 times in only five years from 1922 (Ministry of Railways, Transportation Bureau 1928, pp. 17).

For these reasons, the volume of rice imports in the FRSM did not increase during the interwar period.² Nevertheless, the FRSM was still the largest rice market in Tokyo until the end of the 1930s. Accordingly, we analyze the monthly volume of rice imports in the FRSM from 1917 to 1939, as shown in Figure 1.³

Colonial rice consumption in Tokyo expanded in a stepwise manner, and the process had two turning points. First, Korean rice consumption escalated exponentially in the middle of the 1920s. Second, Korean rice consumption increased further and Taiwanese rice consumption also surged in the early 1930s. At the same time, consumers tended not to buy colonial rice until the aftermath of WWI,

² There is no date on the trading in the Kanda River Rice Spot Market.

³ Figure 1 uses a unit “*koku*” to demonstrate the import volume. The “*koku*” is a standard unit of measurement in Japanese agriculture and one *koku* is equal to 180.39 liters.

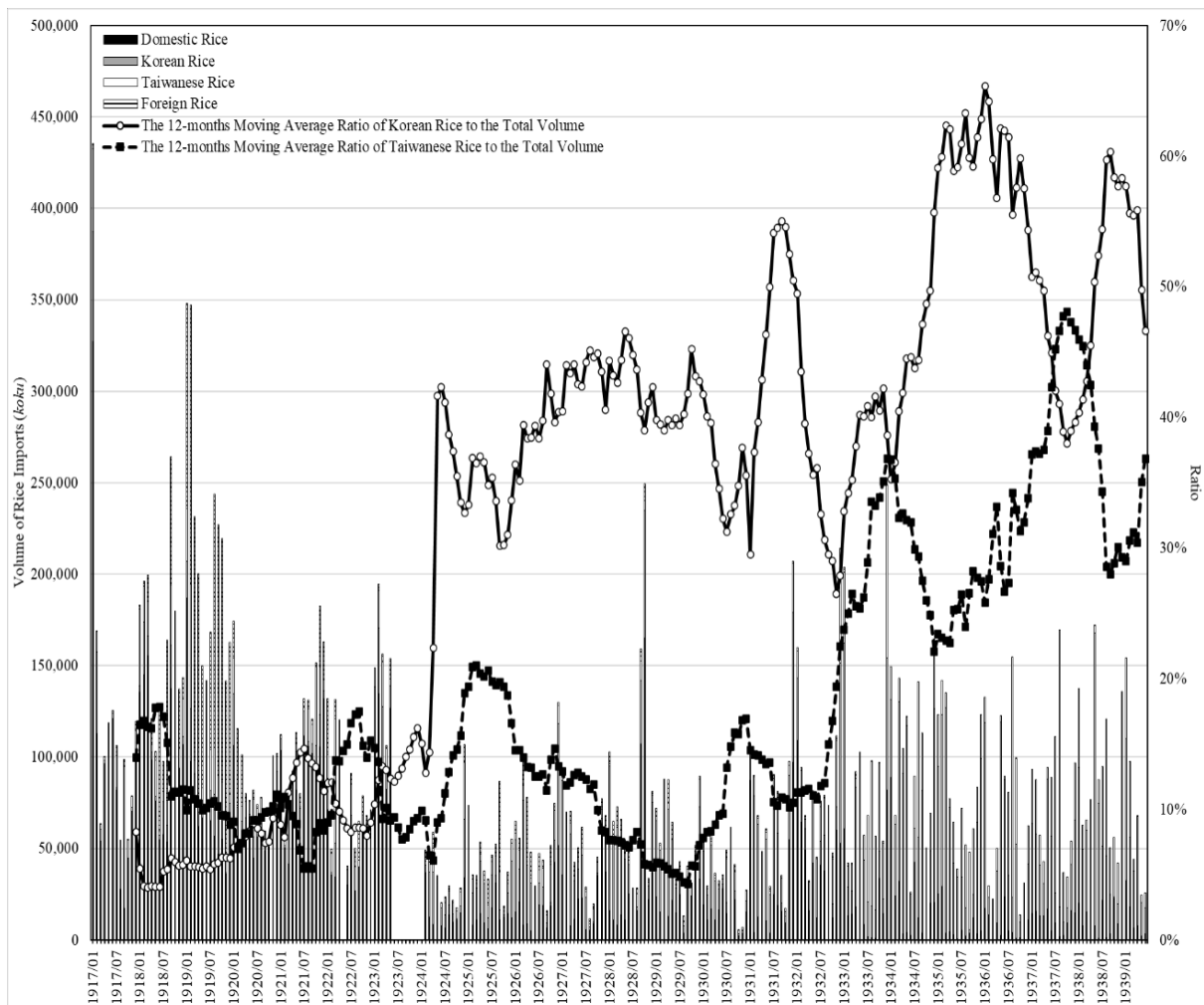


Figure 1

The Volume of Imports in the Tokyo-Fukagawa Rice Spot Market, January 1917–June 1939

Sources: Tokyo City Government (1921, pp. 658–659); Tokyo Chamber of Commerce (1918, pp. 4–7; 1919, pp. 4–7; 1921, pp. 4–7; 1922, pp. 4–7; 1924, pp. 4–7; 1926, pp. 6–9; 1927, pp. 47–50); Tokyo Chamber of Commerce and Industry (1928, pp. 106–09; 1929, pp. 106–09; 1931, pp. 130–33; 1933; pp. 132–35; 1935, pp. 142–45; 1936, pp. 154–57; 1937, pp. 162–65; 1939, pp. 182–85); The data of May 1922 and from June 1923 to January 1924 is missing because the sources were destroyed by fire in the Great Kanto Earthquake of 1 September 1923.

and the 12-months moving average ratios of Korean and Taiwanese rice to the total volume were floundering below 20 percent. During this period, consumers had a relative preference for Taiwanese rice over Korean rice. This consumption pattern resulted from qualitative proximity to the rice harvested in eastern Japan.

Domestic rice could be divided into two major categories, soft and hard, and the farmers in Tokyo-centered eastern Japan cultivated soft rice. Taiwanese rice had a soft texture and a similar quality to rice produced in eastern Japan (Tokyo Rice and Merchandise Exchange, Inspection Division 1934, p. 154). However, Korean rice was not only of a different breed from domestic rice but also had a quality

defect.

The rice threshing method in Korea was different from Japan. Korean farmers slammed paddy rice on a large stone on the ground and gleaned the threshed grains. Hence, Korean rice got contaminated with sand and small stone, and the millers of Korean rice had to possess a specific milling machine for removing the contaminants (Hishimoto 1938, p. 224). Nevertheless, there were a few specialized millers in Tokyo. This caused Korean rice consumption to struggle in Tokyo (Yi 2015, p. 149). These circumstances dramatically changed after the Great Kanto Earthquake of 1 September, 1923.

3.3 Diffusion of Korean Rice After the Earthquake

The Great Kanto Earthquake occurred two minutes before noon when many people set their table for lunch, and a tremendous fire broke out in the kitchens of homes, companies, factories, and schools. The ensuing catastrophe killed about 100 thousand people and turned Tokyo into completely burned-out ruins (Central Meteorological Observatory 1924, p. 4). The survivors suffered from food shortages, and the government transferred 35.1 thousand *kokus* (63 million liters) of stockpiled rice from western cities such as Osaka to Tokyo. This emergency relief included 11.3 thousand *kokus* (20 million liters) of imported rice, and this urgent assistance provided substantive opportunities for the masses in Tokyo to taste Korean rice (Ota 1938, pp. 608–09).

Korean rice consumption in Osaka was greater than in Tokyo before the earthquake for two reasons. First, the Chosen Yusen (Korean Mailing Ship Line) received subsidies from the Governor-General of Korea (GGK) in 1917 and opened a shipping route between Osaka and Korea which transported Korean rice (Chosen Yusen Line 1937, p. 102). Inevitably, the main destination for Korean rice was the port of Osaka (Korean Rice Association 1934, p. 19). Second, the rice traders in Osaka could trade Korean rice because many of them had specialized machines to purify the contaminants of Korean rice. Consequently, in the early 1920s, Korean rice accounted for 54 percent of consumption volume in Osaka (Korea Shokusan Bank 1928, p. 107). Korean rice was unevenly distributed in Japan, and the relief rice from western Japan included Korean rice. In this situation, the GGK regarded the earthquake as an opportunity to expand Korean rice consumption in Tokyo and established the Korean Rice Association in November 1923.

The Korean Rice Association held tasting events and sent samples to distillers of *sake* (rice wine) to promote Korean rice consumption in and around Tokyo (Korean Rice Association 1934, pp. 20–30, 66–69). In tandem with these efforts, the GGK attempted to improve Korean rice quality in three ways.

First, since the 1910s, the GGK had improved the Korean rice breed to suit Japanese consumers' tastes. The average yield ratio for the improved breed to the total rice harvest in Korea rapidly increased from only 12 percent in 1912–14 to 73 percent in 1922–24 (Tohata and Okawa 1939, pp. 438–39). Second, the GGK forced Korean farmers to spread a *mushiro* (straw mat) in the threshing area. Third, it also introduced *senba-koki*, a threshing tool that had been used in Japan since the early eighteenth century. The latter two measures prevented Korean rice from mixing with sand (Korean Rice Association 1934, p. 156).

The GGK enforced these policies to shrink the quality difference with respect to domestic rice,

and the ratio of Korean rice to the total import volume in Tokyo continued at about 40 percent after the earthquake. This ratio further increased to above 50 percent, along with increased Taiwanese rice imports in the early 1930s (see Figure 1).

3.4 Expansion of the Korean and Taiwanese Rice Consumption

The Governor-General of Taiwan (GGT) also attempted to improve the quality of Taiwanese rice, like the GGK. In the 1920s, the Japanese government employed the slogan “Industrial Japan with agricultural Taiwan” (Li 2019, p. 104). In line with this slogan, in 1922, the Taichung Agricultural Experimental Station of the GGT succeeded in creating a new variety of rice, *Hōrai-mai*, which was classified as a japonica breed. This was a game-changing event because the farmers in the tropical zone, including Taiwan, could not cultivate a japonica breed before the appearance of *Hōrai-mai* (Governor-General of Taiwan 1945, p. 244). As a result, the ratio of *Hōrai-mai* to the total yield volume of Taiwanese rice reached 40 percent in 1932–34 (Ministry of Agriculture and Commerce, Food Control Bureau 1944, pp. 224–26). Taiwan could supply rice that suited the domestic consumers’ taste.

In parallel, the GGT enforced the Regulation of Taiwanese Rice Inspection in July 1926 and revised this regulation in July 1931. This regulation stipulated that the GGT had to check the quality, dryness, preparation, weight, and the packaging of rice to promote rice quality (Yagashiro 2012, pp. 234–41). The GGK also introduced regulations that had the same contents as the GGT’s measures.

In November 1932, the GGK started the National Rice Inspection System to check contamination by foreign materials, dryness, volume, weight, and the packaging of the rice (Hishimoto 1938, pp. 308–25). These systems in Korea and Taiwan stabilized the quality of colonial rice. Consequently, colonial rice consumption grew, and the volume of colonial rice imports in Tokyo increased from 1932 (see Figure 1). At the same time, the domestic consumers improved their evaluation of colonial rice.

4 Colonial Rice Catching Up with Domestic Rice in Price

4.1 Shrinking Differences in Price Between Domestic and Colonial Rice

Figure 2 denotes the monthly prices of domestic, Korean, and Taiwanese rice in Tokyo from 1917 to 1939.

