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Source: *Economic Development and Cultural Change*, Vol. 18, No. 4, Part 1 (Jul., 1970), pp. 489-518
Published by: The University of Chicago Press
Stable URL: http://www.jstor.org/stable/1152130
Accessed: 05/10/2009 04:25

The Tokugawa Monetary System: 1787–1868*

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I. Introduction

The collapse of the Tokugawa regime, which paved the way for Japan's modernization, is linked, insofar as it was due to internal causes, to the growth of a commercial economy and the rising economic power of the merchant class. This article is an attempt to examine this general proposition and to throw light on the particular mechanisms by which this came about through a quantitative examination of the late Tokugawa monetary system.

Most modern discussions of the Tokugawa monetary system content themselves with a description of the coinage. The banking institutions of Osaka or the financial or price policies of the Bakufu (Tokugawa government) are commonly treated as though they had almost no relation to the monetary system as a whole beyond the fact that the Bakufu tended to try to solve its financial problems by debasing the coinage. Despite the fact that compilations like the Ministry of Finance's *Dai Nihon Kahei Shi* have preserved a great many odds and ends of information, there is very little direct evidence of how the system worked and, so far as we know, there has been no serious attempt to present a coherent reconstruction. According to one Japanese scholar, "Works written by numismatists and monetary historians tell us what types of money were issued, but not the amounts or their effects. We get only a static picture and not the more important one of the system in action."[1]

This paper puts forward some hypotheses about the operation of the

* This article is a preliminary report of work being done under a grant from the Harvard East Asian Research Center. We are indebted to Professors H. Rosovsky, K. Ohkawa, H. Patrick, and J. Nakamura for criticisms and comments on the earlier drafts of this paper.

[1] Takagaki Torajirō, *Kindai Nihon Kinyūshi* [Financial history of modern Japan], *Ginkō Sōsho* (Tokyo: Zenkoku Chihō Ginkō Kyōkai, 1955), 20: 31.

monetary system in the last third of the Tokugawa period which challenge in some respects the conventional wisdom on the subject. After providing some essential background information on the institutional context, we suggest some hypotheses about the working of the monetary system and test them against a rather large body of hitherto unanalyzed quantitative data. We then apply our findings to some features of the economic history of the period to see whether they suggest any useful insights. Finally, we attempt to incorporate our findings into a tentative interpretation of the monetary history of the period. Our discussion is based throughout on a quantity theory of money.[2]

II. Background

A. The Monetary System

Before attempting to explain the behavior of the monetary system in the period covered by our data, let us briefly review the history of the currency in the seventeenth and eighteenth centuries. When the Tokugawa monetary system originated in the early seventeenth century, its gold coin, the *koban* or 1-*ryō* gold piece, became the standard of value in the shogun's own capital of Edo and its environs, but in Osaka and most other areas the Tokugawa *koban* was treated in the same way as any other coin—and there were over 100 types of gold coin in circulation at the beginning of the seventeenth century. These coins were valued in terms of a numeraire consisting of standard unit of silver in the same way as the many types of coins in circulation were handled in premodern Europe.[3] Silver currency (*chōgin*, *mameita-gin*) circulated by weight and had to be weighed, and sometimes cut, for each transaction. This was not only inconvenient but also expensive, since a charge was made for weighing. At that time the value of the numeraire was linked to the commodity value of its silver content, and since trading in precious metals was not strictly controlled, the value of gold coins was related to the commodity value of their gold content. As long as import and export of bullion or specie were permitted,

[2] A classical quantity theory of money was current in Tokugawa Japan. "Commodity prices are high because the quantity of money is large. The annual production of commodities is fixed, while the quantity of currency minted each year is not. The greater the quantity of money the more acute the rise in prices. The principle is exactly the same as trying to feed more people by cutting the cake into smaller portions" (Satō Jizaemon, *Kahei hiroku* [The secret of currency] ca. 1840, in *Nihon keizai sōsho* [Bibliotheca Japonica oeconomiae politicae], ed. Takimoto Seiichi [Tokyo, 1917], 32: 320).

[3] For the way this operated in Europe, see L. Einaudi, "The Theory of Imaginary Money from Charlemagne to the French Revolution," in *Enterprise and Secular Change*, ed. F. C. Lane and J. C. Riemersma (London: Allen & Unwin, 1953), pp. 229–61; C. M. Cipolla, *Money, Prices and Civilization in the Mediterranean world* (Princeton, N.J.: Gordian Press, 1956), p. 45.

the relative value of gold and silver was close to that in Europe and, as in Europe, attempts to maintain gold coins at a ratio that varied much from that current in other countries would lead to disturbing outflows of either gold or silver.[4] Throughout the seventeenth century the rise in the Japanese gold/silver ratio roughly paralleled that in Europe.[5] Within Japan, however, maintenance of this rate in the face of large and continuous deficits in both the Bakufu's budgets and Edo's balance of payments with Osaka led to virtual exhaustion of the Bakufu treasury's gold reserves.

The Bakufu attacked this problem on three fronts. First, it isolated the coinage from overseas gold/silver ratios by measures designed to restrict foreign transactions in precious metals to a minimum. From the 1690s, foreign trade was conducted on a barter basis with any balances carried over to the following trading season.[6] Second, it isolated the relative values of gold and silver coinage from their commodity values by effectively banning private transactions in precious metals[7] and prescribing very severe penalties for counterfeiting. It was thus able to take the third step of declaring its gold *koban* legal tender for one *ryō* of gold irrespective of its actual gold content. The Bakufu had been able to have its gold coinage accepted on this basis in Edo following the debasements of 1695, but in 1700 the same treatment was required, and accorded, in Osaka.[8] At about the same time the awkward silver currency-by-weight began to go out of use for everyday transactions and to be replaced by credit instruments of various kinds expressed in units of silver.[9]

Between 1714 and 1736 the quantity of monetary silver (*chōgin*) in circulation fell by nearly 60 percent, and in the period under study it does not seem to have circulated at all. According to one source, "When the *ryō* is quoted at 60 *momme* of silver this does not refer to the weight of

[4] See K. Glamann, *Dutch-Asiatic Trade, 1620–1740* (Copenhagen: Danish Science Press, 1958).

[5] Ōkurashō [Ministry of Finance], ed., *Meiji zenki zaisei keizai shiryō shūsei* [Collected materials on the history of finance in the early Meiji period] (Tokyo: Kaizōsha, 1931–33), 12: 19–20, 31–36.

[6] Honjō and Yoshida, eds., *Dainihon kaheishi* [History of the Japanese currency] (Tokyo: Ōkurashō, 1925–26), 6: 552–53.

[7] Ōkurashō [Ministry of Finance], ed., *Nihon zaisei keizai shiryō* [Materials on the history of Japanese finance] (Tokyo: Zaisei Keizai Gakkai, 1922–25), 2: 739–44.

[8] Mitsui Takasumi, *Ryōgae nendaiki kanken* [Key to the annals of the moneychangers] (Tokyo: Iwanami, 1933), 2: 329.

[9] See Crawcour, "The Development of a Credit System in Seventeenth-Century Japan," *Journal of Economic History* 21 (September 1961): 342–60. Silver made up in parcels of 500 *me* continued to be used for certain purposes. The fineness of silver in these parcels was not specified (see *Ryōgae nendaiki kanken*, 2: 188).

chōgin but is simply the exchange rate at which gold units are converted into silver units. From about 1700 the gold 1-*ryō* piece, or *koban*, was fixed at 60 *momme* [for day-to-day purposes in Edo] but in Osaka where silver was the unit of account the rate fluctuated. 'Silver' (*gimme*) meant not a weight of metal but merely a unit of account, represented in Osaka by bills (*tegata*) expressed in that unit."[10] Not that real silver actually became extinct—there were still some 800 tons of it at the time of the Restoration[11]—but it does not seem to have circulated as normal currency. What role it played is not clear, but the most likely explanation is that it was held by the banking system as a reserve of some kind.[12]

Zeni, or copper cash, seems to have been originally intended to circulate as petty coinage at 4,000 to the gold *ryō*, but large issues reduced its value and only sporadic attempts were made to peg it for most of the Tokugawa period. In the eighteenth century its value fluctuated considerably. As in Europe: "When a debasement was put into effect, the maneuver gave to the mint farmers . . . a good chance of gain through speculation upon the difference between the current face value of the petty coins and their newly debased metallic content. Consequently the issues of petty coins entered a period of boom. Quite generally the quantity of petty coins in circulation quickly reached a point at which their current value was forced down till it reached the commodity value of the coins. At this point nobody had an interest in striking petty coins. Issues contracted until a new debasement was decreed."[13] In the eighteenth century, debasement sometimes took the form of minting *zeni* from iron or brass. The market for *zeni* was far from unified, and even while its value was declining in the major cities it was sometimes in acutely short supply in other parts of Japan. Although its value shows a declining trend over the Tokugawa period as a whole, in our period it was very stable in Edo and Osaka at about 6,700 to the *ryō* until the last few years, when its price fell considerably in terms of gold coinage.

[10] Miyamoto Mataji, ed., *Kinsei Ōsaka no bukka to rishi* [Prices and interest rates in Tokugawa Osaka] (Osaka: Nihon Kinsei Bukkashi Kenkyūkai, 1963), p. 35.

[11] Yamaguchi Kazuo, "Edo jidai ni okeru kinginka no aridaka" [The volume of gold and silver currency in circulation in the Tokugawa period] in (Tōdai) *Keizaigaku Ronshū* 28, no. 4 (March 1963): 79. The *chōgin* silver of the 1860s, however, contained only about one-sixth the silver content of the original *chōgin* of the early seventeenth century (see *Meiji zenki zaisei keizai shiryō shūsei*, 12:31, 45).

