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# Non-Agrarian Production and Capital Formation in Pre-Modern Japan*

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## Abstract

Eight sets of time-series (mainly production) statistics have been assembled, covering the late eighteenth and the first half of the nineteenth centuries in Japan. Many of the data indicate a clear increase during the 1790s–1820s, followed by a period of either stable or slightly upward movements until the middle of the nineteenth century. Together with the now widely accepted knowledge that population was stagnant in the same period, the above observation is loosely consistent with a revisionist view that the standard of living in the early modern Japan moderately improved.

## I

There is a revisionist view that the standard of living in Japan improved during the Tokugawa Era (see Hanley 1983, 1986, 1987 and Yasuba 1986). Behind this view, supported by various social phenomena such as the spread of education and of new lifestyles, is the conviction that the average level of per-capita real income moved slowly upward over the period, as evidenced by socio-economic indicators such as:

(1) A stable population, which reached a saturation point at around 1700 and remained at that level for the following 150 years or so (Saito 1985, p. 185);

(2) Practically no expansion of arable land, but clear signs of improvement in average rice yield per unit land (*ibid.*);

(3) The spread of non-rice producing activities including cash crops and non-agricultural production; and

(4) A declining relative tax burden on the populace (Miyamoto 1989, p. 75).

This of course meant not only that the economic surplus increased, but also that a greater proportion of the surplus remained in the hands of the commoners, i. e., farmers, artisans and merchants.

The improvement in real per-capita income and thus in the standard of living created a growing effective demand even under a constant population. But the importation of merchandise was virtually negligible under the policy of seclusion (*sakoku*), especially after 1750 or thereabout, and the rise in demand for goods and services had to be met by an increase in domestic supply. The response to this need by productive agents must have been reasonably good, since one detects only a mild rise in general price levels over the period of (say) 1750–1850 until the rapid inflation which set in toward the very end of the regime.

Now, if an economy operates over the long run with its economic resources fully utilised, the expansion of output requires an increase in factors of production and/or the introduction of new methods of production (sometimes called technological progress). Since we are reasonably certain that during the latter half of the Tokugawa era there was little change in the size of the population, and that the influx of new technology from abroad was almost non-existent due to the seclusion policy, it follows that the required expansion in production facilities could not have taken place without domestic capital formation, and that the increase in physical facilities must have been financed by a matching rise in domestic savings, which were available thanks to the increasing economic surplus.

The question, then, becomes simply: how much capital was formed, during which period, and in which industry?

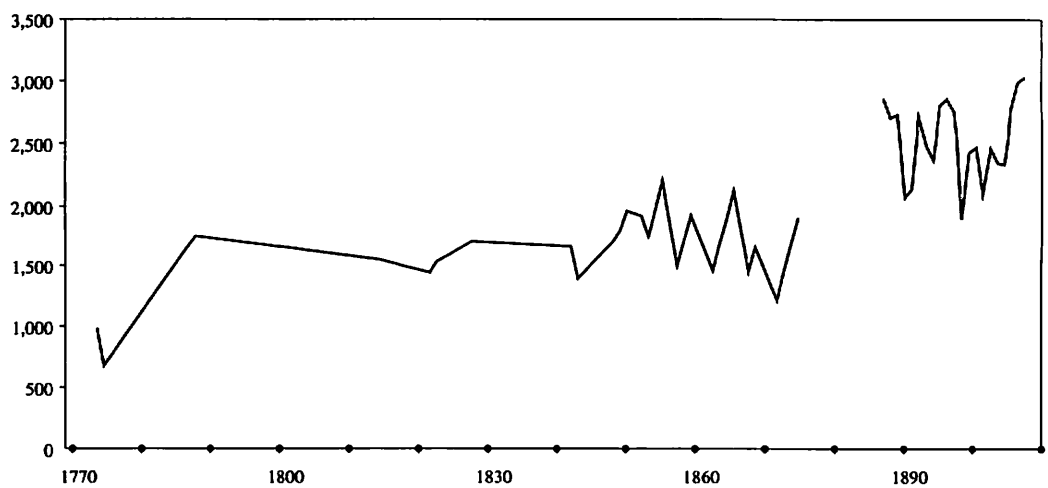
Of course, the quick and honest answer to this query is "we do not know." Economic historians interested in the Tokugawa era have been haunted by the sheer shortage of basic, quantitative data. Even the magnitude of total agricultural output cannot be determined for certain for this period: a great difficulty considering it was dominated by the primary sector. No wonder we know little about the quantitative weights of non-agricultural activities.

These difficulties notwithstanding, we can still attempt to make a bold, educated guess. The following sections will attempt just such a task.