From the late 1910s to 1920, rice prices increased due to rice shortage, and the relative prices of colonial to domestic rice remained above 70 percent. However, at the beginning of the 1920s, the critical rice shortage was eased, and these relative prices decreased. In particular, the relative price of Taiwanese to domestic rice dropped to below 50 percent in 1922. However, the relative price of Korean rice persisted above 80 percent since Korea had raised the production of the improved breed. In the same year, the GGT also created an enhanced breed of rice in Taiwan, and the relative prices of Taiwanese rice began to increase. Furthermore, the GGT enforced the Regulation of Taiwanese Rice Inspection in 1926, and the appreciation rate of relative prices of Taiwanese rice soared in the next year.

Until the beginning of the 1930s, the cultivation of improved rice in the colonies grew, and the GGK and the GGT introduced and strengthened quality regulations. Through these extraordinary

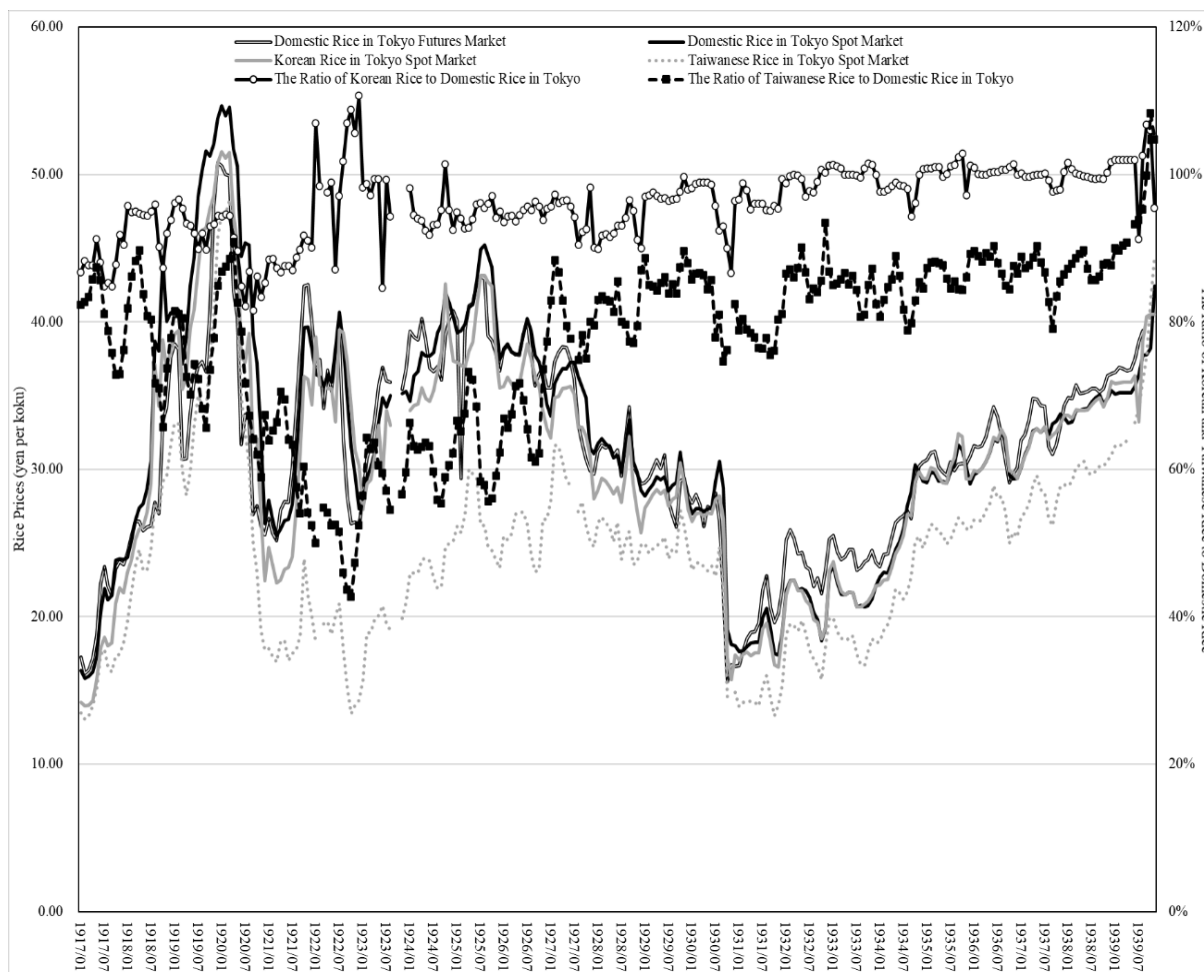


Figure 2

The Rice Prices in Tokyo, January 1917–September 1939

Sources: Ministry of Agriculture and Forestry, Agricultural Bureau (1925, pp. 24–28; 1928, pp. 44–54); Ministry of Agriculture and Forestry, Rice Bureau (1937, pp. 126–97); Ministry of Railways, Transportation Bureau (1925, pp. 516–20); Governor-General of Taiwan, Industrial Bureau (1937, pp. 100–03; 1941, pp. 112–15). Toyo Keizai Shimpo Sha (1923, p. 176; 1924, p. 175). The prices in September and October 1923 are missing because the sources were destroyed by fire in the Great Kanto Earthquake of 1 September 1923, and any other blank in the figure is due to missing values in the sources.

efforts, the ratio of colonial rice to the total volume of rice imports in Tokyo rose (see Figure 1). Colonial rice became an essential foodstuff in Tokyo, and the relative prices of colonial to domestic rice also increased. However, the price difference between types of colonial rice existed even in the 1930s. While Korean rice had surpassed the domestic rice in price since the introduction of the National Rice Inspection System in 1932, Taiwanese rice remained lower in price than domestic rice. Consumers in Tokyo regarded Taiwanese rice as inferior to Korean rice. This recognition was reflected in the delivery system of the TRME.

4.2 Substitutability Between Domestic and Colonial Rice

The rice exchange brokers appreciated the dried Korean rice. The sellers often stored the delivered rice in warehouses for a long time, and the dried rice was suitable for delivery. The National Rice Inspection System guaranteed the dryness of Korean rice, and the brokers expanded their usage of Korean rice in exchanges (Yi 2015, pp. 181–82). The average ratio of Korean rice to the total delivery volume in the TRME often reached more than 80 percent after 1934 (Ministry of Commerce and Industry, Commercial Bureau 1929–39). At the same time, the price difference between domestic and Korean rice almost disappeared (see Figure 2). For these reasons, the rice traders in Tokyo regarded Korean rice as a substitute of domestic rice during the middle of the 1930s. The Japanese government also shared this recognition of the nature of Korean rice in the operation of the Rice Control Law.

The fourth article of the Rice Control Law allowed not only the Ministry of Agriculture and Forestry but also the colonial governments to buy and sell physical rice in the metropole and colonies (Ota 1938, p. 731). Hasumi (1957) records the official purchase and sales volume of rice from 1933 to 1937. According to these records, the central government bought rice extensively in 1934 when the rice prices remained in a slump, and the ratio of the government's purchase to the harvest volume in Japan was 23 percent. In the same year, the GGK also bought rice frequently in Korea, and the ratio of the GGK's purchase to the volume of Korean rice imports in Japan was 19 percent (Ministry of Agriculture and Commerce, Food Control Bureau 1944, pp. 1, 50). Korean rice gained importance as a substitute for domestic rice, and Japan imported it massively (see Figure 1). Accordingly, the authorities considered buying not only domestic rice but also Korean rice as a necessary measure to raise the rice prices.

These authorities diminished their interventions in the spot market after 1935 because the rice prices rose steadily (see Figure 2). The ratios of their purchasing to the supply volume of domestic and Korean rice were less than ten and three percent, respectively (Hasumi 1957, pp. 339–479; Ministry of Agriculture and Commerce, Food Control Bureau 1944, pp. 1, 50). The authorities purchased the physical rice actively only in 1934. By contrast, Taiwanese rice could not become an alternative to domestic rice, and the authorities did not buy it even in 1934.

In the tropical zone, cultivated rice is frequently caught in squalls. Taipei had 38 percent more annual precipitation than Seoul in 1931 (Governor-General of Taiwan 1932, pp. 22–23). Accordingly, Taiwanese rice which had moisture content was perishable (Tokyo Rice and Merchandise Exchange, Inspection Division 1934, pp. 72–73). It was unsuitable for delivery, and rice exchanges did not list it as a deliverable good. The authorities also shared this recognition of the quality difference between domestic and Taiwanese rice. Consequently, they did not purchase the Taiwanese rice even in 1934.

The consumers in Tokyo considered colonial rice to be a different good to domestic rice in the immediate aftermath of WWI. However, the quality difference between the two goods gradually shrank during the interwar period. This change promoted expanding the consumption of Korean and Taiwanese rice, and the growth of colonial rice imports in Tokyo progressed in a stepwise manner. Accordingly, we analyze how these stepwise changes in colonial rice consumption affected the pricing of the rice market in Tokyo.

5. Methodology for Analysis

5.1 The Method

We utilize four series of rice prices: the futures prices of domestic rice in the TRME and the wholesale prices of domestic, Korean, and Taiwanese rice in the spot market from January 1917 to August 1939 in Tokyo. Price data for colonial rice before December 1916 does not exist, and the futures prices do not exist after September 1939 because all rice exchanges were abolished in the previous month. Japan embarked on the Second Sino-Japanese War in July 1937 and faced serious border incidents with the Union of Soviet Socialist Republics in May 1939. Under these deteriorating international relations, the Japanese government introduced new measures to control and mobilize various resources for the wartime economy and commanded all rice exchanges to shut down (Ohno 2018, p. 111).

For these reasons, our data includes 272 months from January 1917 to August 1939. However, there are missing data on all prices for two months in 1923. The Great Kanto Earthquake of September 1923 destroyed the TRME's buildings and the government's offices. The TRME was forced to suspend its futures trading for two months (Tokyo Grain Exchange 2003, p. 61). The government could not collect the spot prices during the same period. Accordingly, we exclude September and October of 1923 and divide the rest of the data for 270 months into three periods, as shown in Figure 2.

The first period is 80 months from January 1917 to August 1923. During the period before the earthquake, the consumers in Tokyo basically bought only domestic rice. The second period is 120 months from November 1923 to October 1933. During the period after the earthquake, Korean rice consumption grew compared to Taiwanese rice consumption. The final period is 70 months from November 1933 to August 1939. During this time, colonial rice consumption expanded, and the Japanese government enhanced its rice policy as symbolized by the enforcement of the Rice Control Law in November 1933. We utilize the data in these three periods and estimate vector autoregressive (VAR) models to explore the changes in the rice pricing in each period.