[12] Sakudō, based on earlier studies, suggests that silver was known to have been used in some cases as a reserve with a ratio of 1:6 or 1:7 against outstanding credit (Sakudō Yotarō, *Nihon kahei kinyūshi no kenkyū* [A study on the history of Japanese currencies and finance] [Tokyo: Mirai-sha, 1961], pp. 287–88).

[13] Cipolla, n. 3 above, p. 32.

With the virtual disappearance of silver currency-by-weight, the cash supply in our period consisted of gold and copper coins all over Japan, including Osaka. In practice the gold cash supply included subsidiary coins—one-quarter *ryō* pieces, one-eighth *ryō* pieces, one-sixteenth *ryō* pieces—which were actually made of a silver alloy, but these had no connection whatsoever with either *chōgin* or the silver unit of account. They played the same role as quarters and dimes do now. In Osaka, however, and for that matter over most of Japan and even to some extent in Edo, accounts for credit purposes continued to be kept in the now-imaginary silver units. This may have been partly because of the convenience of their divisibility by a decimal system, but more importantly because this procedure greatly simplified the accounting of currency whose value fluctuated from day to day, and made it possible to state long-term assets and liabilities in a stable unit. The alternative, actually adopted in 1868, of abandoning silver altogether and using the *ryō* (renamed *yen* in 1871) as the unit of account, was rejected because, although officially legal tender, it was subject to debasement, and in fact several qualities of *koban* were in simultaneous circulation at various discounts. In these circumstances a change in the value of cash in terms of the silver unit of account affected the cash value of instruments whose face value was expressed in the accounting unit.

B. Edo-Osaka Trade and Payments

Osaka was the great entrepôt of Tokugawa Japan. As summarized in figure 1, it acted as a collection point for goods (food, sake, fuel, building materials, household utensils, etc.) from most of Japan, and a large part of these goods was shipped to Edo. It should be remembered that although Osaka had a very large surplus in its balance of trade and usually a substantially favorable balance of payments with Edo, its situation was reversed vis-à-vis the rest of Japan so that in fact Edo ran a deficit with the rest of Japan via Osaka.[14] Most of Osaka's exports were in fact reexports and in addition she, like Edo, had to import most of her consumption requirements. The earnings of her processing industries and commercial services were probably not very much more than sufficient to support her approximately 400,000 inhabitants. These imports into Edo were paid for principally with the tax revenues of the Bakufu and the services provided to daimyo and their retinues in Edo. If these were insufficient, as they were for much of our period, they were supplemented by Bakufu deficits. Edo never ran out of means of payment because, although its production of precious metals decreased, it could increase the supply of coinage through

[14] Some data on the quantity, value and composition of imports into Osaka and Edo are given in Yamaguchi Kazuo, *Nihon keizaishi kōgi* [Lectures on Japanese economic history] (Tokyo: Tōkyō Daigaku Shuppan Kai, 1960), pp. 46, 48.

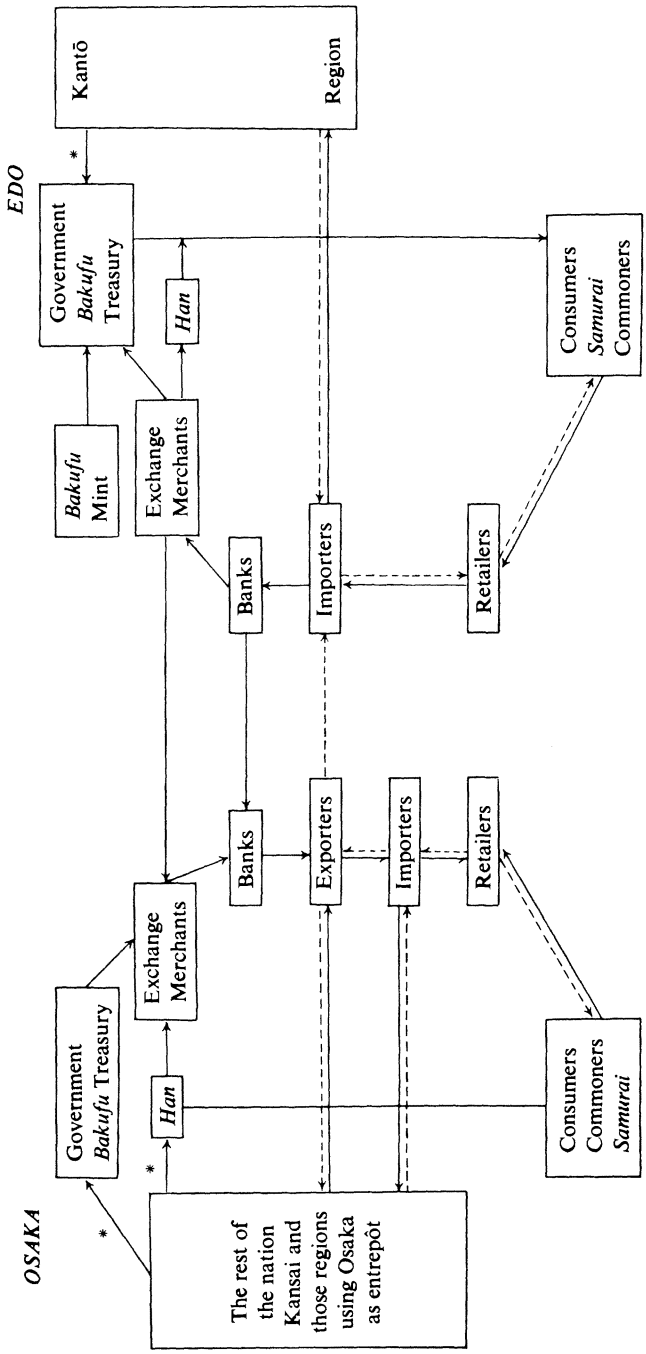

FIG. 1.—Flows of money and goods. —— indicate money; – – – indicate goods; * indicate tax payments. *Han* are administrative districts, controlled by *daimyō*.

debasement; a procedure limited only by increasing difficulty in recovering older coins and by the increasing temptation it presented to the counterfeiter. Most of the revenues of both Bakufu and daimyo came to Edo through Osaka, where their tax rice was marketed and settlement between the two cities was normally effected by means of bills of exchange.

C. The Exchange Bill Market

Osaka merchants who sold goods to Edo drew bills of exchange on their Edo customers or their own branches in Edo. These bills were bought by Osaka exchange dealers who used them to remit Bakufu or daimyo tax proceeds that they had accepted for forwarding to Edo. These transactions were effected in the Osaka exchange bill market where the exchange dealers (*on-kawasegata*) were the buyers and the export merchants (*torikuminin*) were the sellers, with the banks (*ryōgaeya*) acting as brokers (see fig. 1). The banks acting as brokers charged a brokerage commission (*uchibu*) which was paid by the seller. Depending on the state of the market, Edo exchange bills might be at a premium (*gyakuuchi*) paid by the buyer or discount (*hon-uchi*) charged to the seller. When the premium balanced the normal commission the bills were quoted at par (*mu-uchi*).[15]

When, because of heavy remittances of tax proceeds or forced loans (*goyōkin*), an austerity drive in Edo, or possibly speculative or arbitrage operations, Osaka had an unfavorable balance of payments with Edo, demand for Edo bills exceeded the supply and the premium on them rose. If, however, it rose above the cost of shipping cash (including possible losses on exchange if the gold cash price were lower in Edo than in Osaka) the exchange dealers shipped cash to Edo (*shōkudashi*). This reduced the premium on Edo exchange bills in two stages. First, it immediately reduced the demand for the bills. Second, since it was cash that had to be sent to Edo, it produced a demand for gold cash in exchange for credit instruments expressed in silver units, thus tending to raise the spot cash price and therefore reduce the premium on bills over cash. If the excess of demand for Edo exchange bills was so strong as to raise the Osaka gold price in this way, arbitrage remittances from Edo would supplement the supply of Edo exchange bills, again tending toward equilibrium. In the more frequent case of a favorable balance of trade with Edo, this mechanism worked precisely in reverse. When the discount on Edo exchange bills exceeded the cost of shipping cash (again including exchange), Osaka exporters brought their sales receipts from Edo in cash (*gyaku-shōkudashi*), which they normally deposited in the bank probably to repay an advance (expressed in silver units) against their original consignment of goods to Edo. This tended to depress the gold price with results similar to those already described.

[15] Matsuyoshi Sadao, *Nihon ryōgae kinyūshi ron* [History of money-changing and finance in Japan] (Tokyo: Kashiwa Shobō, 1965), pp. 246–47; *Ryōgae nendaiki kanken*, 2: 230.

The price of spot cash in Osaka could vary temporarily from that in Edo and the nature of this gap affected the exchange bill market. For example, if the gold *ryō* was quoted at 65 *momme* in Edo and 64 *momme* in Osaka, the price of an Edo exchange bill in Osaka would include an exchange discount (*hon-uchi*) of one *momme* per *ryō*. If the gap were sufficiently wide, the gain from arbitrage could make it profitable to adopt the alternative of shipping cash.[16] In practice the gap was normally very small.