## II

There are no systematic records whatsoever of capital formation during the Tokugawa era. But one may still gather some information on non-primary production, although it is often quite micro in nature, fragmentary, and scattered over wide geographical areas. Despite the shortcomings, it may still be possible to utilise the data and delineate periods when capital formation was brisk and productive capacities

**Figure 1 Log Output in Tanba (in 1,000 jo)**

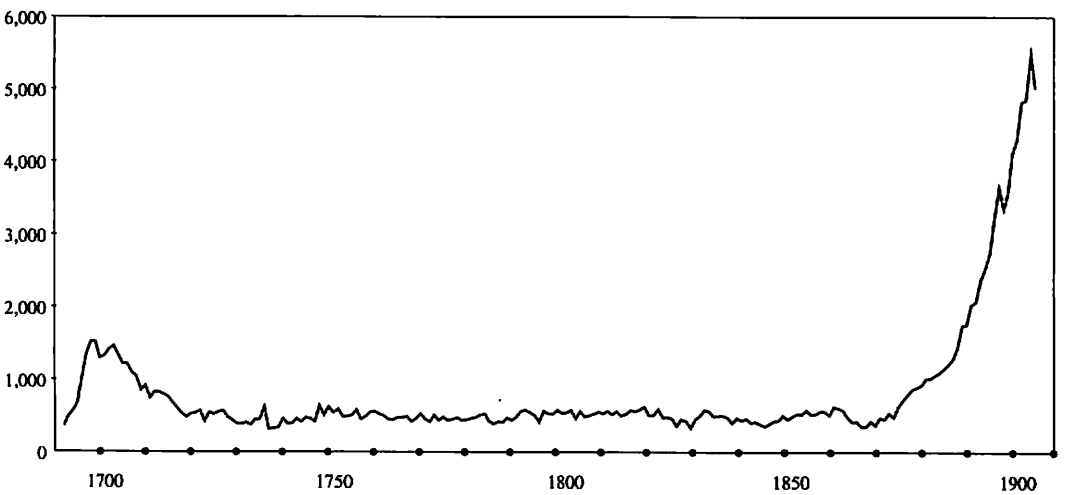



Source : Fujita (1973), pp. 322-23, 496.

**Figure 2 Charcoal Output and Sales in Kishū Domain (in 1,000 tawara)**


Source: Zenkoku Nenryō Kaikan (1960), pp. 296-300. Values for 1807-08 and 10-16 include linear interpolations.

**Figure 3 Annual Copper Output at Besshi Mines (in 1,000 kg)**



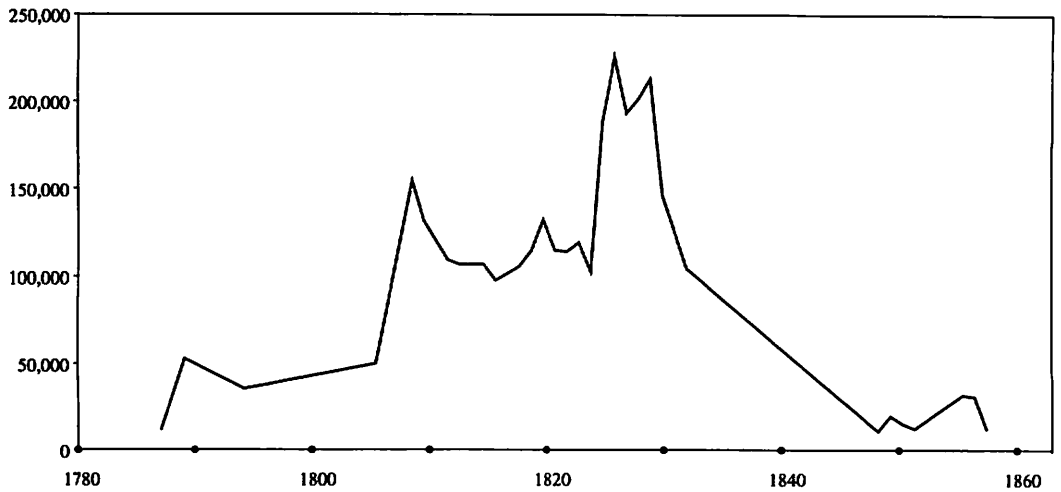

Source: Sumitomo Kinzoku Kōzan (1991), Appendix Volume, pp. 225-29.

expanding from those when it was relatively inactive and economic development relatively slow.

The balance of the present essay serves three purposes. First, it attempts to collect representative statistical information on the non-primary outputs in the latter half of the Tokugawa era. Second, it speculates, on the basis of that information, on the magnitude of, and trends in, the capital formation, in the said period. Finally, it reflects on the changing nature of investment as the economy moved away from proto- to full-scale industrialisation.