5.2 The Model

We employ a four-dimensional VAR model for the multiple time-series data of the futures prices and three spot prices. The VAR model is:

$$\mathbf{y}_t = \mathbf{A}_0 + \sum_{i=1}^p \mathbf{A}_1^i \mathbf{y}_{t-i} + \boldsymbol{\epsilon}_t \quad (1)$$

where $\mathbf{y}_t = [y_{1t}, y_{2t}, y_{3t}, y_{4t}]'$; y_{1t} , y_{2t} , y_{3t} , and y_{4t} are the futures prices and the spot prices of domestic, Korean, and Taiwanese rice, respectively; \mathbf{A}_0 is a four-dimensional constant vector; \mathbf{A}_1^i is a four-by-four parameter vector; a four-dimensional white-noise vector $\boldsymbol{\epsilon}_t = [\epsilon_{1t}, \epsilon_{2t}, \epsilon_{3t}, \epsilon_{4t}]'$. A VAR model does not rely on strong theoretical assumptions and is suitable for the empirical study of economic history. We convert the VAR model into a vector moving average (VMA) form to employ innovation accounting following Sims (1980). This methodology shows the time path of the various shocks on the variable in the VAR system to examine the relationships among variables (Enders 2015, pp. 294–302). The VMA form is as follows:

$$\mathbf{y}_t = \mathbf{C}_0 + \sum_{i=0}^{\infty} \mathbf{C}_i \boldsymbol{\epsilon}_{t-1} \quad (2)$$

where $\mathbf{C}_0 = (\mathbf{I} - \mathbf{A}_1 L)^{-1} \mathbf{A}_0$ and $\mathbf{C}_i = \mathbf{A}_1^i$. The procedure for innovation accounting is described below.

First, we provide a standard deviation unit of impulse on the disturbance term at the zero period in Equation 2. Second, we multiply parameters by impulses in each period to calculate an impulse response function (IRF). An IRF denotes how an impulse has effects on each variable. Third, we compute a relative variance composition (RVC) by capturing the relative contribution degree of dispersion of an impulse on a variable to the other variable's dispersion.⁴ An RVC demonstrates how much the fluctuation of a variable affects the other variable. Finally, we analyze the changes in IRFs and RVCs in each period to grasp how the rice pricing altered with increases in colonial rice circulation.

5.3 Data

We obtain the weighted average monthly data on the futures prices of the deferred contract in the TRME from two statistical surveys: Ministry of Agriculture and Forestry, Rice Bureau (1935b), and Tokyo Stock Exchange (1935–39). The deferred contract transaction was larger in trading volume than the other two transactions (Ito, Maeda, and Noda 2018). The average ratio of the deferred contract to the total volume in the TRME from January 1917 to June 1935 was 74 percent (Ministry of Agriculture and Forestry, Rice Bureau 1935b).⁵ Accordingly, we choose the deferred contract prices as the futures prices.

For the three spot prices, we acquire the weighted average monthly data from five statistical reports: Governor-General of Taiwan, Industrial Bureau (1937; 41), Ministry of Agriculture and Forestry, Agricultural Bureau (1925; 28), Ministry of Agriculture and Forestry, Rice Bureau (1937a), Ministry of Railways, Transportation Bureau (1935), and Toyo Keizai Shimpo Sha (1924; 25). Previous studies also employ parts of these reports; however, they tend not to pay attention to the rice prices in the 1930s.

While Ito, Maeda, and Noda (2018), Omameuda (1993, pp. 112, 144, 257), and Yagashiro (2012, p. 238) deploy the domestic rice prices from 1881 to 1932, the Korean rice prices from 1908 to 1930, and the Taiwanese rice prices from 1920 to 1937, respectively, we extend the term of the investigation until 1939. The price data after 1937 is shown by only the Governor-General of Taiwan, Industrial Bureau (1941) which is held by only five Japanese institutes: Hokkaido University, Shiga University, Osaka Metropolitan University, Okayama University, and Oita University. We gained the cooperation of Oita University to obtain the data.

We utilize these four series of data to estimate VAR models in every three periods: January 1917–August 1923, November 1923–October 1933, and November 1933–August 1939. The estimation

⁴ See textbooks of the time series econometrics such as Enders (2015) for further information on the detailed calculation procedure of an IRF and an RVC.

⁵ Ministry of Agriculture and Forestry, Rice Bureau (1935b) demonstrates the trading volume until June 1935, and the data after the following month is missing.

Table 1
Descriptive Statistics and Results of Unit Root Tests

	January 1917–August 1923				November 1923–October 1933				November 1933–August 1939			
	Futures	Domestic	Korean	Taiwanese	Futures	Domestic	Korean	Taiwanese	Futures	Domestic	Korean	Taiwanese
Mean	0.009	0.010	0.011	0.004	-0.003	-0.004	-0.004	-0.001	0.007	0.009	0.009	0.010
Std. dev.	0.082	0.071	0.083	0.083	0.061	0.055	0.062	0.066	0.026	0.022	0.032	0.030
Min.	-0.241	-0.208	-0.206	-0.192	-0.319	-0.406	-0.438	-0.385	-0.083	-0.077	-0.093	-0.083
Max.	0.021	0.236	0.246	0.246	0.197	0.174	0.183	0.205	0.085	0.063	0.152	0.100
ADF	-6.899***	-4.330***	-8.552***	-5.727***	-9.753***	-8.220***	-8.675***	-8.924***	-6.012***	-5.600***	-7.883***	-6.616***
Lags	0	1	0	0	0	1	0	0	0	0	0	0
<i>N</i>	79	79	79	79	119	119	119	119	70	70	70	70

Notes: “ADF,” “Lags,” and “*N*” denote the ADF test statistics, the lag order selected by the Schwartz Bayesian information criteria, and the number of observations, respectively. “***” means significant at one percent. These statistics are computed using EViews 12.

procedure is as follows.

First we take the first difference of the natural log of each series. Second, we apply the Augmented Dickey-Fuller (ADF) test as the unit root test to confirm whether the variables satisfy the stationarity condition. Table 1 shows the descriptive statistics and unit root test results.

We confirm two characteristic points of the standard deviations. First, the spot prices of Korean and Taiwanese rice were more volatile than the spot prices of domestic rice in all periods. This fact suggests there was a difference in the pricing between domestic and colonial rice. The government began to intervene in the rice market according to the Rice Law in 1921 and traded only domestic and foreign rice (Hasumi 1957, pp. 152–89, 203–23, 234; Ministry of Agriculture and Commerce, Food Bureau 1922–23; 1925; Ministry of Agriculture and Forestry, Agricultural Bureau 1926–30; Ota 1938, pp. 594–710). It did not buy and sell colonial rice, and the price fluctuation of domestic rice remained stable. Second, the standard deviations of all variables decreased after November 1933. The government enforced the Rice Control Law to stabilize the rice prices in the same month, and this measure suppressed the rice price fluctuations.

Table 1 also demonstrates the results of the unit root test. We use the Schwartz Bayesian information criteria (SBIC) to select the optimal lag length for the ADF test, and the results indicate that all variables satisfy the stationarity condition.

In addition, we employ Johansen's (1991) trace test and Johansen's (1988) maximal eigenvalue test to confirm cointegration relations among variables. If the results of these tests indicate the existence of cointegration relations, we should select a vector error correction model instead of a VAR model. However, all maximal eigenvalue tests of every period do not reject any null hypotheses whereas all trace tests of every period reject at least the null hypothesis of no cointegration (see Appendix Table 1). Accordingly, these results do not clearly indicate the presence of cointegration relations, and we estimate VAR models in the next section.

6 Changing the Pricing of the Rice Market

6.1 Market Mainly for Domestic Rice Before the Great Kanto Earthquake

We select the optimal lag length according to the SBIC and estimate VAR models for three periods. Table 2 summarizes our estimation results for all periods.

We convert the estimated VAR model into the VMA form to calculate IRFs and RVCs. Figure 3 shows IRFs for the first period from January 1917 to August 1923.

We observe the 95 percent confidence bands of IRFs deviating from zero and find that the pricing of futures and spot prices of domestic rice affected colonial rice pricing. For details, IRFs denote four points of interrelations among four variables.

First, the pricing in the futures market had an impact on all variables. Second, the pricing of domestic rice in the spot market acted on all other spot prices. Third, the pricing of Korean rice influenced only itself. Fourth, the pricing of Taiwanese rice basically affected itself and had a marginal impact on the pricing of domestic rice in the spot market.

The consumers in Tokyo preferred Taiwanese rather than Korean rice before the earthquake

Table 2
VAR Estimations of Three Periods from January 1917 to August 1939

	January 1917–August 1923				November 1923–October 1933				November 1933–August 1939			
	y_{1t}	y_{2t}	y_{3t}	y_{4t}	y_{1t}	y_{2t}	y_{3t}	y_{4t}	y_{1t}	y_{2t}	y_{3t}	y_{4t}
Constant	0.0101 [0.0092]	0.0087 [0.0077]	0.0102 [0.0088]	0.0033 [0.0086]	-0.0044 [0.0056]	-0.0036 [0.0048]	-0.0031 [0.0054]	-0.0016 [0.0057]	0.0049 [0.0032]	0.0053 [0.0028]	0.0039 [0.0036]	0.0064 [0.0037]
y_{1t-1}	0.2478 [0.1818]	-0.1134 [0.1527]	-0.0169 [0.1741]	0.3420 [0.1705]	0.1701 [0.1464]	0.3193 [0.1249]	0.3318 [0.1400]	0.5360 [0.1480]	0.2742 [0.1760]	0.0597 [0.1501]	0.3216 [0.1937]	0.2617 [0.2019]
y_{2t-1}	-0.1569 [0.2635]	0.1677 [0.2213]	0.5139 [0.2523]	-0.1885 [0.2471]	-0.5873 [0.3028]	-0.0731 [0.2583]	0.1101 [0.2896]	-0.2658 [0.3061]	0.0336 [0.2258]	0.5709 [0.1925]	1.0234 [0.2485]	0.5713 [0.2589]
y_{3t-1}	-0.1712 [0.1870]	-0.0655 [0.1571]	-0.4809 [0.1791]	-0.1447 [0.1754]	0.2733 [0.2476]	-0.0119 [0.2112]	-0.1889 [0.2368]	-0.2533 [0.2503]	-0.3181 [0.1691]	-0.1778 [0.1441]	-0.8869 [0.1861]	-0.4489 [0.1939]
y_{4t-1}	0.2562 [0.1787]	0.3579 [0.1501]	0.3207 [0.1712]	0.3570 [0.1676]	0.1623 [0.1370]	0.1101 [0.1169]	0.1559 [0.1310]	0.1667 [0.1385]	0.1979 [0.1807]	-0.0904 [0.1541]	-0.0143 [0.1989]	-0.0256 [0.2072]
\bar{R}^2	0.0647	0.1197	0.1580	0.1930	0.0154	0.1233	0.1307	0.1253	0.1062	0.1032	0.2785	0.0786

Notes: \bar{R}^2 denotes adjusted R-squared. The standard errors are in brackets. The optimal lag length is selected by the Schwartz Bayesian information criteria. These estimates are computed using EViews 12.