D. The Osaka Gold Cash Market

In the early Tokugawa period, when Edo used gold coin and Osaka used silver by weight and the credit market was still undeveloped, the gold market was the market between gold coin and *chōgin*, and transactions between Edo and Osaka were probably a major factor in it. Despite official pegging, fluctuations appear to have been fairly wide. In our period, however, when gold coin was as acceptable in Osaka as in Edo and *chōgin* had been replaced as a means of payment in Osaka by silver notes or other credit instruments expressed in silver, the Osaka gold market was the market between gold cash and a unit of credit expressed in terms of silver accounting units.

In these circumstances, the balance of payments with Edo was only one factor in the Osaka gold market which was also influenced by the state of payments between Osaka and the rest of Japan and the supply and demand for credit and cash in Osaka, as well as by expectations and the general state of business confidence. The Osaka gold cash price itself was set by the banking system, or more specifically by the *Jūnin ryōgae*, or Big Ten, who held the reserves of the Osaka banking system and in some respects acted like a kind of central bank.[17] Since the Osaka banks operated on a correspondent system through a pyramid culminating in the Big Ten, this small group—not always consisting of exactly ten members—was highly sensitive to the state of the credit/cash market, and also exercised control over credit policy. They were, moreover, the major lenders to daimyo. In this situation they could, if they wished, influence the gold price through credit policy. If an inflow of gold were the result of a rise in exports to Edo, it was largely offset by a correspondingly increased outflow for purchases of goods from other parts of the country, but if the gold inflow were caused by a drop in tax revenues, it would tend to be offset by an increase in loans to daimyo or the Bakufu (*goyōkin*). There is

[16] Mitsui-ke Hensanshitsu, ed. (*Temmei 7-nen–Meiji 4-nen*) *Ōsaka kingin beisen narabi ni kawase hibi sōba hyō* [Daily Osaka market quotations for gold, silver, rice, copper coins and exchange: 1787–1871], *Mitsui-ke kawasegyō shi* [History of the banking and exchange business of the Mitsui family], *Shiryō hen* [Data section], part 5 (privately printed), 1: 16–17.

[17] See Crawcour, n. 9 above, p. 354.

ample evidence that loans of this kind as well as advances to merchants and producers outside of Osaka increased substantially over our period.[18]

E. Rural Developments

The period with which we are dealing was a period of rapid rural commercial development. This was not a new development. The commercialization of rual economic life seems to have been rapid during the first century of the Tokugawa period, and although it may have slowed during the eighteenth century, Andō, Smith, and others[19] have shown that the tempo increased again from around the start of the nineteenth century. For most of this time increases in production of commercial crops and the growth of rural industry were primarily in response to rising urban demand.

Technical progress in industry was very slow and the output of urban industry was approaching its limit before the middle of the eighteenth century. Thereafter city merchants sought increased supplies by utilizing part-time and off-season rural labor, at first in the Kinki region but progressively over more and more remote areas of the country.[20] Rising demand for industrial goods stimulated increases in the production of industrial crops. Almost all of this increased output was channeled to the cities, especially to Osaka, through monopsonistic merchant associations backed up by the political power of the Bakufu. In return, the countryside was supplied with increased amounts of fertilizer but with very few consumption goods, and the balance was settled by a flow of cash to the rural areas. This does not seem to have raised prices of rural products to the cities until around the 1830s (see fig. 2 and table A4) because of a strongly rising rural transactions demand for cash with the monetization of the rural economy. As subsistence agriculture gave way to a monetary economy, goods which had once been self-consumed or bartered were sold for cash, so the supply of goods available for sale for a time increased faster than production. In this situation the volume of monetary transactions could increase faster than output without inflationary results. By the 1830s, however, the monetization process had reached a plateau, and from then on continued rises in rural income were accompanied by rising

[18] Of the many sources, Horie Yasuzō, *Nihon shihon shugi no seiritsu* [The establishment of Japanese capitalism] (Tokyo: Daidō Shoin, 1939), pp. 39–53, is detailed and lucid.

[19] Andō Seiichi, *Kinsei zaikata shōgyō no kenkyū* [A study of rural commerce in the Tokugawa period] (Tokyo: Yūhikaku, 1958); Thomas C. Smith, *The Agrarian Origins of Modern Japan* (Stanford, Calif.: Stanford University Press, 1959).

[20] This process provides an interesting comparison with that in Europe as described by P. Mantoux, *The Industrial Revolution in the Eighteenth Century*, rev. ed. (New York: Harper & Row, 1965), pp. 181–84.

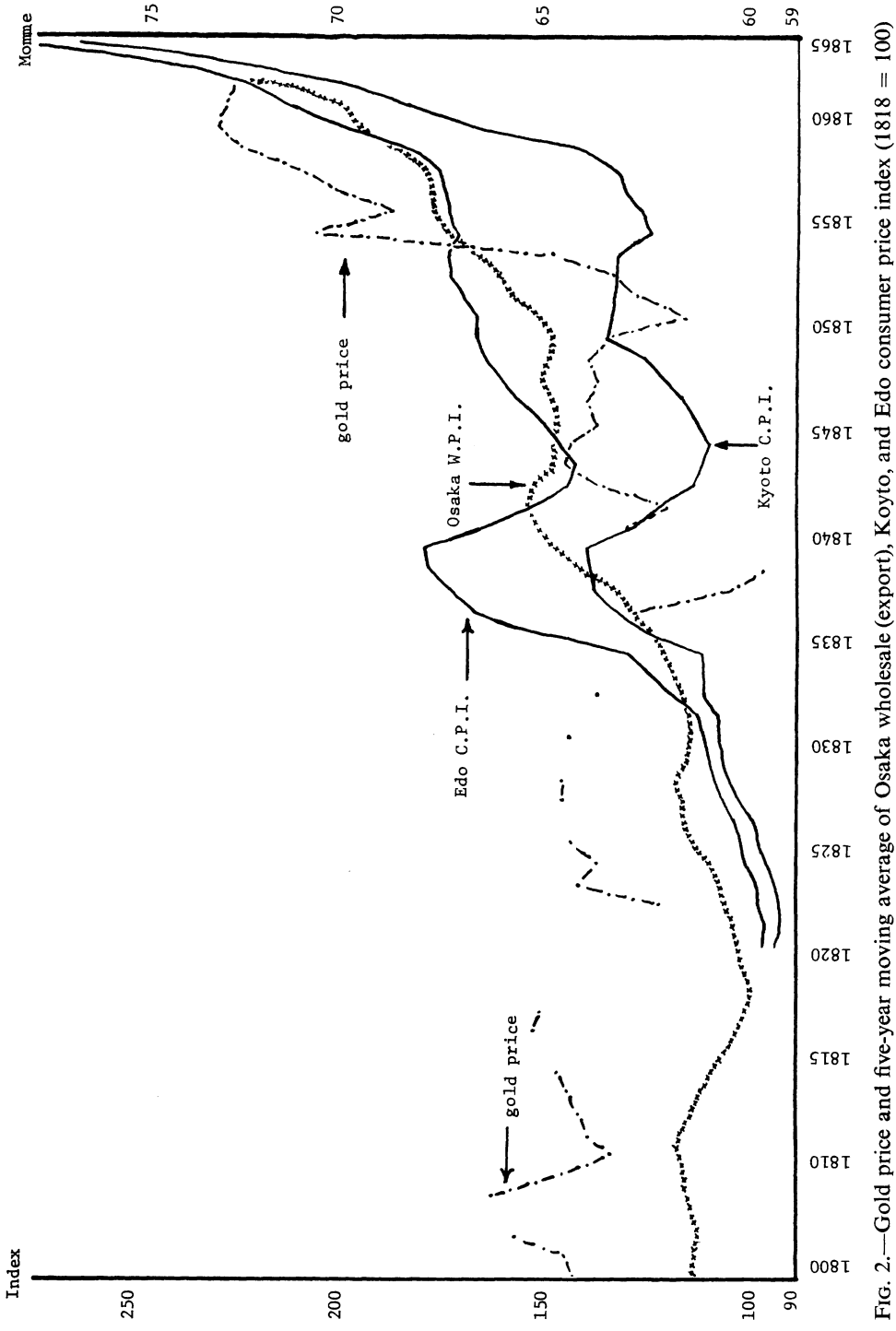

FIG. 2.—Gold price and five-year moving average of Osaka wholesale (export), Koyto, and Edo consumer price index (1818 = 100)

prices. Also, rural inflation and rising rural demand began to cut into the supply of goods to the cities, and even a determined effort by the Bakufu to reform the system of marketing in the early 1840s had only a temporary effect. Thereafter, control of distribution drifted beyond the waning power of the Bakufu, especially when alternative sales routes by-passing the official system were sponsored by daimyo. By the 1850s the mechanism by which the cities had been able to run a large trade deficit with the countryside without raising import prices against themselves was no longer operating effectively.

F. The Role of the Bakufu

Behind the efforts to maintain adequate supplies of goods to Edo and to keep prices down lay the political power of the Bakufu, applied with varying degrees of effectiveness at almost all points of the system. By exhortation and regulation; this power attempted to restrict rural consumption and to encourage agricultural production. When goods were in short supply in Edo, it sent people out of Edo and back to the country. It backed up the monopoly marketing institutions that compelled shipment of goods to Osaka and Edo and prevented their sale to rural areas. When Edo prices rose, from time to time it brought pressure to bear on merchant associations to reduce them. When the gold price showed a tendency to fall, it set a floor price and occasionally tried to maintain it by buying gold from the banking system in return for silver.[21] Whether on these occasions it sold real *chōgin* or not is not clear, but most likely the "silver" consisted of silver certificates which perhaps played a role analogous to treasury bills.