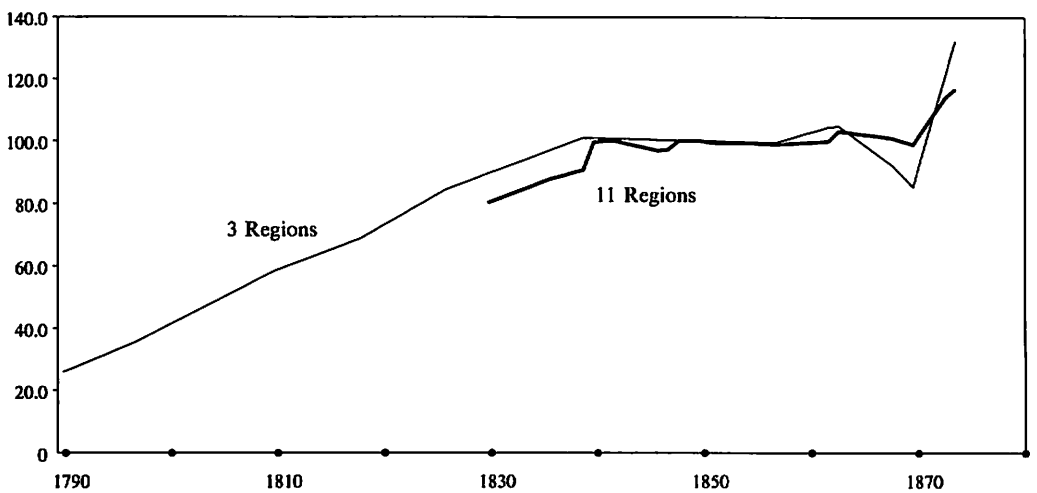
As core materials for this analysis, I have used the following eight time series statistics which are readily available from publication (see Figures 1-10):

**Figure 4 Pig Iron Output in Nanbu Domain (in 1,000 kan)**




Source: Mori (1983), ch. 10.

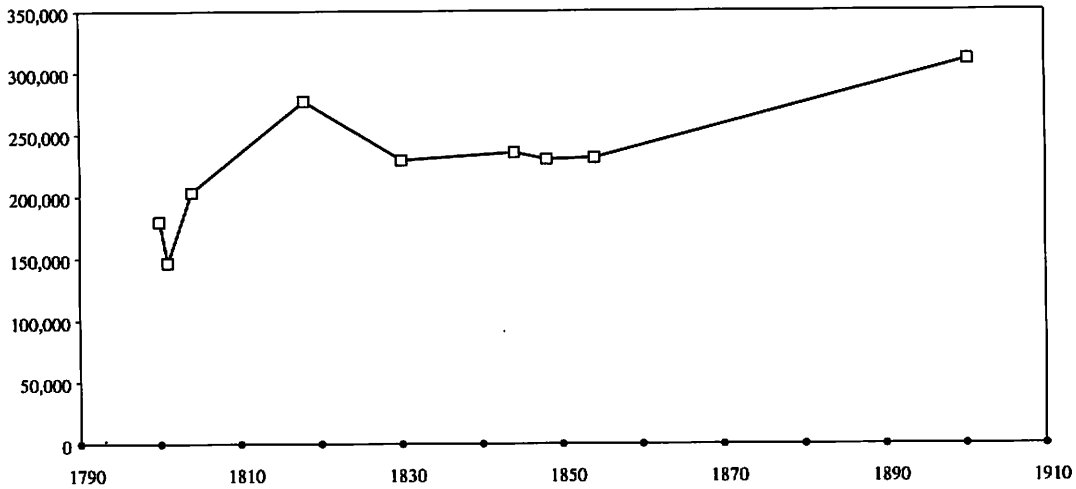
**Figure 5 Output Indices of Cotton Clothes (1850=100)**




Source: Abe (1988), pp. 79-83.