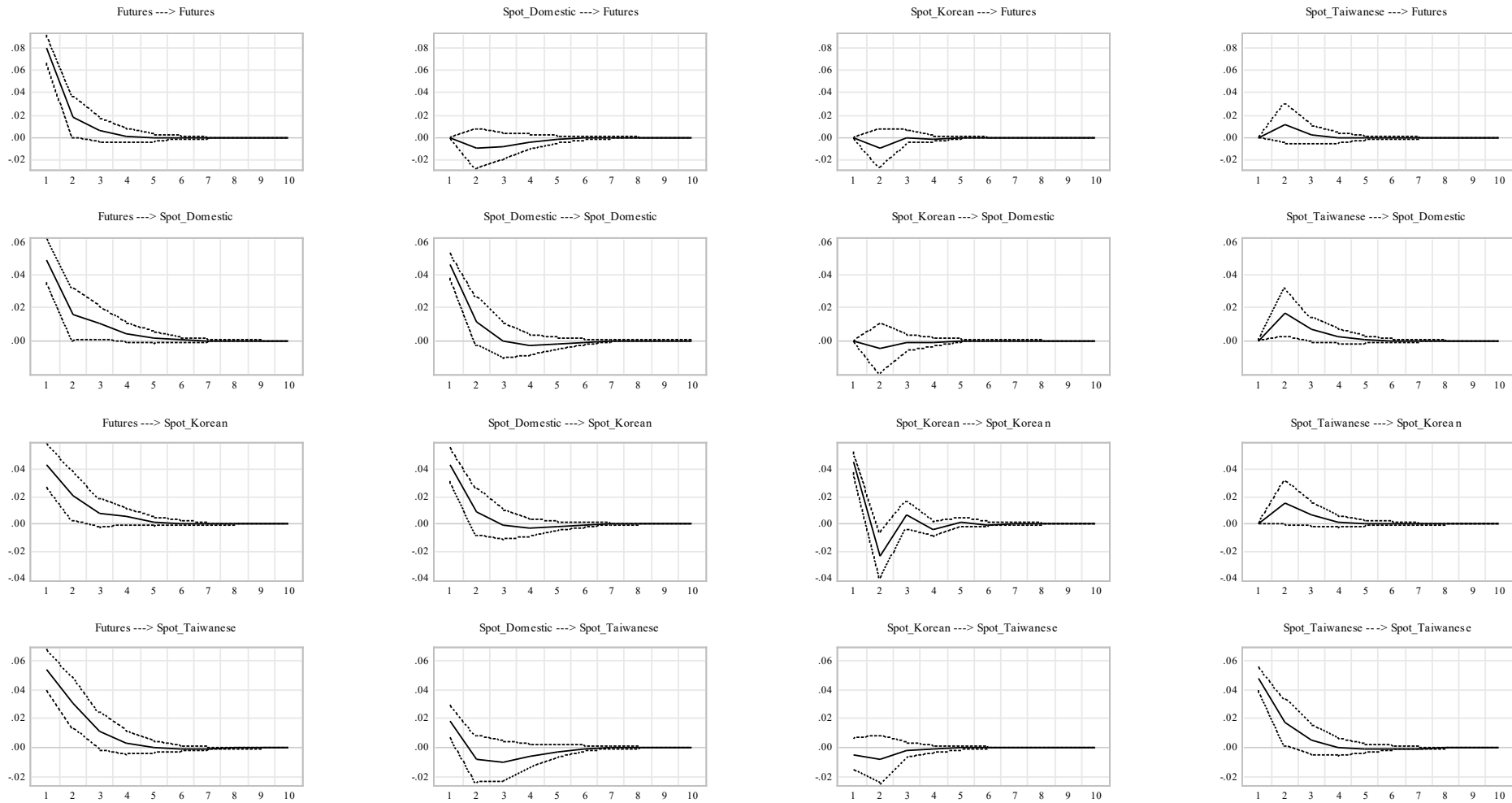


Figure 3

Impulse Response Functions from January 1917 to August 1923

Note: The dashed lines represent the 95 percent confidence band. These estimates are computed using EViews 12.

of 1923, as we mentioned above. The import volume of Taiwanese rice tended to be larger than Korean rice during the period (see Figure 1). It had a role in complementing the rice supply in Japan and had a marginal power to alter the pricing of domestic rice in the spot market. Nevertheless, Taiwanese rice was not a substitution good for the domestic one.

Taiwanese rice was radically different in quality from any other rice. It belonged to an indica breed, while domestic and Korean rice were a japonica and a subspecific japonica breed, respectively. Based on this, the consumers did not regard Taiwanese rice as an alternative to the domestic one and bought it as a mixed diet to supply a deficiency at the time just prior to the harvest season of domestic and Korean rice (Mochida 1970, p. 144; Yamazaki 1914, pp. 187–88).

The rice export volume from Taiwan to Japan entered its peak from June to September while the circulation volume of domestic and Korean rice in Japan increased from the fall season and reached full bloom in November and December every year (Ministry of Agriculture and Forestry, Rice Bureau 1936, pp. 18–20; 1937b, pp. 70–78; Ministry of Agriculture and Commerce, Food Control Bureau 1944, p. 34). Taiwanese rice began to be distributed in large quantities in Japan before the rice harvest season and differed in price from other rice during spring and summer. From April to August in 1917–23, the average rate of change in prices of domestic, Korean, and Taiwanese rice were 11.9 percent, 11.0 percent, and -5.7 percent, respectively.⁶ Taiwanese rice prices were inversely proportional to domestic rice prices. This fact suggests that Taiwanese rice was little more than a complementary good for the domestic rice. The pricing of domestic rice had a negative impact on Taiwanese rice pricing, albeit that the confidence band of the IRF from domestic rice in the spot market to Taiwanese rice does not deviate from zero (see Figure 3). In stark contrast, the pricing of domestic rice had a positive impact on Korean rice pricing. It means that Korean rice was a substitutional good to the domestic one. For further analysis, we scrutinize the RVCs of the same period, as shown in Figure 4.

The pricing in the futures market impacted the pricing of both domestic and colonial rice in the spot market. Domestic rice pricing in the spot market was affected by three pricing influences: itself, the pricing of the futures, and Taiwanese rice pricing. However, Taiwanese rice pricing had only a limited effect. Therefore, colonial rice pricing did not fundamentally affect the pricing of domestic rice in the futures and spot markets. Antithetically, domestic rice pricing spilled over to colonial rice pricing.

Korean rice pricing resulted from itself and the pricing of domestic rice in the futures and spot markets. The RVC of Korean rice prices is composed of about 40 percent of itself, about 30 percent of domestic rice prices in futures, and about 30 percent of domestic rice prices in the spot market. The pricing of domestic rice exercised a major impact on the price volatility of Korean rice. Taiwanese rice pricing also showed the same tendency as Korean rice pricing.

The RVC of Taiwanese rice prices is constituted of about 40 percent of itself, about 50 percent of domestic rice prices in futures, and about ten percent of domestic rice prices in the spot market. About 60 percent of Taiwanese rice price volatility resulted from the pricing of domestic rice in the futures and spot markets.

⁶ We calculate the average rates of change in rice prices by utilizing the data shown in Figure 2.

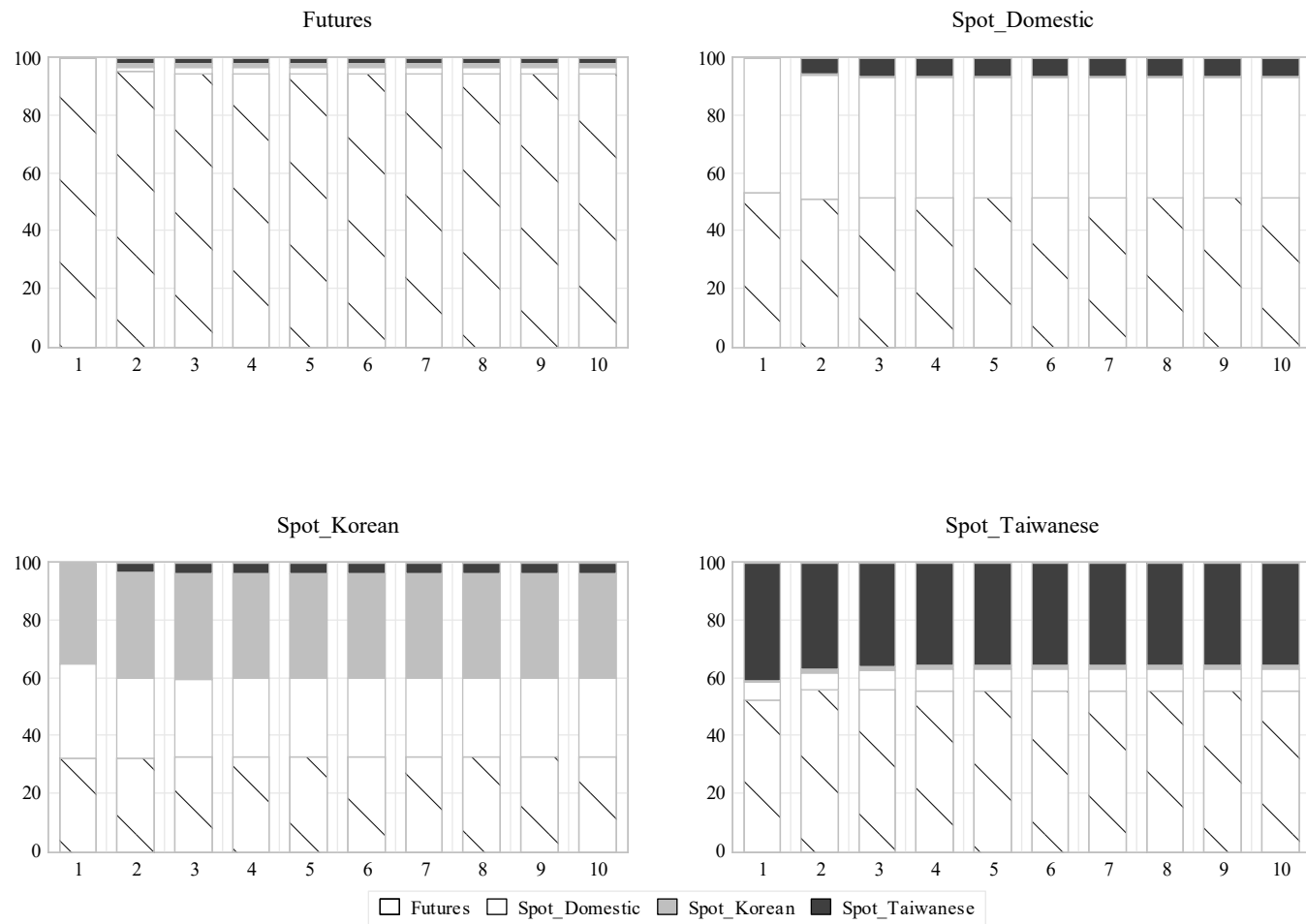


Figure 4

Relative Variance Compositions from January 1917 to August 1923

Note: These estimates are computed using EViews 12.

To sum up, according to our investigation as the first clinometric analysis on the pricing of domestic and colonial rice in Japan, the pricing of colonial rice depended on both itself and the price variation of domestic rice. By contrast, colonial rice pricing did not affect the pricing of domestic rice in the futures and spot markets. Furthermore, the pricing of Korean and Taiwanese rice did not affect each other. Consequently, the pricing of domestic rice had a large impact on not only itself but also colonial rice pricing. According to these observations, the rice market in Japan was mainly for domestic rice before the Great Kanto Earthquake of 1923.

6.2 The Market with an Increase in the Korean Rice Imports

Table 2 and Figure 5 show our estimation results of the VAR model and IRFs for the second period from November 1923 to October 1933.

These have similar shapes to the IRFs for the first period. However, the confidence band of the IRF from the spot prices of domestic rice to Taiwanese rice prices in Figure 5 deviates from zero, and the pricing of domestic rice in the spot market clearly had a negative impact on Taiwanese rice pricing. This fact means that Taiwanese rice obviously became a complementary good to the domestic one.