The Bakufu could influence the money market in other ways also. Although salaries of samurai were in principle payable in rice, the Bakufu adopted the practice of paying a proportion in cash at a conversion rate which could vary from the current rice price. By varying the proportion paid in cash and the rate at which rice was converted, it could exercise some influence over the Edo money market. The extent to which this was done at the expense of the samurai will be clearer when we have analyzed the data on these payments and compared it with rice and gold price series. Further, the Bakufu was itself a substantial lender, particularly to daimyo but also to some extent to Edo bankers and merchants. In our period these loans were running at the level of about 3.5 million *ryō*, which was a very considerable sum.[22] Through these loans it could exert

[21] *On-kaiage kin*, *On-haraigin*. See, e.g., *Ōsaka kingin beisen*, 1: 545.

[22] Takeuchi Makoto, "Bakufu keizai no hembō to kinyū seisaku no tenkai" [Changes in the Bakufu economy and the development of financial policy], in *Nihon keizaishi taikei* [Japanese economic history series], no. 4, *Kinsei no ge* [Tokugawa period 2], ed. Furushima Toshio (Tokyo: Tōkyō Daigaku Shuppan Kai, 1965), pp. 177–224.

some influence on the credit market. They seem also to have been a means of gaining acceptance for issues of debased coinage by issuing them in the form of loans at low interest. When all else failed and the Osaka banking system was so glutted with gold cash that the gold price was in serious danger, it could relieve the pressure by requiring a cash loan from the Osaka banking system which might or might not be repaid.[23]

The Osaka rice market seems to have been largely beyond the control of the Bakufu. Only one attempt was made to peg the price of rice in our period (and this was not a floor price but a ceiling), namely, for the three winter months of 1811 following a poor harvest. When the rice price was unusually low as it was in the early 1800s, the Bakufu simply ordered Osaka bankers and merchants to buy up rice. Sometimes, as in 1806,[24] it offered low-interest loans, or ordered the Osaka bankers to make loans, for this purpose. On the whole these operations do not seem to have been very effective. The Osaka rice market was very large and contained a considerable speculative element which was thought to be destabilizing by the Bakufu. Rice brokers and speculators, however, operated on very small margins and they were financed by specialized institutions, the *komegata ryōgae*. It seems strange, therefore, that the Bakufu did not attempt to influence the market more directly through these credit institutions.

In summary, though the effectiveness of official policy varied, it played an important role in the operation of the economic system, and the Bakufu, at least in the short run, was by no means simply a passive victim of economic forces. The relationship between the economic disruption of the end of the period and the decline of the political power of the Bakufu can scarcely have been a simple one-way one.

III. Quantitative Appraisal of the System

The purposes of this section are to examine two generally accepted hypotheses against a large body of hitherto unanalyzed data and to report some statistical results, obtained from the data, which contribute to an understanding of the workings of the Tokugawa monetary system. The data examined are *daily* series of the relative prices of gold, silver, and copper currency, the price of rice, and the margins (discount or premium) on gold bills of exchange drawn on Edo for the period from 1787 to 1868—with a few gaps.[25] We have also calculated wholesale (export) price index for Osaka and consumer price indexes for Edo and *Kamigata*

[23] These forced loans were resorted to occasionally throughout the period but with much greater frequency from the 1850s.

[24] Takeuchi, p. 211.

[25] *Ōsaka kingin beisen*. The missing years are 1788, 1790–92, 1796–97, 1802–3, 1815, 1818–19, 1821, 1829, 1831, 1833–35, 1839.

(Kyoto-Osaka region) from existing price data on selected commodities for the period between 1751 and 1868.[26]

The first hypothesis to be examined is the long-accepted view that changes in the relative values of gold and silver currency performed the function of a flexible rate of exchange in trade between Edo and Osaka, "in a fashion quite analogous to that observed between two nations nowadays."[27] This hypothesis implies that when Edo had adverse balance of payments the gold price fell, making her imports dearer and her exports (tax receipts?) cheaper until equilibrium was restored.

An examination of the data, however, clearly refutes this hypothesis. As is evident in figure 2 and table A1, despite great variation in Osaka–Edo economic relations, the gold price was stable for over half a century until 1854, when Perry arrived and the whole monetary system entered a period of rapid change, as will be noted shortly. In fact, the standard deviation of gold price for the period between 1800 and 1849 was 2.266 *momme* about a mean of 63.772 *momme*, or a coefficient of variation of 0.036. It should be noted also in table A1 that the gold price shows no falling trend, and actually rises when the financial condition of the Bakufu is at its worst.

To examine the above result further and to ascertain the possible mechanism which enabled such secular stability of the gold price in the face of the known constant adverse balance of trade for Edo vis-à-vis Osaka, we have calculated annual means and standard deviations for the difference between the gold exchange bill price and the gold price (i.e. the margin on exchange bills) as shown in table A2. As this difference is either the discount (*hon-uchi*) or premium (*gyaku-uchi*) on gold exchange bills, it represents the relative strength of demand and supply in the Osaka exchange bill market. Standard deviations are included to provide an indication of the variability of discount or premium around the par (*mu-uchi*) value (at which the difference between the gold exchange bill and spot gold prices is zero).

In calculating these means and standard deviations we added proxy values of +200 *momme* per 100 *ryō* for gold shipment from Osaka to Edo and −200 *momme* per 100 *ryō* for reverse gold shipment from Edo to Osaka. By doing so we attempted to include in our calculations the impact of these shipments on the bill market. It will be recalled that continued excess demand or supply conditions for bills resulted in gold shipment which tended to restore the market to equilibrium. The values plus or minus 200 *momme* per 100 *ryō* were chosen as, in our judgment, the values which on one hand are sufficiently above the highest discount or premium figures observed and on the other hand are not so high as to

[26] For the sources, see notes to tables A3 and A4.

[27] Sakudō, n. 12 above, p. 340. Sakudō regards this as accepted theory and cites a number of earlier authorities, all of whom give the same interpretation.

exaggerate the effect of these shipments. We believe these values are acceptable proxies for the impact of gold shipments, and although not presented in this paper, monthly means and standard deviations calculated with these proxies show, when examined against the raw data, that the use of these proxies reflected the actual market conditions quite realistically.[28]

The results of calculations seen in table A2 provide striking findings. First we discover that the annual means of the margins (premiums or discounts on exchange bills) are extremely small throughout the period covered by the data. Before 1854, when the situation changed profoundly as will be noted shortly, the largest absolute value of this annual mean was only 2.12 *fun* (0.212 *momme*) for 1838. This is less than 0.04 percent of the mean gold price for that year (59.84 *momme*). Even for the turbulent years following 1854, the maximum annual mean of the margin reached only about 0.13 percent (1860). In more general terms, the mean margin for the entire period, namely for the 13,209 days for which this data is available, was −0.1094 *momme* per *ryō*, or about 0.16 percent of the mean gold price for the entire period (68.75 *momme*).[29] This is very close to the cost of

[28] The cost of shipping cash from Osaka for delivery in ten days in Edo is shown in the following table.

COST OF SHIPPING CASH: OSAKA–EDO

Year	*Momme* per 100 *Ryō*	%
1800.....	8	0.13
1806.....	11	0.17
1838.....	8.5	0.14
1858.....	10	0.14

SOURCE.—*Ryōgae nendaiki kanken* (n. 10 above), 1: 736–45.

The standard handling charge for exchange bills is said to have been two *momme* per 100 *ryō*, or approximately 0.03 percent according to Sekiyama Naotarō, *Nihon kahei kinyūshi kenkyū* (Tokyo: Shinkeizai Sha, 1943), p. 53. Nevertheless, the margin on bills could be much higher than the cost of transporting cash if there was a substantial gap between the Edo and Osaka gold prices.

[29] Confirming this observation, when a regression equation is calculated in the form gold price = $a + b$ (gold bill price), we obtain an intercept of −0.1338 *fun* and a regression coefficient of virtually 1 (the first seven figures after the point were 9s). Given the smallness of the difference between the gold bill and gold prices, this is a result to be expected. That is to say, the unexplained error term is so small that the ratio of explained error divided by total error is bound to be extremely high.

shipping cash (see n. 28), which indicates that the gap between the Osaka and Edo gold cash prices was not systematically biased in either direction.

The second significant observation, closely connected with the comments just made, is that the standard deviation of the exchange bill margins for any given year were large *relative to their annual means for that year.* The ratio of standard deviation to the mean, that is, the coefficient of variation, fluctuated widely and often exceeded 5.0. For the entire period the ratio was as high as 3.7. On inspection, this wide band of fluctuation is found to apply equally to monthly data and to the raw data themselves.

The high coefficient of variation coupled with the very small absolute value of the means of the margins indicate that the market was highly sensitive and functioned very smoothly. The extreme smallness of the means of the margins was not an inevitable result—they could well have been much larger than observed had the market not worked so efficiently. For example, if a particular month had experienced fifteen days of gold shipment and fifteen days of equilibrium (*mu-uchi*), the mean of the margin for that month would have been 1.5 percent of the gold price, assuming the latter to have been 60 *momme* to the *ryō*. Our monthly data contain no such magnitude, but behave very much like the annual data shown in table A2. This indicates that any gap between the Edo and Osaka gold prices was quickly adjusted.

These findings indicate that the gold bill market was highly sensitive to the balance of payments between Edo and Osaka and functioned with an efficiency comparable with that of the international exchange market, with premia and discounts fluctuating narrowly around the stable gold price without involving a mechanism analogous to flexible exchange rates. The fluctuations of the margins seem large when evaluated in terms of coefficient of variation only because they are seen in relation to the extremely small means of these fluctuations.