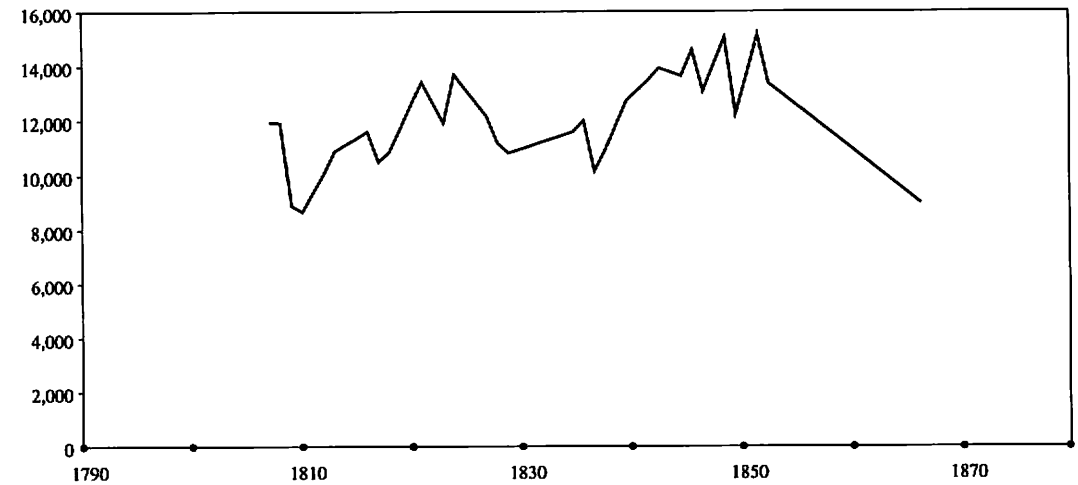
(a) log production in Kyoto (Fujita, 1973; see Figure 1),
(b) charcoal production in *Kishū* (now in Wakayama Prefecture) (Zenkoku Nenryō Kaikan, 1960; Figure 2),
(c) the copper output at the Sumitomo House in *Besshi* (now in Ehime Prefecture) (Sumitomo Kinzoku, 1991; Figure 3),
(d) traditional iron making in *Nanbu* (now in Aomori Prefecture), which is renown for its cast iron products for domestic use such as agricultural tools and cooking utensils (Mori, 1983; Figure 4),
(e) cotton weaving in eleven districts (Abe, 1988; Figure 5),
(f) indigo production in the *Tokushima* region(Amano, 1986 and Izumi, 1989; Figure 6),

**Figure 6 Indigo Output in the Yoshino-gawa Plain (in 1,000 tawara)**




Source : Izumi (1989), p. 225. Reported values (shown by squares) have been linearly interpolated.

**Figure 7 Soy Sauce Output at Tatsuno (in cho)**




Source : Hasegawa (1993), p. 91. Missing values have been linearly interpolated.

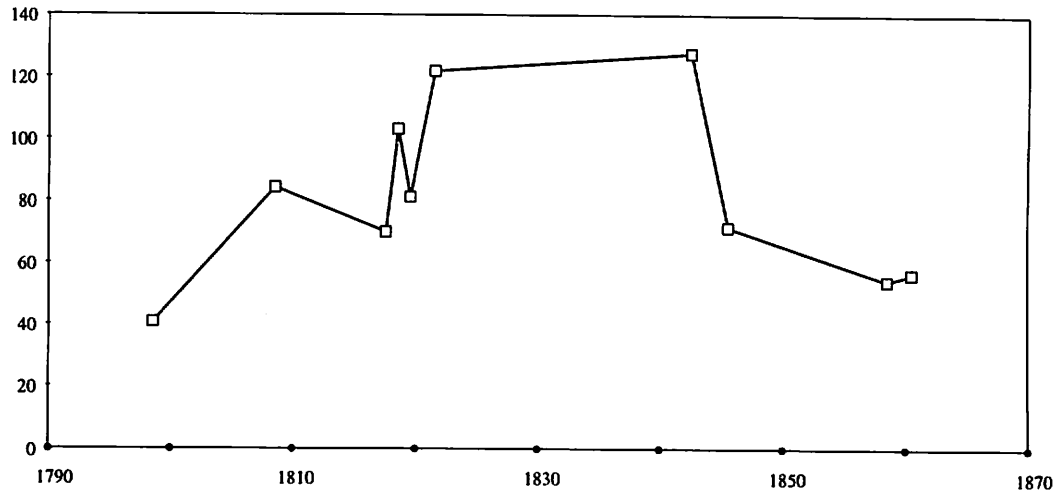
(g) soy sauce brewing in *Noda* (now in Chiba Prefecture) and in *Tatsuno* (now in Hyōgo Prefecture) (Tanimoto, 1990 [not shown in the figures] and Hasegawa, 1993; Figure 7), and

(h) coastal shipping on the west side of the Honshū island (Omura, 1992, Takei, 1972, and Uemura, 1989; Figures 8–10).

Upon close examinations of each of these time series data, one observes the following.