After the beginning of the 1920s, the price difference between Korean and Taiwanese rice increased, and the relative prices of Korean rice compared with domestic rice increased because the difference in quality among them shrank (see Figure 1). In the same decade, the measure for quality improvement in Taiwan fell behind Korea, although the quality difference between Taiwanese and domestic rice also began to shrink. The GGK had already improved rice breeding techniques from the 1910s. On the other hand, the GGT finally succeeded in improving the Taiwanese rice breed in 1922, and the harvest of the new breed increased after a few years. As a result, Taiwanese rice received a poor evaluation in the middle of the 1920s, and the influence of Taiwanese rice pricing on the pricing of domestic rice in the spot market disappeared in the second period. This change in the relative position between Korean and Taiwanese rice influenced the pricing in the rice market. Figure 6 demonstrates the RVCs for the second period.

The RVCs of domestic rice in the spot market and Korean rice altered from the first period, and the pricing of domestic rice in the futures market and Taiwanese rice in the first and second periods have almost similar tendencies. The pricing of domestic rice in the spot market was independent of the Taiwanese rice pricing. The pricing of domestic rice in the futures market reinforced its power to affect Korean rice pricing. The brokers in rice exchanges utilized Korean rice as a deliverable good with an increase in the harvest of improved Korean rice. Korean rice began to have a similar quality to domestic rice, and the ratio of futures prices in the RVC of Korean rice prices increased from about 30 to 60 percent during two periods (see Figures 4 and 6).

In the second period, the rice pricing was rarely different from the first period, and the pricing of colonial rice still did not affect the pricing of domestic rice in the futures and spot markets. This situation drastically changed in the final period.

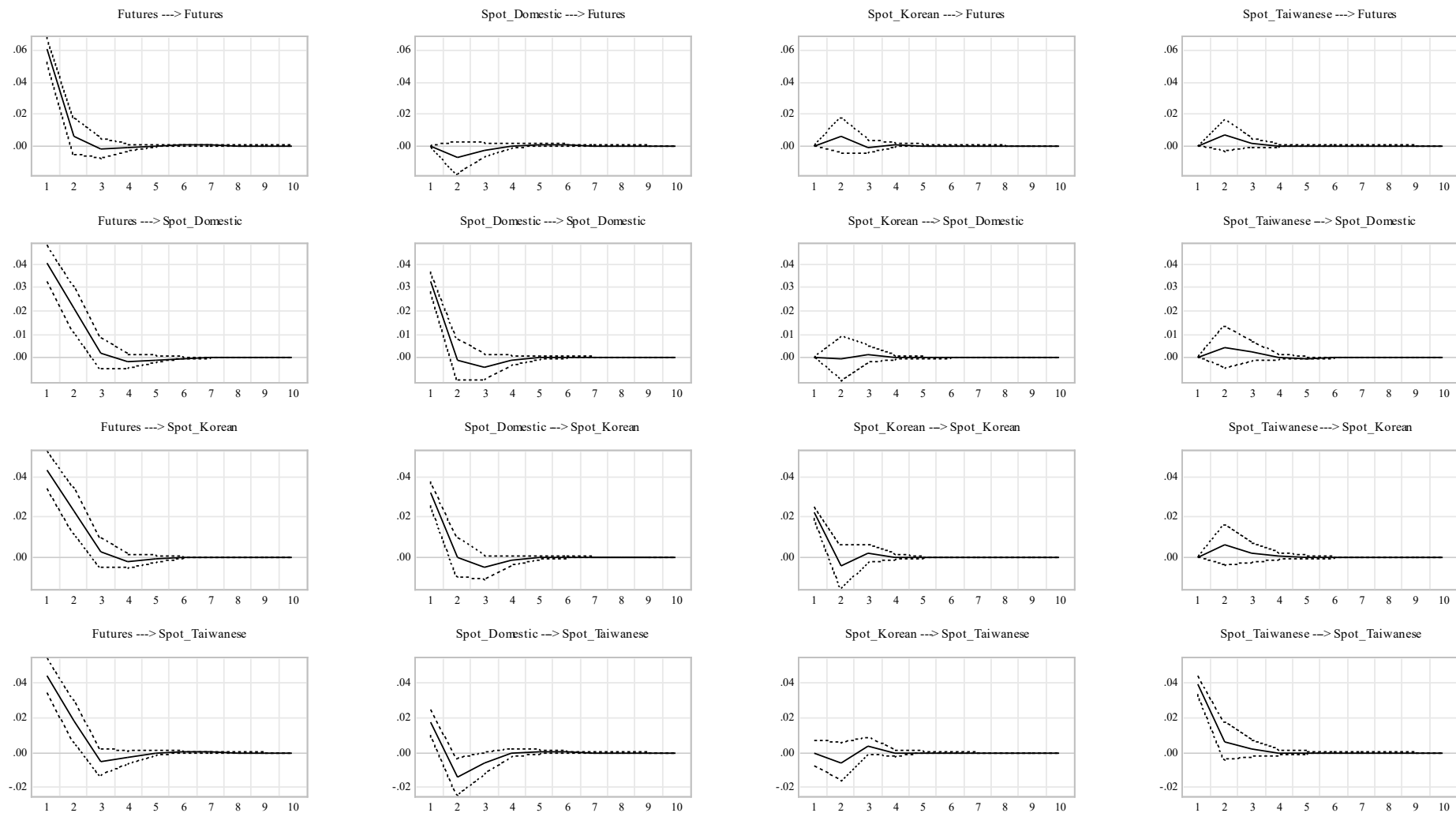


Figure 5
Impulse Response Functions from November 1923 to October 1933

Note: As in Figure 3.

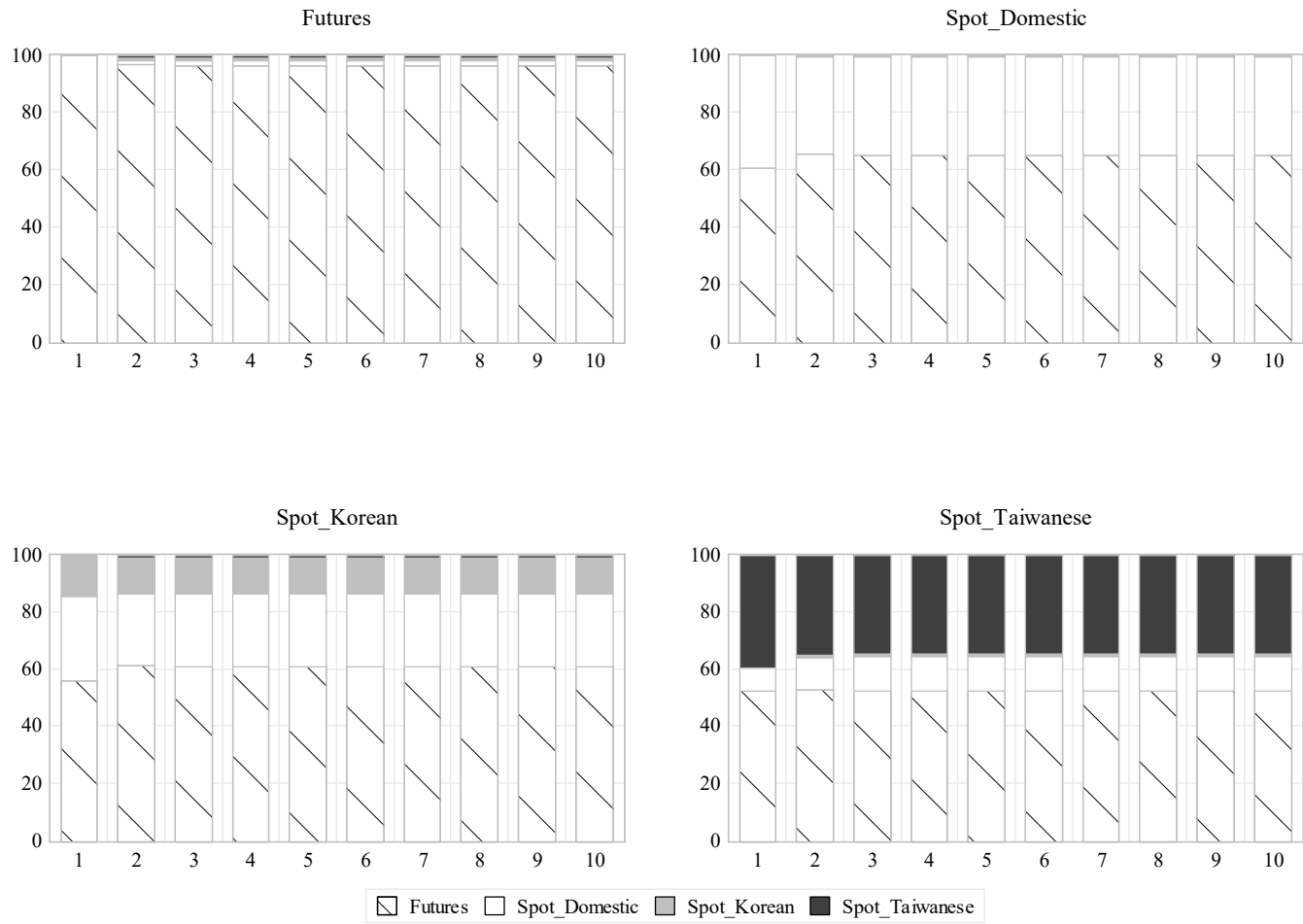


Figure 6

Relative Variance Compositions from November 1923 to October 1933

Note: As in Figure 4.

6.3 The Market After the Quality Improvement of Colonial Rice

Table 2 and Figure 7 illustrate our estimation results of the VAR model and IRFs for the third period from November 1933 to August 1939.

The IRF from the spot prices of domestic rice to Taiwanese rice prices alters from negative to positive in the third period. This alteration means that Taiwanese rice changed from a complementary good to a substitute good. In fact, the average rates of change in the prices of domestic, Korean, and Taiwanese rice from April to August in 1934–39 were 4.4 percent, 4.3 percent, 0.9 percent, respectively.⁷ Although the rate for Taiwanese rice in 1917–23 was a negative value and was 17.6 percent lower than domestic rice, it turned into a positive value and had a difference of only 3.5 percent to the domestic rice in 1934–39. Taiwanese rice improved in quality and thus reduced the quality difference against domestic rice. The ratio of *Hōrai-mai* to the total volume of rice exported from Taiwan increased from 44.4 percent in 1925 to 75.9 percent in 1936 (Ministry of Agriculture and Forestry, Rice Bureau 1937b, pp. 66–67). As a result, the price gap between Taiwanese and domestic rice reduced, and the peculiar price trend of Taiwanese rice disappeared. However, there was still a difference in quality between Korean and Taiwanese rice. This difference affected colonial rice pricing.

After 1933, Korean rice prices often surpassed domestic rice prices and remained at a level higher than Taiwanese rice prices (see Figure 2). Under this situation, Korean rice pricing marginally affected not only Taiwanese rice pricing but also the pricing of domestic rice in the futures and spot markets. It denotes that colonial rice pricing began to influence the futures pricing of domestic rice. By contrast, Taiwanese rice pricing still did not influence the pricing of the other rice, including in the futures trading. We also observe these facts from the RVCs shown in Figure 8.

All RVCs for the third period are different from the second period. The pricing in the futures market was partly influenced by Korean rice pricing whereas it was almost independent of other prices. In the same manner as the futures market, the pricing of domestic rice in the spot market was also affected by Korean rice pricing.

For the RVC of domestic rice prices in the spot market, the percentage of the futures prices decreases from about 60 percent in the second period to about 20 percent in the third period. At the beginning of the third period, the government established the Rice Control Law allowing the authorities to buy and sell physical rice to control the price of domestic rice. This law caused futures trading to shrink and impaired the functions of the futures market (see Table 1 and Appendix Figure 1). However, this measure had a limited effect on colonial rice pricing.