The persistent negative signs of the annual means of the exchange bill margins indicate net shipment of gold cash from Edo to Osaka, although we are unable to determine the quantities involved. Nevertheless, since the mean margin was negative in forty-nine out of fifty-five years for which we have data between 1800 and 1868, the total flow of cash from Edo to Osaka over this period was presumably substantial. Such a flow of gold might have been expected to have depressed the Osaka gold price, but as noted earlier, the gold price displays no obvious trend before 1854 and thereafter moves sharply up rather than down (fig. 2).

In view of the above findings, our second question concerns relative price movements. If Edo's persistent balance-of-payments deficit vis-à-vis Osaka was settled by gold shipment as described above, did this raise the price level in Osaka more visibly than in Edo? On the analogy of international trade with stable exchange rates we would expect that it did.

The answer suggested by the available data, however, is negative. That is, as seen in figure 2 and table A4, the price level in Osaka—both

wholesale (export) and consumer goods—was consistently below that of Edo during the period for which we have the data. More importantly, we find that when prices began to rise sharply during the early 1830s, the Edo price index rose faster and it maintained approximately 30 points differential from the *Kamigata* (Kyoto–Osaka) indexes until 1854, when *Kamigata* prices, too, began to rise very steeply.

Our results indicate that Edo–Osaka payments were balanced by an effectively functioning exchange bill market and by shipment of gold currency to Osaka, and not by a mechanism analogous to that of a flexible exchange rate which required the price of gold to fall under the constant excess import condition of Edo. It is also clear that, in spite of the gold shipment to Osaka, Osaka export prices did not rise until the 1830s (see table A3), remained stable at this higher level during the 1840s, and then rose sharply again from 1850 to the end of the period. We have very little information on the volume of Osaka exports to Edo, but there are some indications that it did fall in response to the rise in Osaka export prices in 1840–42.[30]

At this point, however, it will be useful to add some results of our empirical findings, as they not only provide quantitative answers to long-standing questions of the Tokugawa economy but also provide additional evidence which helps clarify the explanations to be offered in the following section.

First, although the Bakufu attempted to stabilize the rice price, as the data in table A1 show, yearly means fluctuate significantly with large standard deviations. In fact, for the entire period, 1787–1868, the coefficient of variation was a large 0.422.[31] As we examine the monthly means of the rice price, which have been calculated though not presented

[30] See a report by Abe Tōtōmi-no-kami printed in *Ōsaka shishi* [History of Osaka City], ed. Ōsaka Shiyakusho [Osaka Municipal Government], 2d ed. (Osaka: Ōsaka Shiyakusho, 1927), 5: 679. The Osaka city officials were required to report the volume of exports to Edo of eleven commodities at three-month intervals from the 1720s, but these records do not seem to have survived (see *Ōsaka shishi*, 1: 312).

[31] The mean price of rice for the entire period was 83.405 *momme* per *koku* and the standard deviation was 36.88 *momme*. The rice price has been adjusted to take account of differences which occurred in actual quantity of rice per nominal *koku*. In the raw data the daily quotation for rice was given in terms of six different types of rice, each expressed in *koku* of differing real content. To eliminate apparent price fluctuation due to changes in the standard rice, we divided each price by the actual amount of rice contained. For example, *Kaga* rice which contained 1.036 *koku* per unit was divided by 1.036 to obtain the price per standard *koku*. Higo rice which contained 0.967 standard *koku* per unit was adjusted similarly. All calculations in table 1A were in terms of these adjusted rice prices.

in this paper, it is evident that the price was a function of seasonal variation and harvest conditions. When the daily price of rice was regressed against the stable gold price, the results obtained, whether for the entire period or per year, yield correlation coefficients which are consistently small vis-à-vis sample sizes, and 22 percent of the monthly correlation coefficients calculated (168 months out of 727 months) were negative. We conclude that the rice price reflected general monetary conditions only weakly, and was relatively unresponsive to monetary policy.[32]

IV. Gold and Commodity Prices, 1787–1868

The aim of this section is to explain the movement of the gold price from 1787 to 1868 in the light of our statistical findings and historical events, and to suggest an interpretation of the monetary history of the period.

The exceptionally low gold price from 1787 to 1793 was associated with the disastrous Temmei famine of 1786. The price of rice soared to an annual mean not reached again for fifty years, and Bakufu tax income in 1787 fell to 22 percent below the average of the five years on either side of that year. Moreover, this drop in revenue followed a period of chronic deficits[33] that resulted in a fall in Bakufu reserves from 3,004,100 *ryō* in 1770 to 817,207 *ryō* in 1788.[34] In normal times the Osaka banking system might have absorbed this and still maintained the relative value of gold cash, for example by expanding silver credit, but in the famine conditions of the late 1780s this was not possible.

In the summer of 1787, Matsudaira Sadanobu took office as Senior Councillor (*rōjū*) and head of the government, and immediately announced an economy drive which ushered in the period of the Kansei reforms. With the help of forced contributions from daimyo and the Osaka banks, the Bakufu achieved a net cash surplus over the following decade of some 263,000 *ryō*, which may well have contributed to the improvement in the gold price. Between 1798 and 1816, however, the cash reserves of the Bakufu again fell by 428,000 *ryō*[35] despite some forced loans. Nevertheless, the effect of this deficit on the gold price was very small. This does not seem to have been because the Osaka banking system expanded silver-unit credit to match the increase in holdings of gold cash, since if this had been

[32] Only exception is the *Tempō kaikaku* (Reforms of Tempō) during the early 1840s, as will be discussed in the next section.

[33] *Nihon zaisei keizai shiryō* (n. 7 above), 10: 483.

[34] Mukōyama Gendayu (Seisai), *Edo jitsujō Seisai zakki* [Seisai's miscellany of conditions in Edo], *Edo sōsho* [Edo series] (Tokyo: Edo Sōsho Kankō Kai, 1917), 9: 36–37.

[35] This information is from Furushima Toshio, "Bakufu zaisei shūnyū no dōkō to nōmin shūdatsu no kakki" [Trends in Bakufu income and the periodization of peasant exploitation], *Nihon keizaishi taikei*, 4:37. This article provides an excellent summary of sources available on Bakufu finance.

the case we should expect the value of gold and copper cash to move together relative to silver, whereas in fact the relationship is very weak ($R = .007$ for $n = 2{,}396$ for the decade 1800–1809).[36] We believe that what kept the Osaka gold price from falling at this time was a flow of cash from Osaka to rural areas, a flow that had been going on for many years and which was now resumed after an interruption caused by the 1786 famine.

The increase in the rural money supply did not raise the prices at which rural products were supplied to the cities. In fact, the Osaka wholesale price index fell by about 10 percent between 1800 and 1818 (see table A3). As already stated, we believe that the increase in the rural cash supply was absorbed by a rapidly rising volume of rural cash transactions associated with commercialization of agriculture and monetization of the rural economy at this time. In addition, increasing production for the market and a monopoly procurement system (the Osaka *kabunakama*) that had still not lost its effectiveness combined to reduce procurement prices.

Toward the end of 1819 the coinage was debased. Unfortunately we do not have data for this year; in fact the data are missing for several of the most interesting years in which fluctuations could be expected to have been higher than usual, and this may exaggerate somewhat the impression of stability conveyed by the tables and other statistical results. When the data starts again, only two months after the debasement, the gold cash market was still unsettled and low with a mean of 56.51 *momme* in January. Copper and rice were also cheap and the Osaka wholesale price index fell, suggesting appreciation of silver rather than depreciation of gold. Since *chōgin* was debased even more than gold coin, the net effect of the debasement was to raise the intrinsic value of gold relative to *chōgin*, but this fact seems to have had little significance. This confirms our speculation that the standard against which gold currency was measured was not *chōgin* but the unit of silver credit, which therefore appreciated with the debasement of gold currency in much the same way as a fall in the price of gold is now equivalent to appreciation of the dollar. In fact, although the debasement was of the order of 13 percent, the fall in the gold cash price was less than 9 percent. The Edo exchange bill market seems to have worked smoothly through this period with margins and standard deviations not noticeably higher than usual. By 1823 all series returned to normal levels, although the debased coinage continued to be issued in large quantities into the 1830s.

What kept the gold price stable during the 1820s seems to have been primarily an increase in silver-unit credit in Osaka. For the decade 1820–29, all price series expressed in silver move much more closely together than

[36] Here and below, where coefficients of correlation are given for decades, they have been checked against annual and monthly correlations, and in each case the decade figure reasonably accurately reflects the relationship within years and months.

usual (Gold and copper: $R = .603$ for $n = 2{,}367$; gold and rice: $R = .517$ for $n = 1{,}646$). This could be explained by a trend from the side of silver itself, and this explanation is confirmed by the marked trend of commodity prices expressed in silver (see fig. 2 and table A4). Expansion of the cash supply and the supply of silver credit reversed the downward trend of commodity prices despite a run of good rice harvests, but the rise in commodity prices was still mild because of the continued capacity of rural areas to absorb cash.