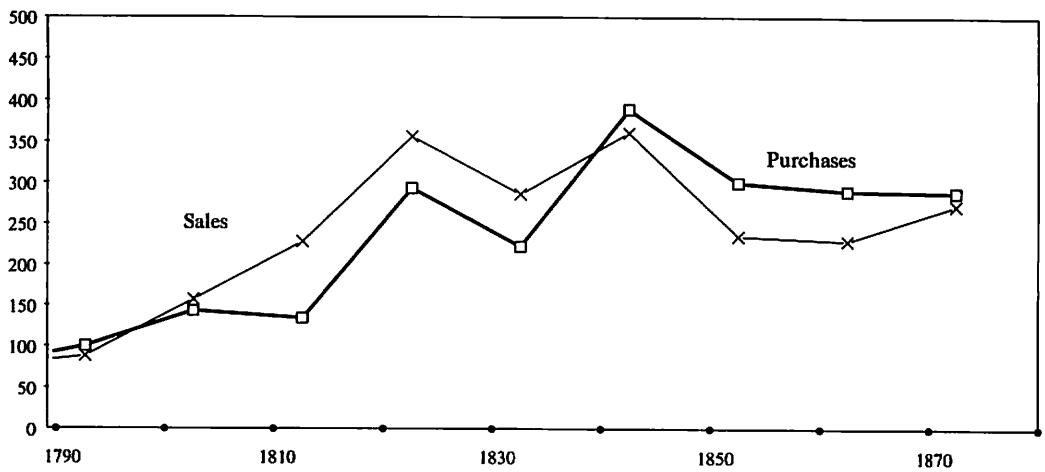
First, the eight sets of data may be classified into two groups : namely, (i) industries with stable output levels over a fairly long period, stretching from the late eighteenth to the first half of the nineteenth centuries ((a), (b) and (c)), and (ii) those which indicate a clear rising trend through the 1830s ((d) – (h)).

**Figure 8 Vessel Arrivals at Tabuchi House in Awa (weighted index, 1799=100)**




Source : Uemura (1989), p. 150. Reported values (shown in squares) have been linearly interpolated.

**Figure 9 Transactions of Merchant Houses with Coastal Vessles at Port Shimizu in Iwami Domain (number of cases)**

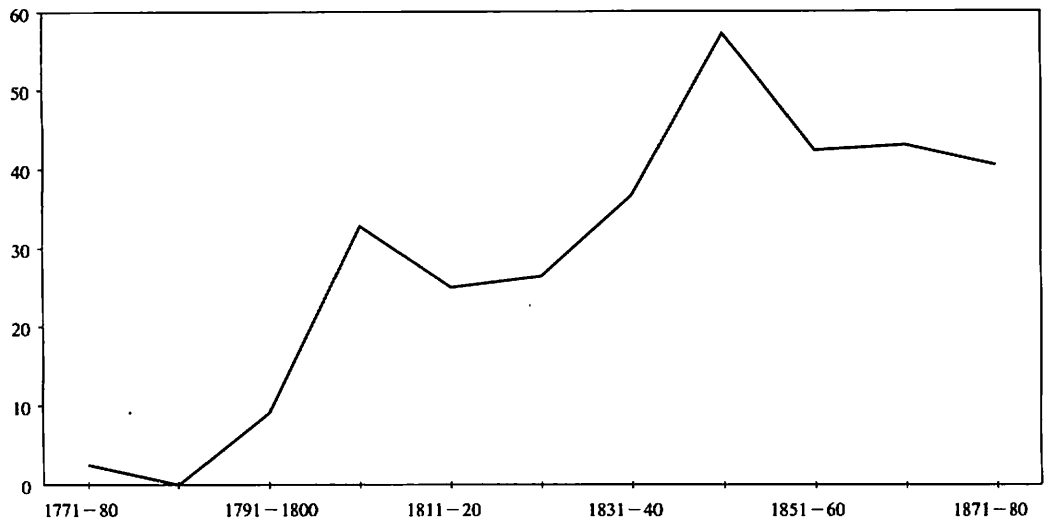



Source : Takei (1972), pp. 285-86. Reported numbers (shown in squares and crosses) have been linearly interpolated.

The industries in the first group all faced natural limitations to growth of one kind or another. In the case of log production, for instance, the physical capacity of raft transporting on the *Yodo* River set a maximum annual quantity of logs obtainable from the mountains. By the same token, copper and charcoal outputs were constrained by the supply of wood, which was the essential energy source for the chemical transformation of the raw materials. In these industries investment was hardly possible above the need for simple reproduction.