The Ministry of Agriculture and Forestry constantly intervened in the rice spot market to control domestic rice prices according to the Rice Control Law. The first article of *Beikoku Tōsei Hō Shikō Rei* (the Order for Enforcement of the Rice Control Law) limited the target of the government's price control to only domestic rice. Hence, the government attempted to stabilize the domestic rice prices through its frequent interventions, and the colonial authorities controlled the shipping volume of colonial rice to Japan (Ota 1938, p. 742). The colonies were smaller in their scale of interventions than the metropole. Furthermore, the colonial authorities intervened in the rice market only in 1934, as we

⁷ As in footnote 6.

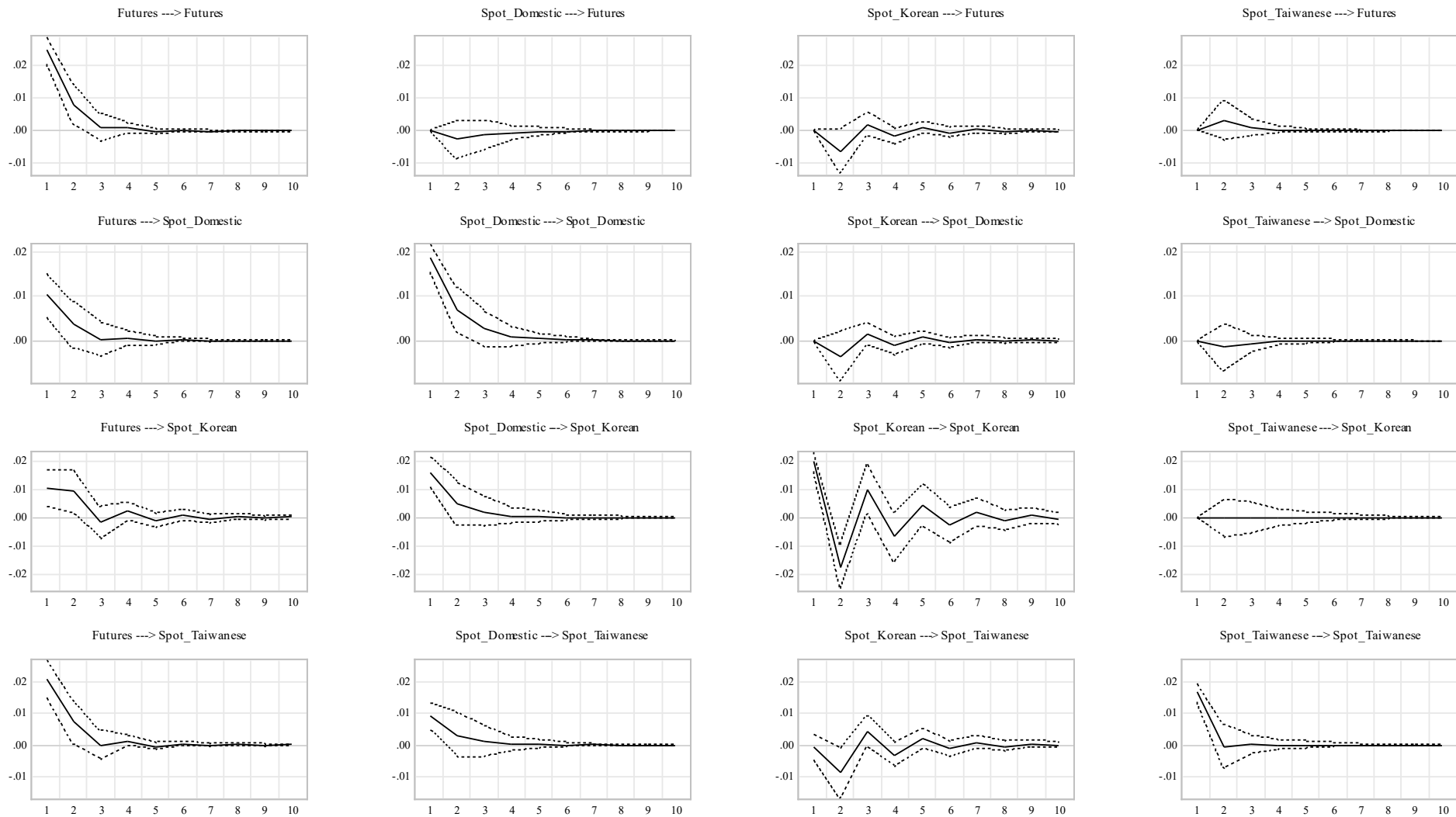


Figure 7

Impulse Response Functions from November 1933 to August 1939

Note: As in Figure 3.

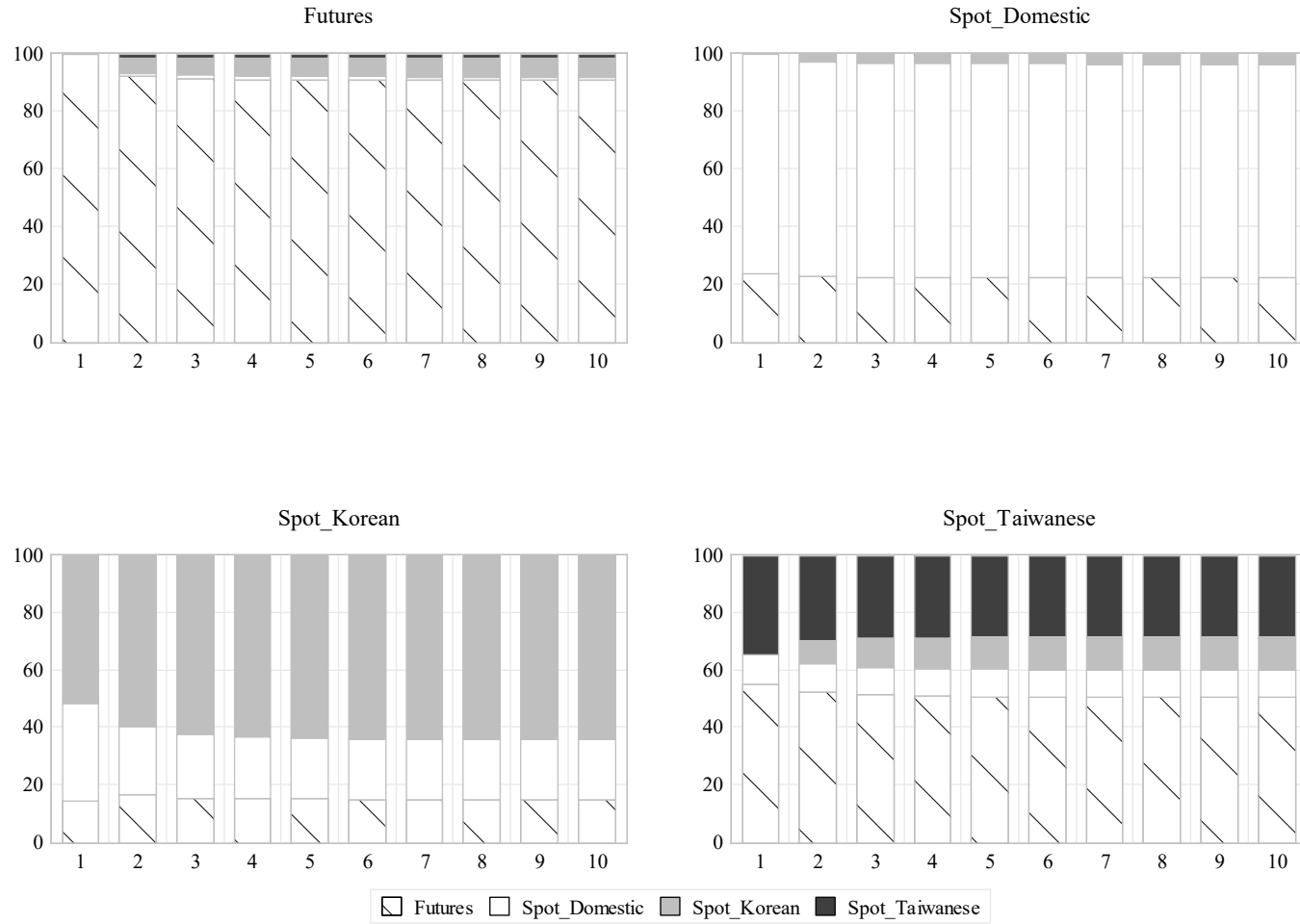


Figure 8
Relative Variance Compositions from November 1933 to August 1939

Note: As in Figure 4.

mentioned in Section 4. Consequently, these interventions had a lesser impact on colonial rice pricing, and this pricing changed in the third period.

For the RVC of Korean rice prices, the percentage of itself surges from about 20 percent in the second period to over 60 percent in the third period. Korean rice pricing strengthened its independence from other prices and increased its effect on Taiwanese rice pricing. The impact of Korean rice pricing appears in the RVC of Taiwanese rice prices. However, Taiwanese rice pricing did not affect Korean rice pricing. That is, Korean pricing had a one-way effect on Taiwanese rice pricing.

The GGT's measures certainly improved the rice quality. Taiwanese rice caught up with domestic rice in quality, and its property altered from mixed diets to principal ones in the 1930s (Kawano 1941, p. 299; Tokyo Rice and Merchandise Exchange 1934, p. 105). Hence, Taiwanese rice became a substitute good for domestic rice. Nevertheless, the differences in quality and price level with respect to the other rice still existed even after the middle of the 1930s. For this reason, Taiwanese rice pricing did not affect the pricing of the other types of rice.

7 Conclusions

Until the beginning of the 1930s, colonial rice pricing did not affect the pricing of domestic rice. Colonial rice was inferior in quality to domestic rice, and the consumers assessed both types of rice as separate goods. Furthermore, there was a difference in quality among colonial rice. Taiwanese rice was of a lower quality than Korean rice, and the pricing of the two types of colonial rice did not affect each other. Korean rice was a substitutional good to domestic rice whereas Taiwanese rice was only a complementary good. The nature of the domestic rice market was not stable and altered with the quality improvement of colonial rice.

After the mid-1930s, domestic and colonial rice had partially influenced each other in the futures and spot markets. The GGT's measures improved the rice quality in Korea, and Korean rice prices frequently surpassed domestic rice prices during this period. With this change in the relative relationship of prices, the influence of domestic rice pricing on Korean rice pricing was reduced. Nevertheless, Korean rice pricing began to affect Taiwanese rice pricing and the pricing of domestic rice in the futures market. The GGT followed the GGT's lead and improved the quality of rice in Taiwan, and the price gap between domestic and Taiwanese rice shrank. Accordingly, Taiwanese rice became a substitutional good to domestic rice from a constitutional one.

Rice was one of the significant primary products from the colonies and was one of the principal colonial goods for export to the metropole within the Japanese Empire. It is a staple food in Japan, and the government and the colonial authorities devoted tremendous efforts to improving the production and distribution of colonial rice. Nevertheless, decades were needed to increase the colonial rice consumption to satisfy the demand in Japan.

Japan procured not only rice but also other agricultural products such as soybeans, barley, and wheat from its colonies. These commodities accounted for a large portion of colonial trade and were different in quality to domestic products since the botanical varieties differed by region in the empire, which spread across three climate zones. Hence, the government often struggled to handle the quality

differences between domestic and colonial goods, including rice. This attempt required considerable time, and the Japanese Empire, which collapsed in nearly half a century, had a limited amount of time to fully utilize its colonies as suppliers of primary commodities. In this manner, the Japanese Empire sacrificed about 40 years to become “the world’s largest empire.” However, when the government reaped the harvest, its measures caused not only an expansion of colonial commodity consumption but also an alteration in the structure of the domestic commodity market. The forging of a closer relationship among the regions within the empire structurally transformed both the colonial economies and the metropole’s economy.