It was in the 1830s that commodity prices first rose steeply with the Edo consumer price index, reaching twice the 1830 level in 1837. Osaka wholesale prices also began a pronounced upward trend at this time. The rise in consumer prices is clearly due to a very sharp increase in the cash supply. The issue of one-eighth-*ryō* gold pieces (*nishukin*) in 1832 added 7.4 million *ryō* to the cash supply, in 1835 a new debased copper coin (*Tempō sen*) was issued, and by 1870 no less than 38.78 billion *mon* of this new copper coinage was put into circulation. This sum is roughly equivalent in value to 6 million *ryō* or one-third of the gold currency in circulation in 1818.[37] This was followed in 1837 by a debasement of the gold coinage that increased the amount in circulation by 3.45 million *ryō*,[38] and in the same year the first quarter-*ryō* silver pieces were issued—the first of some 80 million issued between that year and 1854. Although made of silver, they in fact added to the supply of gold-unit cash. This large issue of small-denomination subsidiary coins in gold units, added to the large issue of copper, probably contributed to the fall in the value of copper cash in 1838, which prompted the Bakufu to attempt to maintain its price at 5,700–6,000 to the *ryō*, apparently with little success.

The volume of silver-unit credit also seems to have expanded during the 1830s. Depreciation of *chōgin* by almost 20 percent in 1837 added 80,000 *kamme* to the supply and if this was, as we have surmised, some sort of reserve, it is likely that the volume of credit based on it expanded by much more. The steep rise in commodity prices expressed in silver suggests the same conclusion.[39] Despite this, however, the gold price fell steeply from an annual mean of 64.53 *momme* in 1830 to an annual mean of 59.84 *momme* in 1838. We attribute both the steep price rises and the fall in the value of gold cash to a kind of saturation of rural demand for cash. Monetization of the rural economy had reached a plateau, and the

[37] Yamaguchi, "Edo jidai ni okeru kinginka no aridaka," p. 79.

[38] *Ryōgae nendaiki kanken* (n. 8 above), 1: 782.

[39] No inference about the movement of silver can be made from the fact that the coefficient of correlation between gold and copper is low in this decade ($R = .057$ for $n = 1{,}558$) since, because of independent movements in the volume of gold and copper in circulation, we would expect a weak relationship, even though there were some trends in the volume of silver-unit money.

volume of monetary transactions could no longer increase faster than the volume of production without inflationary effects. Two factors intensified the effect of this change in the 1830s. First, the increase in the cash supply was greater than in any previous decade covered by our data. Second, rural output was increasing at a slower rate, partly because of poor harvests in the late 1930s and partly because the geographical spread of rural industry was approaching a temporary limit. These conditions are reflected in the widespread rural unrest that characterized the decade.

It was to deal with these problems that the Tempō reforms were announced in mid-1841, inaugurating a change in Bakufu economic policy. Control through official procurement and distribution agencies was clearly becoming ineffective in the face of rising rural cash demand, and the Bakufu was forced to consider controlling the sources of inflation—namely high wages, rising costs of raw materials, and high costs of production in general. The official urban trade organizations (*kabunakama*) were dissolved and attempts were made to find a more comprehensive form of control closer to sources of supply. As in earlier periods of reform, the Bakufu instituted strict budget economy. In 1842, price and wage controls were imposed and interest rates were ordered to be lowered from 15 percent to 12 percent,[40] and in the following year a loan of 855,000 *ryō* was raised from the merchant community of Osaka and its environs. Even though the amount raised was less than half the amount "requested," it was still by far the largest amount raised up to that time.[41] At the same time the Bakufu called in its own loans on a large scale.[42] Edo's imports from Osaka were reduced not only by fiscal economy but by two other factors. First, efforts were made, beginning in 1843, to reduce Edo's demand for consumption goods by ordering the evacuation of all unauthorized Edo residents to their native villages. Second, a tendency for imports from Osaka to be replaced by purchases from the hinterland of Edo was strengthened by the dissolution of the Edo–Osaka trading monopolies.[43]

By these and other related measures, aided by good harvests, consumer prices were sharply reduced and the gold price strengthened. The improvement was, however, shortlived. In particular the Osaka wholesale price index, which reflects the prices at which goods were supplied from rural areas, failed to fall in the 1840s, but fluctuated around a level 36 percent above the average of the 1820s. Attempts to control rural prices

[40] Tsuda Hideo, "Tempō kaikaku no keizaiteki igi" [The economic significance of the Tempō reform], *Nihon keizaishi taikei* 4: 301–57.

[41] Honjō Eijirō, ed., *Nihon keizaishi jiten* [Encyclopedia of Japanese economic history] (Tokyo: Nihon Hyōron Sha, 1940), 1: 597.

[42] Furushima, 4: 43.

[43] See Itō Kōichi, *Edo jimawari keizai no tenkai* [Development of the Edo hinterland economy) (Tokyo: Kashiwa Shobō, 1966), chap. 3.

having met with little success, the *kabunakama* were restored in modified form in 1851, but they were no more effective than they had been in the 1830s. The rural economy was no longer able to absorb rapid increases in its money supply without inflationary results, and the Bakufu was no longer able to prevent rural cash demand from effectively competing with the cities for supplies of goods. In more general terms, the cities could no longer run a deficit with rural Japan with impunity. Thus the expedient by which the Bakufu had long been able to supplement the resources available to it by running a cash deficit with rural Japan was now denied to it—and just at a time when demands on its resources were enormously increased. Defense commitments which had begun to rise in the 1840s soared with the arrival of Perry in 1853, and these increased commitments made it impracticable to follow the kind of deflationary fiscal policy that the monetary and price situation called for. Continued deficits financed by further increases in currency issue sent prices far above the peaks of the 1830s.

On the analogy of previous periods of heavy deficit financing, we might have expected the gold price to fall, but on the contrary, it rose at an accelerating rate for the rest of the period. Several factors account for this. The first and by far the most important was depreciation of the silver unit. Again the strength of the trend in silver is illustrated by a very high relationship between gold and copper, both expressed in terms of silver ($R = .782$ for $n = 1{,}857$ for the period 1860–68) despite a marked change in the value of copper in terms of gold. Depreciation of silver was the result of an unprecedented increase in loans by the Osaka market to daimyo to cover increasing burdens of expenditure, especially for military purposes. Between 1844 and 1867 (the bulk probably after 1850), loans to diamyo amounted to 11,220,841 *yen* in the currency of the 1870s.[44] This figure understates the amount of these loans since the loans were converted to the new currency at a low rate. Loans contracted in Edo were converted at 1 *yen* = 60 *momme*; those contracted in Kyoto were converted at the annual average price of the *ryō* in the year the loan was contracted; and those contracted in Osaka were converted at the price of the *ryō* on the day the Osaka gold market closed (1 *yen* = 219 *momme*). On the conservative assumptions that half the amount was contracted in Osaka, one quarter in Kyoto and one quarter at Edo at an average gold price of 1 *ryō* = 80 *momme* (the average rate for the period), the amount of the loans would have been 1.7 million *kamme* in silver units or 21 million *ryō*. This huge sum is roughly comparable with the total debts of the daimiates outstanding in 1844. To this must be added loans to the Imperial Court.

Among other reasons for the strength of the gold price were large forced loans from the Osaka merchant community to the Bakufu. Whether

[44] *Hansai shūroku* [Account of *han* debts], in *Meiji zenki zaisei keizai shiryō shūsei*, 9: 138.

these loans were made in gold cash or silver credit is not clear, but either way the effect on the gold price would be the same. Edo's imports from Osaka also probably continued to decrease as Edo imported more from its own hinterland and as daimyo and their large retinues moved out of Edo to Kyoto or to their home provinces. The effect of this move is clearly reflected in the relative movements of Kyoto and Edo consumer prices after the relaxation of the requirements of *sankin kōtai* by which daimyo were required to maintain establishments in Edo.

With the opening of foreign trade in 1859 under the Ansei treaties we might have expected very large movements in the gold price to adjust to the international ratio between gold and silver metal. In fact the rise in gold price could hardly have been due to this cause. The sudden outflow of gold following the opening of trade in 1859 has been estimated at 500,000 *ryō*[45] but it is not reflected in any way in the Osaka gold cash price. The reason is that the outflow of gold was largely balanced by an inflow of Mexican silver dollars which circulated in Japan, not as silver (*gimme*),but as three-quarter *ryō* pieces and so formed part of the gold-unit currency.

The higher overseas gold/silver ratio was reflected in the relative value of gold coins vis-à-vis silver coins expressed in gold units but it was not reflected in the Osaka gold price, which confirms our assumption that the latter had very little to do with the metallic content of either gold coin or *chōgin*. This does not rule out the possibility that expectations generated by the overseas ratio may have contributed to loss of confidence in silver in the closing years of the period.

By the 1860s the Bakufu's needs had completely outrun the resources available to it and, apparently in desperation, it ran unprecedented budget deficits financed by depreciation. This resulted in an increase in the supply of gold-unit currency from 48.8 million *ryō* in 1854 to 127.2 million *ryō* at the time of the Restoration.[46] Although the volume of *chōgin* actually fell by 10 percent over this period, this fact was of no significance whatever compared with the precipitous depreciation of the silver credit unit, the extent of which is reflected in the soaring relative price of gold despite such an increase in its volume. Even without the added financial commitments associated with the opening of the country and the disturbances that preceded it, deficits could have been expected to rise at an accelerating rate. With the rural "transactions trap" filled, each deficit raised prices, and since revenue was price-inelastic the deficit became greater each year. This accounts for the exponential appearance of the price series in figure 2. The similar upward trend of the gold price is an indication that the daimyo were, if anything, in an even more serious financial condition.

[45] See Okada Shumpei, *Bakumatsu ishin no kahei seisaku* [Monetary policy in the late Tokugawa and Restoration periods] (Tokyo: Moriyama Shoten, 1955), chap. 3.