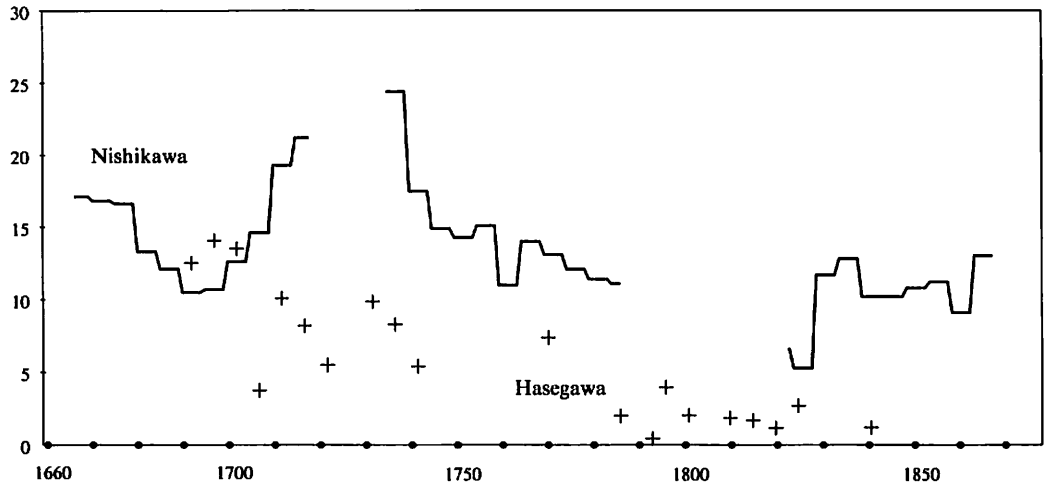
An exception to this was the case of *Nanbu* cast iron, another natural-resource dependent industry, where output clearly grew through 1830. The relatively small size of its operation must have facilitated frequent shifts of its production sites from one region to another, as the supply of raw materials (iron ore and woods) was

**Figure 10 Ratio of Long-distance Travel Vessels at Izumiya in Sado Island (%)**




Source: Omura (1992), pp. 152-54.

**Figure 11 Gross Profit Rates of Major Merchant Houses in Edo (%)**

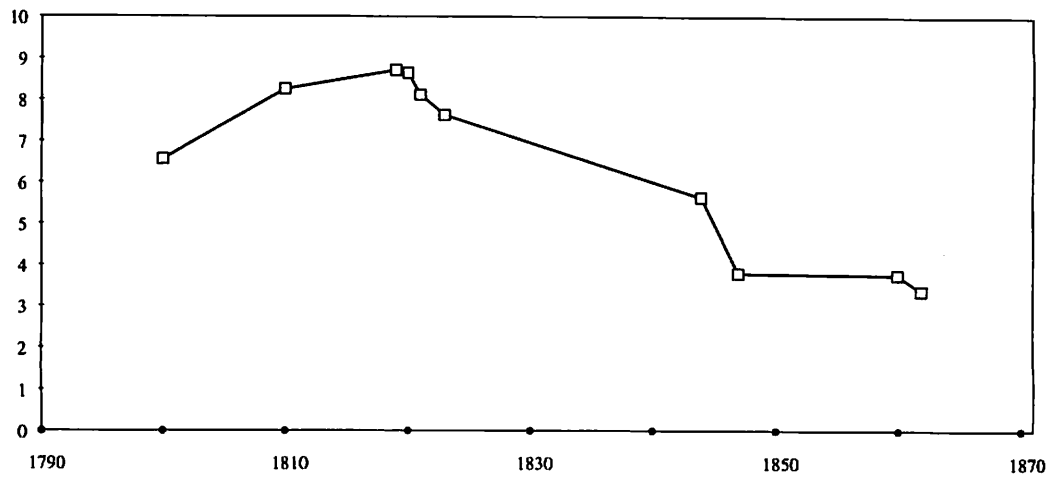



Source: Yasuoka (1970), pp. 140, 143.

exhausted. The sharp decline of pig iron output after the mid-nineteenth century, on the other hand, was probably due at least in part to the emergence of a powerful competitor at *Kamaishi* (near Sendai), where the western-style method (albeit primitive) of pig iron production was successfully adopted by Takatō Ōshima under the auspices of the *Bakufu* (the Shogunate).

In sharp contrast to the first group, the outputs of the second group of industries continued to grow throughout the early part of the nineteen century (the so-called *Kasei* era) before reaching a peak. The specific timing varied from one case to another: 1820 for indigo, 1830 for pig iron as well as cotton weaving, and around 1850 for *Tatsuno* soy sauce and coastal shipping. *Chōshi* soy sauce was the only example

**Figure 12 Crew Size of Vessels Arrived at Tabuchi (persons)**




Source: Uemura (1989), p. 150. Reported values (shown by squares) have been linearly interpolated.

in the group that displayed continuous expansion throughout the entire nineteenth century, though at a very modest rate (Tanimoto, 1990, p. 250). In any case, the growth of these outputs was subject only to the size of market demand.