As we mentioned in the introduction, previous literature on imperialism pays close attention to how the metropole’s actions affected the colonial societies. In contrast to the previous studies, we maintain that the history of imperialism should extend its view in the opposite direction and examine the effect within the empire. By adding this perspective, we will capture the mutual relationship between the metropole and the colonies as a cyclic structure to acquire more a profound historical understanding of imperialism.

A limitation of this study is that we investigate only the rice market in Tokyo. Japan imported not only grain but also mineral resources such as coal and iron ore. Even other Western imperial countries, which had lower degrees of colonial trade linkage than Japan, procured primary products from their colonies. Further research will be necessary to analyze the cases of other commodities and other imperial countries.

References

- Acemoglu, Daron, Johnson, Simon, and Robinson, James A. “The colonial origins of comparative development: An empirical investigation.” *American Economic Review* 91 no. 5 (2001): 1369–1401.
- Bank of Japan. *Meiji Ikō Oroshiuri Bukka Shisū Tōkei (Hundred-year Statistics of Wholesale Price Indexes in Japan)*. Tokyo: Bank of Japan, 1987.
- Basu, Dipak, and Miroshnik, Victoria. *Imperialism and Capitalism, Volume I: Historical Perspective*. Cham, Switzerland: Springer, 2020.
- Beasley, William G. *Japanese Imperialism, 1894–1945*. Oxford: Oxford University Press, 1987.
- Central Meteorological Observatory. *Kanto Daishinsai Chōsa Hōkoku, Jishin-hen (The Investigative Report of Kanto Great Earthquake, Volume of Earthquake)*. Tokyo: Central Meteorological Observatory, 1924.
- Chosen Yusen Line. *Chōsen Yūsen Kabushikikaisha 25-nen Shi (Twenty-five Years’ History of Chosen Yusen Line)*. Keijo (Seoul): Chosen Yusen Line, 1937.
- Duus, Peter. *The Abacus and the Sword: The Japanese Penetration of Korea, 1895–1910*. Berkeley: University of California Press, 1995.
- Enders, Walter. *Applied Econometric Time Series, Fourth Edition*. Hoboken, New Jersey: Wiley, 2015.
- Fabiosa, Jacinto F. Globalization and trends in world food consumption. In *The Oxford Handbook of the Economics of Food Consumption and Policy*, edited by L. Jayson, R. Jutta, and S. Jason, 591–

611. Oxford: Oxford University Press, 2011.
- Fama, Eugene F. "Efficient capital markets: A review of theory and empirical work." *The Journal of Finance* 25, no. 2 (1970): 383–417.
- Flath, David. *The Japanese Economy*. Oxford: Oxford University Press, 2014.
- Francks, Penelope. *Japanese Economic Development: Theory and Practice*. New York: Routledge, 2015.
- Fukao, Kyoji, and Settsu, Tokihiko. Japan: Modern economic growth in Asia. In *The Cambridge Economic History of the Modern World Volume II: 1870 to the Present* edited by S. Broadberry and K. Fukao, 100–28. Cambridge: Cambridge University Press, 2021.
- Governor-General of Taiwan. *Taiwan Gensei Yōran (Handbook of Taiwan)*. Taihoku (Taipei): Governor-General of Taiwan, 1932.
- _____. *Taiwan Tōchi Yōran (Directory of Administration in Taiwan)*. Taihoku (Taipei): Governor-General of Taiwan, 1945.
- Governor-General of Taiwan, Industrial Bureau. *Taiwan Beikoku Yōran (Directory of Rice in Taiwan)*. Annual Series, 1926–41. Taihoku (Taipei): Governor-General of Taiwan, 1937; 1941.
- Hasumi, Yasushi. *Shokuryō Seisaku Shiryō Shūsei (The Corpus of Food Policies)*. Tokyo: Nippon Shokuryō Kyokai, 1957.
- Hishimoto, Choji. *Chōsenmai no Kenkyū (The Study of Korean Rice)*. Tokyo: Chikura Shobo, 1938.
- Hori, Kazuo. Nihon Teikoku to shokuminchi kankei no rekishiteki igi (The historical significance of the relationship between the Japanese Empire and its colonies). In *Nihon Teikokushugi to Chōsen, Taiwan: Teikokushugika no Keizai Hendō (The Japanese Empire, Korea, and Taiwan: Economic Fluctuation under Imperialism)*, edited by K. Hori and S. Nakamura, 3–28. Kyoto: Kyoto University Press, 2004.
- _____. *Higashi Ajia Shihonshugi-shi Ron Dai 1-kan (A Study on the History of Capitalism in East Asia)*. vol. 1. Kyoto: Minerva Shobo, 2009.
- _____. "Colonial economy under Japanese imperialism: Comparison with the case of India." *International Journal of South Asian Studies* 4, (2011): 27–52.
- Ito, Mikio, Maeda, Kiyotaka, and Noda, Akihiko. "Market efficiency and government interventions in prewar Japanese rice futures market." *Financial History Review* 23, no. 3 (2017): 325–46.
- _____. "The futures premium and rice market efficiency in prewar Japan." *Economic History Review* 71, no. 3 (2018): 909–37.
- Johansen, Søren. "Statistical analysis of cointegration vectors." *Journal of Economic Dynamics and Control* 12, no. 2–3 (1988): 231–54.
- _____. "Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models." *Econometrica* 59, no. 6 (1991): 1551–80.
- Kaneda, Hiromitsu. Long-term changes in food consumption patterns in Japan. In *Agriculture and Economic Growth: Japan's Experience* edited by K. Ohkawa, Johnston, B. F., and H. Kaneda, 398–431. Princeton and Tokyo: Princeton University Press and University of Tokyo Press, 1970.
- Kawahigashi Yasuhiro. *Senzen Nihon no Beika Seisakushi Kenkyū (History of Rice Price Policies in Japan before the Second World War)*. Kyoto: Minerva Shobo, 1990.

- Kawano Shigeto. *Taiwan Beikoku Keizai Ron (Rice Economy in Taiwan)*. Tokyo: Yuhikaku, 1941.
- Korean Rice Association. *Senmai Kyōkai 10-nen Shi (Ten Years' History of Korean Rice Association)*. Tokyo: Korean Rice Association, 1934.
- Korea Shokusan Bank. *Chōsen no Kome (Korean Rice)*. Keijo (Seoul): Korea Shokusan Bank, 1928.
- Latham, Anthony J. H. *Rice and Industrialisation in Asia*. New York: Routledge, 2022.
- Li, Xiaobing. *The History of Taiwan*. Santa Barbara: Greenwood Publishing Group, 2019.
- Maeda, Kiyotaka. *Shio to Teikoku: Kindai Nippon no Shijō, Senbai, Shokuminchi (Salt and Empire: Market, Monopoly System, and Colonies in Modern Japan)*. Nagoya: Nagoya University Press, 2022.
- Management and Coordination Agency, Statistics Bureau. *Nihon Chōki Tōkei Sōran 1 (Historical Statistics of Japan I)*. Tokyo: Japan Statistical Association, 1987.
- Matsumoto, Takanori. Senzenki Nippon no bōeki kōzō to sekai bōeki (The structure of Japan's foreign trade and world trade before the Second World War). In *Senzenki Nippon no Bōeki to Soshikikan-kankei (Japan's Foreign Trade and the Interinstitutional Relationship before the Second World War)* edited by T. Matsumoto, 45–105. Tokyo: Shin Hyoron, 1996.
- Ministry of Agriculture and Commerce. *Nōshōmu Tōkeihyō (The Statistical Yearbook of Agriculture and Commerce)*, Annual Series, 1886–1925. Tokyo: Ministry of Agriculture and Commerce, 1912–23.
- Ministry of Agriculture and Commerce, Food Bureau. *Beikoku-hō Shikō no Keika Gaiyō (Administration Report of the Rice Law)*, Annual Series, 1922–23; 1925. Tokyo: Ministry of Agriculture and Commerce, 1922–23; 1925.
- Ministry of Agriculture and Commerce, Food Control Bureau. *Shokuryō Yōran (Directory of Food)*. Tokyo: Ministry of Agriculture and Commerce, 1944.
- Ministry of Agriculture and Forestry, Agricultural Bureau. *Beikoku Tōkei Nenpō (Annual Statistics of Rice)*, Annual Series, 1920–28. Tokyo: Ministry of Agriculture and Forestry, 1925; 1928.
- _____. *Beikoku-hō Shikō no Keika Gaiyō (Administration Report of the Rice Law)*, Annual Series, 1926–30. Tokyo: Ministry of Agriculture and Forestry, 1926–30.
- Ministry of Agriculture and Forestry, Rice Bureau. *Osaka Seisan Kome Gengetsu-betsu Ichidaihyō (Trading Volume and Prices in the Osaka-Dojima Rice Exchange)*. Tokyo: Ministry of Agriculture and Forestry, 1935a.
- _____. *Tokyo Seisan Kome Gengetsu-betsu Ichidaihyō (Trading Volume and Prices in the Tokyo Rice and Merchandise Exchange)*. Tokyo: Ministry of Agriculture and Forestry, 1935b.
- _____. *Chosen-mai Kankei Shiryō (Statistics on Korean Rice)*. Tokyo: Ministry of Agriculture and Forestry, 1936.
- _____. *Beika oyobi Beikoku Nisshi (Dairy Records of Prices and Circulation of Rice)*. Tokyo: Ministry of Agriculture and Forestry, 1937a.
- _____. *Taiwan-mai Kankei Shiryō (Statistics on Taiwanese Rice)*. Tokyo: Ministry of Agriculture and Forestry, 1937b.
- Ministry of Commerce and Industry, Commercial Bureau. *Torihikijo Ichiran (Directory of Exchanges)*, Annual Series, 1929–39. Tokyo: Ministry of Commerce and Industry, 1929–39.