[46] Yamaguchi, "Edo jidai ni okeru kinginka no aridaka," p. 79.

V. Conclusions

Looking at our period as a whole, we are impressed with the general stability of the gold price and the apparently smooth working of the exchange bill market. Our data suggest that the Osaka gold cash price was very unresponsive to changes in the balance of payments between Edo and Osaka, and what data we have suggest that although urban commodity prices fluctuated, particularly in Edo, they do not show a marked tendency to rise until the 1830s, and the rise becomes very marked after 1854. We find strong evidence to suggest that silver was a unit of credit with very little if any relation to the composition of metallic silver currency (*chōgin*).

Our findings suggest that there was a strong tendency for increases in the gold-unit cash supply to be balanced not by movements in the gold price—the ratio between gold cash and silver credit—but either to be dispersed into rural areas or to be balanced by increases in the supply of silver-unit credit money. Since Osaka commodity prices began to rise consistently only in the late 1820s and 1830s, we conclude that increases in the cash supply moved out of Osaka into rural areas up to that time, and that this increase in rural cash supply was not reflected in higher procurement prices for rural goods until then because of a combination of political control, elastic supply conditions, and the process of monetization of the rural economy.

Beginning around 1830, however, this situation no longer obtained. The flow of cash to rural areas now began to raise the general level of rural prices, and with the elasticity of supply (at least to the cities) probably falling, the Bakufu and the commercial agencies it sponsored could no longer keep procurement prices down. The Bakufu, which had long relied on the ability of the rural economy to absorb its deficits—and indeed the deficit of urban vis-à-vis rural Japan—was deprived of this resource just when its needs were greatest. Thus we conclude that the process of commercialization in a sense aided the Tokugawa regime, and that it was the leveling off of the process before other sources of revenue could be found that precipitated the financial crisis associated with its fall.

Appendix

Monetary units reference to are: gold, 1 *ryō* = 4 *bu* = 16 *shu*; silver, 1 *kamme* = 1,000 *momme* = 10,000 *fun* = 100,000 *rin* = 1,000,000 *mō*; copper, 1 *kammon* = 1,000 *mon*; rice, 1 *koku* = 2.5 *hyō* = 10 *to* = 100 *shō*.

TABLE A1

ANNUAL MEANS AND SDs OF GOLD, COPPER, AND RICE PRICES (1787–1868)

	GOLD*		COPPER†		RICE‡	
YEAR	Mean	SD	Mean	SD	Mean	SD
1787.....	55.518	0.868	9.407	2.728	103.241	24.365
1789.....	55.613	0.504	9.709	0.104	60.483	3.814
1793.....	58.415	0.549	9.522	0.070	77.078	6.538
1794.....	62.347	2.458	9.425	0.289	74.968	18.625
1795.....	63.452	1.713	9.527	0.110	59.014	3.002
1798.....	61.400	0.389	9.269	0.218	66.020	2.447
1799.....	62.540	4.644	9.108	0.189	60.862	3.680
1800.....	63.030	0.462	9.385	0.158	69.789	5.465
1801.....	61.640	2.421	9.328	0.308	65.589	6.131
1804.....	64.377	3.808	9.464	0.419	51.893	4.131
1805.....	64.571	0.633	8.900	0.438	54.636	3.501
1806.....	65.730	0.505	9.304	0.492	58.144	14.921
1808.....	66.437	0.217	9.252	0.084	66.848	4.947
1809.....	66.624	1.237	9.248	0.065	63.055	7.413
1810.....	63.513	0.336	9.275	0.039	55.277	14.270
1811.....	64.080	0.195	9.261	0.063	65.340	11.604
1812.....	64.330	0.138	9.229	0.055	55.729	6.758
1813.....	64.548	0.322	9.175	0.078	61.371	7.017
1814.....	64.759	0.188	9.012	0.862	67.290	3.279
1816.....	65.388	0.221	9.001	0.037	60.221	6.753
1817.....	65.293	0.171	8.913	0.064	64.079	3.334
1820.....	59.524	1.287	8.879	0.178	48.391	5.359
1822.....	62.417	0.619	8.880	0.060	54.219	2.961
1823.....	64.355	0.870	8.937	0.072	57.351	3.192
1824.....	63.859	0.912	9.166	0.207	58.821	3.018
1825.....	64.501	0.398	9.805	0.269	61.277	6.484
1827.....	64.654	0.127	9.540	0.072	55.492	2.983
1828.....	64.662	0.308	9.439	0.053	64.653	10.927
1830.....	64.532	0.160	9.361	0.144	73.799	8.480
1832.....	63.770	7.696	9.247	0.062	67.963	4.257
1836.....	62.896	1.232	8.971	0.134	102.632	26.996
1837.....	60.597	0.906	9.003	0.220	162.709	52.205
1838.....	59.839	1.263	8.895	0.081	102.210	15.698
1840.....	63.060	6.523	9.040	0.093	65.541	8.026
1841.....	62.181	0.257	9.539	0.644	64.579	4.917
1842.....	63.905	0.941	9.523	0.535	66.971	9.042
1843.....	64.616	0.403	9.884	0.205	67.475	6.742

TABLE A1 (*continued*)

	Gold*		Copper†		Rice‡	
Year	Mean	SD	Mean	SD	Mean	SD
1844.....	64.517	0.372	10.000	0.000	72.150	5.363
1845.....	63.891	0.612	9.704	1.601	78.903	8.140
1846.....	64.108	0.283	10.000	0.000	85.856	8.144
1847.....	63.897	0.118	10.000	0.000	80.376	5.656
1848.....	64.042	5.488	10.000	0.000	81.715	4.591
1849.....	63.601	0.375	10.000	0.000	87.775	8.766
1850.....	61.722	0.613	9.281	0.354	113.327	20.001
1851.....	62.977	0.536	9.537	4.515	106.783	24.780
1852.....	63.496	1.719	9.624	0.094	77.416	4.655
1853.....	64.999	2.926	9.766	0.166	91.987	8.573
1854.....	70.694	45.644	9.865	0.172	95.621	8.915
1855.....	68.791	1.089	10.112	0.978	74.721	3.477
1856.....	70.150	0.687	10.425	0.068	76.316	4.798
1857.....	71.040	0.918	10.620	0.122	91.506	7.599
1858.....	72.448	0.811	10.656	0.066	116.572	7.490
1859.....	73.068	1.647	10.692	0.351	114.939	5.036
1860.....	72.912	2.352	11.224	0.213	134.812	16.793
1861.....	72.551	0.654	11.496	0.398	163.034	27.482
1862.....	75.239	4.240	11.782	0.734	148.020	15.428
1863.....	83.692	2.702	12.982	0.416	156.947	18.878
1864.....	90.254	7.632	13.920	1.390	183.703	59.252
1865.....	103.083	44.103	15.106	0.611	137.103	111.753
1866.....	115.770	12.352	14.569	0.893	97.744	27.573
1867.....	129.373	11.431	14.532	0.928	95.016	28.324
1868.....	200.391	14.957	19.297	1.163	64.593	4.492

* The unit is *momme* per *ryō*.
† The unit is *momme* per *kan*.
‡ The unit is *momme* per adjusted *koku*.

TABLE A2

ANNUAL MEANS AND SDS OF THE DIFFERENCE BETWEEN GOLD BILL PRICE AND GOLD PRICE* (1787–1868)

Year	Mean of Difference	SD	Year	Mean of Difference	SD
1787.....	−0.166	0.161	1837	−0.220	1.440
1788.....	0.154	0.741	1838	−2.117	0.996
1793.....	0.101	0.879	1840	−1.145	1.478
1794.....	0.039	1.087	1841	−0.366	1.010
1795.....	0.082	0.981	1842	−1.601	2.302
1798.....	0.116	0.341	1843	−1.086	1.506
1799.....	0.040	0.184	1844	−0.379	1.851
1800.....	−0.143	0.908	1845	−0.330	1.343
1801.....	−0.313	0.726	1846	−0.493	1.339
1804.....	−0.016	0.415	1847	−0.041	1.225
1805.....	0.228	0.850	1848	−0.105	1.420
1806.....	−0.027	1.470	1849	−0.250	1.442
1808.....	−0.600	1.016	1850	−0.114	1.513
1809.....	−0.602	1.021	1851	0.085	1.112
1810.....	−0.323	0.790	1852	−1.512	1.422
1811.....	−0.631	1.625	1853	−0.231	1.486
1812.....	−0.084	0.588	1854	−0.911	2.131
1813.....	0.126	1.436	1855	−1.267	2.077
1814.....	0.294	0.362	1856	−1.599	1.797
1816.....	−0.173	0.372	1857	−2.732	2.305
1817.....	−0.315	0.408	1858	−1.718	2.316
1820.....	−0.029	0.467	1859	−1.520	2.010
1822.....	−0.376	0.296	1860	−9.421	8.886
1823.....	−0.342	0.632	1861	−2.819	2.161
1824.....	−0.428	0.464	1862	−1.857	1.751
1825.....	−1.266	0.733	1863	−5.614	6.256
1827.....	−1.218	0.733	1864	−8.195	8.183
1828.....	0.089	0.454	1865	−5.522	4.603
1830.....	−0.241	0.406	1866	−3.725	10.730
1832.....	−0.215	1.169	1867	3.644	6.850
1836.....	0.448	1.303	1868	−1.828	6.276

* Unit is in *fun* per *ryō*.