There are some indications that after the *Kasei* Era the economic activities of major cities such as Edo, Kyoto and Osaka faced relative decline whereas those of provincial districts, especially in the western part of the country, flourished. One notes, for instance, that the rate of profit actually declined for some big merchant houses in urban centuries (see Figure 11) while those in the local districts rose (Yasuoka, 1970, chs. 7–8). By the same token, inter-regional travel became increasingly more frequent between local communities, as evidenced by the rising number of coastal, passenger vessels in the mid-nineteenth century (Takei, 1972, pp. 282–83). In one region, short-distance vessels were physically down-sized to suit the local demand for more frequent travel using relatively light passenger loads per trip (see Figure 12). It is likely that the slowing of economic activities in the 1840s (or 1850s), which was apparent in the group (ii) industries, reflected the workings of these two counteracting forces.

All in all, one may conclude that production recorded at least a non-negative, and, in the cases of clothing, food and transport industries, a clearly rising trend until the end of the seclusion, although there were clear signs of an economic recession in the 1850s.

## III

The mature, peaceful consumption-oriented Tokugawa society of the mid-nineteenth century faced a new challenge in the decades immediately after the arrival of Commodore Matthew Perry (1853). Hand-in-hand with the freer inflows of personnel and merchandise from overseas, the volume of domestic transactions and exportation increased several-fold.

This sudden expansion of the market offered an opportunity to realise economies of scale in certain cases, and thus constituted a new opportunity for domestic suppliers of goods and services. Whereas some indigenous manufacturers were unable to compete with the newly introduced western commodities and were phased out of existence, the overwhelming majority carried on their businesses by incorporating some changes, either in their manner of production and/or in their style of activities.

Of the eight cases which are dealt with in the present essay, actual declines in production took place in two instances: old-style pig iron manufacturing, and coastal shipping by indigenous vessels, which were rapidly replaced by steam-engine liners on the Pacific coast as well as by railroad networks. In the remainder of the industries, however, the outputs maintained a moderately upward trend until the very end of the Tokugawa era.

## IV

One may infer that the rising trend in non-primary outputs during the first half of the eighteenth century was accompanied by positive gross capital formation. Cases of new investment were probably more noticeable in the latter half of the eighteenth and early part of the nineteenth, than in the mid-nineteenth centuries. For one thing, neither primary nor non-primary production required much motive power. Japan's water wheels, for instance, were considerably smaller than those used in eighteenth-century England. The long political truce during the Tokugawa regime also deprived the country of the opportunity to nurture the development of machine tools.

Moreover, the size of investments (say, in relation to output) were quite moderate by Western standards even in the days of proto industrialisation. According to a detailed listing in 1823 of physical assets at Matsukura, a traditional-style iron maker in the *Nanbu* domain, the producer owned, in addition to 75 buildings of various kinds, lodging and boarding facilities valued at 591 *kanmon* (monetary unit of copper or iron coins), smelting equipment valued at 134 *kanmon,* forging equipment valued at 91 *kanmon,* and hand tools etc., loaned to workers, valued at 52 *kanmon.*

According to the record of another iron mine, the buildings were worth (approximately) 2.2 times the production equipment as listed above. Adopting this value as a first approximation, and using the effective exchange rate of 6.3 *kanmon* to 1 *ryō* (monetary unit of gold coin), the total value of the physical assets at Matsukura would have been 235 *ryō.* As one *ryō* would purchase 55 *kan* (in volume) of cast iron at the officially quoted price of iron, the average annual gross output between 1823 and 1828 would have been 1,782 *ryō,* yielding a capital-output ratio of just 0.13 !

One must quickly add that it was not easy in those days to recruit an adequate number of production workers who were willing to live in the workers' quarters deep in the mountains away from their families for long periods of time. To overcome this, employers began to offer to settle the accumulated debts of prospective applicants by advancing their annual wages. The addition of this lump sum payment, essentially a part of "working capital," to the above-mentioned value of physical assets, yields a capital-output ratio of a still meager 0.71.

This low-asset content of the traditional iron-making technology stands in remarkable contrast to the Western style of iron making. For instance, at the Tanaka

Foundry, which took over from the Kamaishi Iron Foundry, that had originally been established by Takatō Ōshima in 1857 with the adoption of western technology under government ownership, the capital-output ratio in 1895 was 3.7 (calculated from *Meiji 28 nen Iwate ken kobunsho ruisan* [Collected Public Documents of the Iwate Prefecture, 1895], unpublished).

All of this suggests that the financial burden of capital formation was considerably light in pre-industrialised Japan compared to that in the age of industrialisation come of age, when large-scale, expensive machinery and buildings had to be installed in line with Western technologies.