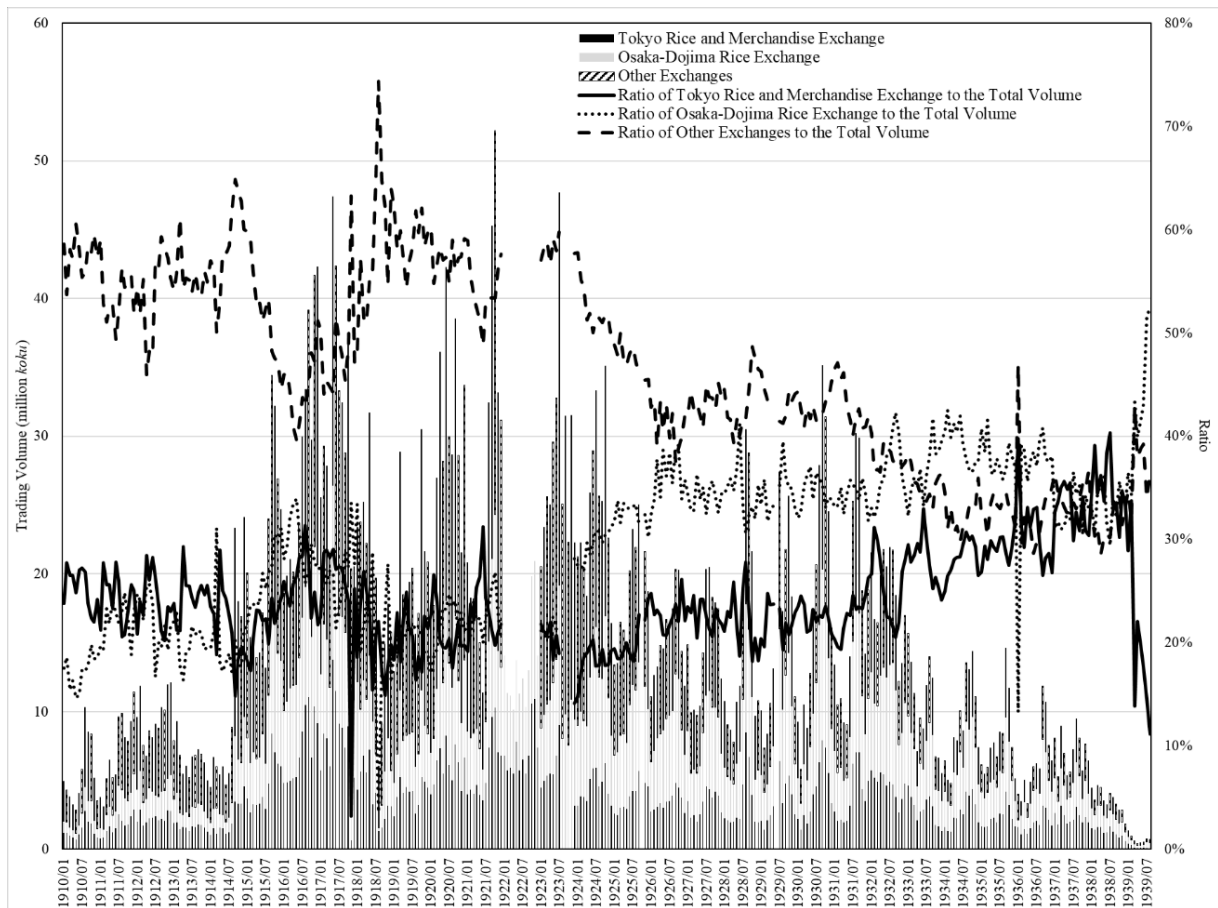
- Ministry of Railways, Transportation Bureau. *Kome ni kansuru Keizai Chōsa (Report of Rice)*. Tokyo: Ministry of Railways, 1925.
- _____. *Tokyo-shi oyobi Fukin Kamotsu Shūsan Jyōkyō (Distribution of Goods in and around Tokyo City)*. Tokyo: Ministry of Railways, 1928.
- Mochida, Keizo. *Beikoku Shijō no Tenkai Katei (The Development of the Rice Market)*. Tokyo: The University of Tokyo Press, 1970.
- Nakajima, Kentaro, and Okazaki, Tetsuji. “The expanding empire and spatial distribution of economic activity: The case of Japan’s colonization of Korea during the prewar period.” *Economic History Review* 71, no. 2 (2018): 593–616.
- Ohno, Kenichi. *The History of Japanese Economic Development: Origins of Private Dynamism and Policy Competence*. New York: Routledge, 2018.
- Okubo, Toshihiro. “Trade bloc formation in interwar Japan: A gravity model analysis.” *Journal of the Japanese and International Economies* 21, no. 2 (2007): 214–36.
- Omameuda, Minoru. *Kindai Nihon no Shokuryō Seisaku (Food Policy in Modern Japan)*. Kyoto: Minerva Shobo, 1993.
- _____. Tokyo shijō wo meguru jimawari-mai to ongoku-mai (Rice transported from neighborhood and remote sites in Tokyo). In *Shōhin Ryūtsū to Tokyo Shijō (Commodity Circulation and Market in Tokyo)*, edited by Y. Oikawa and M. Omameuda, 193–221. Tokyo: Nihon Keizai Hyoron Sha, 2000.
- Ota, Kasaku. *Meiji Taisho Showa Beika Seisaku Shi (Rice Price Policy in the Meiji, Taisho, and Showa Eras)*. Tokyo: Maruyamasha Shoten, 1938.
- Radetzki, Marian. *A Guide to Primary Commodities in the World Economy*. Oxford: Blackwell, 1990.
- Seth, Michael J. *A Concise History of Korea: From Antiquity to the Present, Third Edition*. Lanham, Maryland: Rowman & Littlefield, 2020.
- Shizume, Masato. “Ryōtaisenkanki Nihon ni okeru bukka hendō yosō no keisei: Shōhin sakimono kakaku dēta wo mochiita bunseki (Formulation of expectations in price fluctuation in Japan during the interwar period: An analysis using commodity futures price data).” *Shakai Keizai Shigaku (Socio-Economic History)* 77, no. 1 (2011): 25–47.
- Sims, Christopher A. “Macroeconomics and reality.” *Econometrica* 48, no. 1 (1980): 1–48.
- Stearns, Peter N. *Globalization in World History, Second Edition*. New York: Routledge, 2017.
- Taketoshi, Kazuki. “Meiji kara Showa shoki ni okeru kome sakimono kakaku ni kansuru keiryō bunseki (An econometric analysis of rice futures prices in prewar Japan).” *Sakimono Torihiki Kenkyū (Japan Futures Studies)* 4 (1999): 125–45.
- Tohata, Seiichi, and Okawa, Kazushi. Chōsen beikoku keizairon (The rice economy of Korea). In *Beikoku Keizai no Kenkyū (Study of the Rice Economy)*, vol. 1, edited by Japan Society for the Promotion of Science, 297–446. Tokyo: Yuhikaku, 1939.
- Tokyo City Government. *Dai 17-kai Tokyo-shi Tōkei Nenpyō (The 17th Annual Statistics of the City of Tokyo)*. Tokyo: Tokyo City Government, 1921.
- Tokyo Chamber of Commerce. *Tokyo Shōgyō Kaigisho Tōkei Nenpō (The Annual Statistical Report of the Tokyo Chamber of Commerce)* Annual Series, 1912–27. Tokyo: Tokyo Chamber of Commerce,

- 1918–19; 21–22; 24; 26–27.
- Tokyo Chamber of Commerce and Industry. *Tokyo Shōkō Kaigisho Tōkei Nenpō (The Annual Statistical Report of the Tokyo Chamber of Commerce and Industry)* Annual Series, 1928–42. Tokyo: Tokyo Chamber of Commerce and Industry, 1928–29; 31; 33; 35–37.
- Tokyo Grain Exchange. *Tokyo Beikoku Torihikijo Shi (History of Tokyo Rice and Merchandise Exchange)*. Tokyo: Tokyo Grain Exchange, 2003.
- Tokyo Rice and Merchandise Exchange. *Taiwan no Kome (Taiwanese Rice)*. Tokyo: Tokyo Rice and Merchandise Exchange, 1934.
- Tokyo Rice Wholesalers Association. *Tokyo Kaimai Tonya Kumiai Fukagawa Shōmai Shijō 50-nen Shi (Fifty Years' History of Tokyo Rice Wholesalers Association and Fukagawa Rice Spot Market)*. Tokyo: Tokyo Rice Wholesalers Association, 1937.
- Tokyo Stock Exchange. *Zenkoku Torihikijo Eigyo Gaihyō (The Monthly Report of Exchanges in Japan)* Monthly Series, 1919–30. Tokyo: Tokyo Stock Exchange, 1919–30.
- _____. *Tokyo Kabushiki Torihikijo Tōkei Geppo (The Monthly Statistical Report of Tokyo Stock Exchange)* Monthly Series, 1930–43. Tokyo: Tokyo Stock Exchange, 1930–39.
- Toyo Keizai Shimpo Sha. *Taisho 12-nendo Keizai Nenkan (Economic Yearbook on 1923)*. Tokyo: Toyo Keizai Shimpo Sha, 1923.
- _____. *Taisho 13-nendo Keizai Nenkan (Economic Yearbook on 1924)*. Tokyo: Toyo Keizai Shimpo Sha, 1924.
- Verschuer, Charlotte. *Rice, Agriculture, and the Food Supply in Premodern Japan*. New York: Routledge, 2016.
- Wakimura, Kohei. Gurōbaru hisutori kara mita Nippon teikoku (The Japanese Empire from the perspective of global history). In *Nippon Shokuminchi Kenkyū no Ronten (The Points of Discussion on the Japanese Colonial Studies)*, edited by the Society of Japanese Colonial Studies, 230–39. Tokyo: Iwanami Shoten, 2018.
- Wilson, Sandra, and Cribb, Robert. Japan's colonial empire. In *Routledge Handbook of Modern Japanese History*, edited by S. Saaler and C.W.A. Szpilman, 77–91. New York: Routledge, 2018.
- Yagashiro, Hideyoshi. *Teikoku Nihon no Ryūtsū Network (The Circulation Network of the Japanese Empire)*. Tokyo: Nihon Keizai Hyoronsha, 2012.
- Yamazaki, Shigejiro. *Beikai Shiryō (The Information of the Rice Market)*. Tokyo: Yamazaki Shigejiro Shoten, 1914.
- Yi, HyongNang. *Shokuminchi Chōsen no Kome to Nippon (The Rice from the Colonized Korea and Japan)*. Tokyo: Chuo University Press, 2015.

Appendix Table 1
Results of Cointegration Tests

	January 1917–August 1923					November 1923–October 1933					November 1933–August 1939				
	Trace		Max Eigen			Trace		Max Eigen			Trace		Max Eigen		
	Eigen- value	Test Stats	CV (1%)	Test Stats	CV (1%)	Eigen- value	Test Stats	CV (1%)	Test Stats	CV (1%)	Eigen- value	Test Stats	CV (1%)	Test Stats	CV (1%)
None	0.3163	79.47	71.48	29.28	37.49	0.2739	74.61	71.48	36.81	37.49	0.3570	77.42	71.48	29.59	37.49
At most 1	0.2539	50.19	49.36	22.55	30.83	0.1575	37.79	49.36	19.71	30.83	0.2509	47.84	49.36	19.36	30.83
At most 2	0.2164	27.65	31.15	18.78	23.98	0.0843	18.08	31.15	10.13	23.98	0.2411	28.48	31.15	18.48	23.98
At most 3	0.1088	8.87	16.55	8.87	16.55	0.0668	7.95	16.55	7.95	16.55	0.1386	10.00	16.55	10.00	16.55

Notes: “Trace” and “Max Eigen” denote the results of Johansen’s (1991) trace test and the results of Johansen’s (1988) maximal eigenvalue test, respectively. “Test Stats” in the “Trace” and “Max Eigen” columns means the trace statistics and the maximum eigenvalue statistics, respectively. “CV (1%)” is the critical value at the 1% significance level for each test. EViews 12 was used to compute the statistics.



Appendix Figure 1

The Trading Volume of Rice in Japan's All Exchanges, January 1910–August 1939

Sources: Ministry of Agriculture and Commerce (1912–23); Ministry of Agriculture and Forestry, Rice Bureau (1935a, p. 11; 1935b, p. 11); Tokyo Stock Exchange (January 1923–August 1939); The “*koku*” is a standard unit of measurement in the Japanese agriculture and one *koku* is equal to 180.39 liters. The volume of other exchanges in 1922, the volume of the Tokyo Rice and Merchandise Exchange in August–November 1923, and the volume of all exchanges in October 1925 and June 1929 were unknown because the data sources are missing.