TABLE A3
KYOTO PRICE INDEXES, 1751–1817
(1751 = 100)

Year	Polished Rice (*Hakumai*)	Soy Bean Paste (*miso*)	Soy Sauce (*shōyu*)	Wine (*Sake*)	Lamp Oil (*tōyu*)	Sauerbeck Index
1751..	100.00	100.00	100.00	100.00	100.00	100.00
1752..	87.38	87.50	98.98	96.69	94.29	92.97
1753..	72.11	81.25	92.23	79.61	88.57	82.75
1754..	62.28	81.25	94.27	78.50	74.29	78.12
1755..	78.22	106.25	93.66	80.12	80.00	87.65
1756..	119.65	112.50	95.19	106.97	94.29	105.72
1757..	104.65	118.75	94.99	116.06	91.43	105.18
1758..	96.28	118.75	97.44	105.01	94.29	102.35
1759..	97.61	106.25	94.79	106.03	105.71	102.08
1760..	86.06	87.50	94.58	100.08	94.29	92.70
1761..	79.02	93.75	92.94	99.83	82.86	89.68
1762..	73.44	87.50	92.43	100.08	94.29	84.09
1773..	74.37	...	102.25	114.70	85.71	94.26
1774..	70.39	...	102.25	107.05	82.86	90.64
1775..	74.37	...	102.25	107.05	102.86	96.63
1776..	82.34	...	102.25	99.41	97.14	95.29
1777..	95.75	...	102.25	99.41	82.86	95.07
1778..	87.65	...	102.25	99.41	68.57	89.47
1779..	84.46	...	102.25	99.41	68.57	88.67
1780..	71.85	...	81.80	99.41	...	84.35
1781..	78.09	...	81.80	99.41	71.43	82.68
1782..	102.66	...	81.80	99.41	...	94.62
1783..	130.54	...	81.80	102.72	80.00	98.77
1784..	147.68	...	81.80	129.99	105.71	116.30
1785..	107.17	...	81.80	103.65	94.29	96.73
1786..	92.96	...	81.80	103.65	105.71	96.03
1787..	222.97	...	81.80	137.64	...	147.47
1788..	118.86	...	81.80	133.22	...	111.29
1789..	109.30	...	133.95	132.54	...	125.26
1790..	90.70	...	...	111.30	...	101.00
1791..	80.48	106.25	76.69	96.86	77.14	87.48
1792..	121.91	125.00	76.69	117.25	94.29	107.03
1793..	131.87	131.25	78.73	131.44	85.71	111.80
1794..	97.34	112.50	117.59	103.40	94.29	105.02
1795..	99.87	112.50	78.43	101.10	94.29	97.24
1796..	118.06	118.75	77.91	110.88	97.14	104.55
1797..	109.69	118.75	77.51	108.75	97.14	102.36

TABLE A3 (*continued*)

Year	Polished Rice (*Hakumai*)	Soy Bean Paste (*miso*)	Soy Sauce (*shōyu*)	Wine (*Sake*)	Lamp Oil (*tōyu*)	Sauerbeck Index
1798..	113.01	118.75	79.24	106.29	85.71	100.60
1799..	106.24	106.25	70.55	118.95	88.57	98.11
1800..	119.39	112.50	69.53	110.11	94.29	101.16
1801..	110.76	125.00	69.53	114.70	91.43	102.28
1802..	99.60	106.25	68.61	100.34	77.14	90.39
1803..	98.94	112.50	68.40	108.75	91.43	96.00
1804..	80.21	106.25	63.80	93.03	85.71	85.80
1805..	80.74	118.75	62.68	97.03	80.00	87.84
1806..	85.66	112.50	66.05	93.71	80.00	87.58
1807..	84.20	106.25	76.89	94.14	74.29	87.15
1808..	108.10	118.75	73.42	110.62	77.14	97.61
1809..	113.28	118.75	70.45	102.72	80.00	97.04
1810..	87.65	106.25	70.25	100.93	77.14	88.44
1811..	87.65	100.00	70.04	101.95	85.71	89.07
1812..	90.04	100.00	69.43	101.95	80.00	88.28
1813..	82.87	100.00	70.86	96.01	74.29	84.81
1814..	105.58	112.50	71.68	103.65	77.14	94.11
1815..	105.44	112.50	71.06	105.01	71.43	93.09
1816..	98.14	112.50	71.37	99.41	65.71	89.43
1817..	111.69	118.75	72.60	103.23	62.86	93.83

NOTE.—The source of the data is *Kinsei kōki ni okeru shuyō bukka no dōtai* [Movements of major commodity prices during the late Tokugawa period], ed. Nakai Nobuhiko (Nihon Gakujutsu Shinkō-kai, 1952), pp. 69–72. The original data were compiled by the House of Mitsui which has had offices in Edo, Osaka, and Kyoto for their money-changing and retail (textile goods) business since the late seventeenth century. The data included, in addition to the five commodities used in this Appendix, the price of salt and four wage series. (The salt series was not included because it was missing nearly 50 percent of the time and the prices were for various types of salt whose quality differentials we were unable to ascertain. Neither were the wage data, as they are not directly relevant for our purpose at hand, are also incomplete, and, since they are fixed by guilds, are not sensitive to prices.) The prices were recorded only for spring and fall. We chose the spring prices which are normally closer to the annual average than the fall prices. The five commodities used accounted for a significant proportion of expenditure of consumers of the time, and therefore provide reasonably accurate reflections of the general trends of consumer prices. The last column, the Sauerbeck index, is an unweighted mean of the five price indexes, i.e.,

$$\sum_{i=1}^{n} \frac{P_{it}}{P_{io}} / n$$

where P_{io} is the base price of ith commodity and n is the number of commodity indexes available for that year. As the original source noted, "these prices might understate the actual prices somewhat since they were the prices which the Mitsui shops paid," i.e., "their bulk buying undoubtedly enabled them to buy at lower prices." This, however, should not affect the *trend* of prices.

TABLE A4

SAUERBECK PRICE INDEXES OF OSAKA WHOLESALE (EXPORT), KAMIGATA (KYOTO), AND EDO CONSUMER GOODS, 1802–1868 (1818 = 100)

Year	Osaka Wholesale*	Kyoto Consumer†	Edo Consumer†
1802.....	112.25	...	...
1803.....	119.59	...	...
1804.....	114.68	...	...
1805.....	113.82	...	...
1806.....	116.80	...	...
1807..... ..	108.01	...	...
1808.....	115.55	...	...
1809.....	122.86	...	...
1810.....	119.18	...	...
1811.....	118.08	...	...
1812.....	116.02	...	...
1813.....	113.71	...	...
1814.....	112.77	...	...
1815.....	106.45	...	...
1816.....	103.98	...	...
1817.....	99.99	...	...
1818.....	100.00	100.00	100.00
1819.....	101.82	97.71	96.16
1820.....	102.19	91.95	95.74
1821.....	113.32	94.34	97.89
1822.....	106.40	95.55	101.50
1823.....	103.87	94.59	100.53
1824.....	111.03	96.47	100.76
1825.....	111.63	96.00	99.81
1826.....	125.81	105.14	112.91
1827.....	127.42	103.06	106.91
1828.....	117.34	103.49	108.31
1829.....	109.56	114.49	113.44
1830.....	109.22	109.68	111.36
1831.....	118.72	111.30	116.58
1832.....	124.72	103.87	113.75
1833.....	116.40	108.54	116.04
1834.....	114.84	130.93	148.63
1835.....	127.80	109.55	137.47
1836.....	131.57	116.58	143.20
1837.....	139.94	172.30	224.05
1838.....	136.76	143.23	189.65
1839.....	135.64	153.73	183.23

TABLE A4 (*continued*)

Year	Osaka Wholesale*	Kyoto Consumer†	Edo Consumer†
1840.....	169.05	118.43	156.93
1841.....	163.31	120.52	150.76
1842.....	159.51	116.13	146.82
1843.....	144.80	114.55	132.87
1844.....	133.66	107.45	139.30
1845.....	146.63	111.15	153.40
1846.....	156.48	115.36	168.29
1847.....	157.49	125.59	163.49
1848.....	151.05	127.95	163.60
1849.....	150.71	135.63	159.87
1850.....	138.29	133.52	172.63
1851.....	149.71	158.59	181.34
1852.....	173.81	122.29	162.76
1853.....	182.96	125.07	180.37
1854.....	168.91	135.28	175.63
1855.....	163.08	124.60	174.75
1856.....	184.07	121.31	169.84
1857.....	191.12	134.79	171.53
1858.....	184.45	147.24	186.56
1859.....	175.79	146.15	181.64
1860.....	199.49	163.81	207.11
1861.....	230.82	245.05	249.30
1862.....	210.07	203.61	236.20
1863.....	248.16	231.23	238.65
1864.....	424.08	270.51	269.08
1865.....	630.59	365.38	379.05
1866.....	804.69	719.82	502.19
1867.....	1077.74	1107.19‡	625.17
1868.....	1049.47	578.80	578.67

NOTE.—Source is same as table A3.

* This is the Sauerbeck price index for three commodities: rapeseed oil, charcoal, and cotton cloth. All three commodities were identified as of standard origin and quality. This index can be considered applicable to wholesale prices in *Kamigata* (Kyoto–Osaka region) and for exports to Edo and other parts of Japan. We used data for the fourth month of the Japanese calendar for the same seasonal reasons as stated in table A3.

† These series are the Sauerbeck price indexes calculated from the same five commodities as in table A3.

‡ This is due to an extremely bad harvest of 1867 which raised the rice price index from 907.09 in 1866 to 1534.22 in 1867.