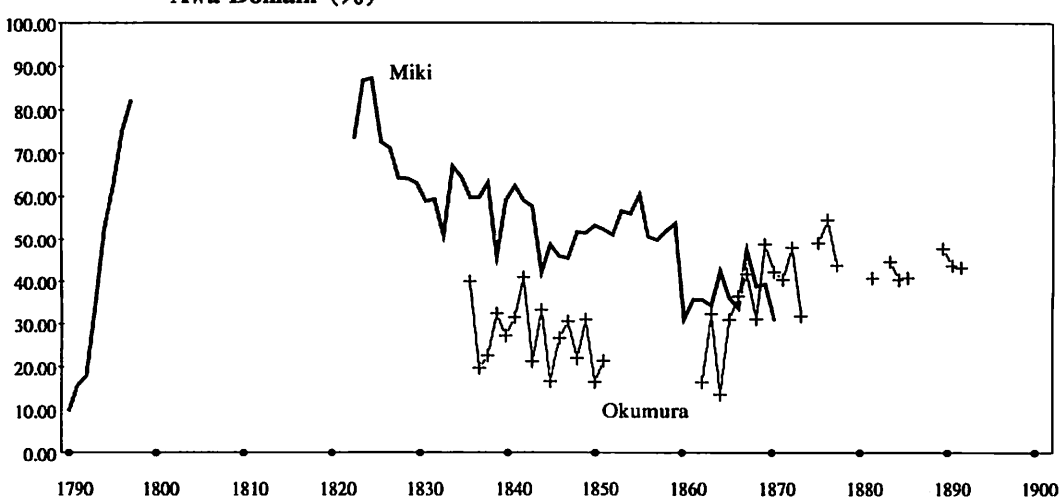
## V

We will now move on to a general picture of investment activities in the Tokugawa era. First, improvements in agricultural production (more specifically, an upward movement in land productivity) resulted in an increase in agrarian surplus, which was retained in the hands of villagers. In this sense, the basic prerequisite for capital formation was met by the beginning part of the eighteenth century.

Second, notable instances of large-scale investment during the Tokugawa era were, if anything, confined to the primary sector by way of the construction of water control facilities and land reclamation. Nonetheless, the rising trend in non-primary investments in the early part of the nineteenth century (*Kasei* period), that appeared in growth sectors such as cotton textile and shipbuilding, was sustained through the middle of the century, when the economy fell into recession.

Third, the final decades of the Tokugawa era saw a relative decline in the economic hegemony of the big cities and a counterbalancing rise of local districts. In other words, many investment projects started in the local cities, in contrast to the much slower investment in the major cities. In all likelihood, the sum of these two counteracting forces resulted in a positive gross investment figure, but by only a small

**Figure 13 Ratio of Product Inventory to Total Asset at Indigo Merchant Houses in Awa Domain (%)**




Source: Amano (1986), chs. 3-4.

margin.

A fundamental characteristic of capital formation in the non-primary sectors in the Tokugawa era may be found in the relative importance of inventory investment. Records from well-known merchant manufacturers such as the Miki and Okumura Houses indicate that anywhere between 30 and 80 per cent of total assets were held in this form (Amano, 1986, pp. 134–35, 138–39, 272–73 ; see Figure 13). Not only was production technology relatively unsophisticated and inexpensive, but the scale of production was limited by the small size of the product market. Since it took quite some time for goods to reach the final consumers, the wholesalers found it absolutely essential to maintain a relatively large stock of inventories. The predominance of inventory investment was a salient feature also of British manufacturing in the days of David Ricardo. The capital formation in the Tokugawa Era echoed the spirit of this age, perhaps in a much sharper, unmistakable fashion.

## VI

Capital formation in the Tokugawa era, while increasing, was modest in scale, because of the underdevelopment of markets and the restrictions imposed by political as well as administrative necessities. The size of the product market was severely limited by the lack of exportation, and the haphazard conditions of transportation and communication which severely limited the flows of people, merchandise and information.

The Ricardian nature of capital formation in the Tokugawa Era stands in clear contrast to the investment activities in the age of full industrialisation (say, 1906–80), which was characterised by (1) a continuous rise in the capital-output ratio accompanied by (2) ever-rising efficiency of production. Active investment called for the mobilisation of massive financial resources, which was met by rising domestic saving ratios of both households and corporations.

It was the opening of the country in 1858 that brought a fundamental transformation to the economy. In this sense, the Meiji Restoration marked a watershed point in the changing nature of capital formation, and also in Japanese economic development.

## Notes

* More detailed discussion of the subject has been attempted in Odaka (1998).

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