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Abstract

This paper reconstructs a comparable series of Japan's household consumption in the 1940s, using historical records about household outlays and black-market transactions, and interpolating missing values in the existing statistics. Specifically, nominal outlays of urban and farm households are estimated, and then converted into real outlays by effective price indexes containing black-market transactions. Household outlay per capita is then computed by taking the average of urban and farm household outlays using population shares as weights. Real outlay in 1945 is estimated at a little less than 50 percent compared to that in 1940, although statistics are missing for 1945. Even considering alternative estimates using other records, real outlay in 1945 is a little more than 50 percent compared to that in 1940. Thus, it is concluded that Japan's household consumption in 1945 declined to the level in 1875–1880.

Keywords: Household survey; Black-market prices; Effective prices; In-kind outlay; World War II

JEL classification: N35, Y10, D19, E21

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1. Overview

This paper attempts to gauge Japan's household outlay in the 1940s. First, nominal outlays of urban and farm households are reconstructed with interpolation of the missing period, and are also converted into real outlays using contemporaneous prices. Next, the average of urban and farm household outlays is taken using population shares as weights, thus estimating Japan's household outlay per capita. This estimate should be properly comparable with personal consumption per capita in the existing statistics. Japan's prewar and wartime household surveys did not necessarily reflect reality. Meanwhile, the availability of historical records has gradually improved thanks to progress in organizing rediscovered materials and digitization of records. This has helped researchers to interpolate missing data and reconstruct Japan's household outlay in the 1940s.

Such interpolation and reconstruction is important in two respects. The first is the reconsideration of historical records. Japan's personal consumption during the 1940s remains unclear due to high inflation and insufficient statistics. Wartime data for 1945 are missing while data for 1940–1944 are imprecise, and so data of household outlay must be reconstructed. The second point is that there is room for quantitative assessments with a longer time horizon. Japan's economy in the 1940s greatly differed from that today. Such differences include wartime controls, the coexistence of controls with black-market transactions, and the high share (40 percent) of farm households. Accordingly, the reconstruction of household outlay from records will contribute to research in modern fields as well as in historical areas.

2. Earlier Studies

This section reviews earlier studies from three aspects: historical statistics, contemporaneous records, and wartime economy.

(1) Historical statistics

Existing statistics include personal consumption in the national accounts and surveys of household outlay. The former are macroeconomic data covering the entire nation; Japan's Cabinet Office provides historical records such as those of the Economic Planning Agency (EPA (1963)) with data going back to 1930.[1] Particularly, the Economic Council Agency (ECA (1954)) explains how to construct nominal personal consumption expenditure in prewar years.[2] The ECA (1954) mainly uses surveys of urban and farm households,

[1] See "Release Archive" of "Annual Report on National Accounts" on their Japanese webpage, browsed on March 11, 2019 (http://www.esri.cao.go.jp/jp/sna/data/data_list/kakuhou/files/rekishi/sna_top.html).

[2] It was also referred to as personal consumption outlay. Specifically, personal consumption from 1930 to 1940 was calculated from urban and farm household surveys with the population shares of urban, farm, and non-farm rural households. Data from 1941 to 1944 were adjusted with data from 1940 and data in official

population ratios of urban and farm households, early estimates of national accounts by the Ministry of Finance (MOF (1947)), and price indexes (so-called Morita's price indexes) considering black-market transactions indirectly. In estimating personal consumption from 1940 to 1944, the MOF (1947, p. 193) "evaluated them mainly based on **production data** with adjustment of stock, export, import and military demand in **official prices**."[3] (Bolds are added by the author; the same applies hereafter.) At the same time, the MOF (1947, p. 193) recognized that the "proportion of consumption in the civil sector in 1942 was smaller than those in 1940 and 1941 … thereby implying some **risk of underestimation for consumption from 1940 to 1941**."

As for this early series, the ECA (1954, p. 4) recognized that it "should consistently revise and interpolate existing and sporadic estimates … based on all records available at present … because primary records may become less complete over time." The EPA (1964, pp. 148–149) notes that "**personal consumption expenditure should be explored** after more refined estimates become available in future" while using the same data of ten years before. The problem of incomplete primary records remains, and recent research still uses the data from the ECA (1954).[4]

As for non-government statistics, Japan's *Long-Term Economic Statistics* (LTES) is well known for its historical series of household consumption. LTES volume 6 (Shinohara (1967)) meticulously compiled personal consumption expenditures from 1874 to 1940, using historical materials of consumption items. Meanwhile, for consumption from 1941 to 1945, Shinohara (1967) just introduced existing estimates by the EPA (1964) and MOF (1947), due to a lack of primary records in wartime.[5] In addition, Mizoguchi and Nojima (1992, 1993) meticulously estimated real gross national product in 1945 using records such as items of agricultural productions. Also, Nakamura (1989) estimated supply indexes of consumption goods per capita in 1933–1953 using production data. But, production may diverge significantly from consumption under greater military demand and greater black-market transactions during wartime.[6] In this regard, Saito (2017) argues that aggregate expenditure exceeded aggregate income from 1937 to 1949 by about 10

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prices from 1941 to 1944, using Morita's retail prices (where adjustment = (extrapolation in official prices – in-house consumption) × (retail effective price × urban household outlay + farm price × its household outlay) ÷ (Cabinet Bureau's cost of living index)). For details, see ECA (1954, pp. 347–349).

[3] Citation page numbers of the MOF (1947) come from a reprinted version in EPA (1963, pp. 161–212).

[4] For example, Fukao and Settsu (2018) use data in ECA (1954) to show nominal GNP and shares of expenditure items in personal consumption from 1940 to 1944.

[5] LTES vol. 8 (Ohkawa et al. (1974, p. 63)) treated price data from 1939 to 1945 as unavailable due to the lack of reliable records for the wartime years.

[6] Supply indexes of staple food, other foods, textiles and fuels (23 items such as rice) are estimated by using household outlays in 1934–1936 as weights, and then dividing by the population index. The supply index of each item is based on KKRI (1954), Statistics Bureau (1987, 1988), and Toyo Keizai (1987).

percent of GNP due to black-market activities, significantly higher than in peacetime periods.[7] In addition, Utsunomiya (2008) reassessed Shinohara's consumption estimates from 1917 to 1936 although data in the 1940s were not explored.

It would appear that the lack of sufficient wartime records for interpolating household outlay remains a challenge.

(2) Contemporaneous research and records

To gauge household outlay in the 1940s, contemporaneous research and records are important. Many records and data were classified as military secrets in Japan during the Pacific War (1941–1945), were damaged in air raids, or were discarded during the period between surrender and the entry of the Allied forces.[8] In response, the United States Strategic Bombing Survey (USSBS) recovered materials intensively, thus improving the wartime statistics in order to assess the effect of air attacks on Japan's wartime economy. The U.S. President ordered the USSBS to conduct a comprehensive study of the effects of air attacks for Germany first, and then for Japan. The USSBS, with 1,150 staff (including 300 civilians), interrogated more than 700 Japanese from politics, military, government and business, and published 108 reports.[9] Although most of them were military studies, report No. 53 (USSBS (1946)) includes an overall assessment of the effect of strategic bombing on Japan's wartime economy based on recompiled economic statistics. Also, report No. 42 (USSBS (1947a)) on living standards and the utilization of manpower contains data of household outlays at the time. These reports are useful primary records. Furthermore, Cohen (1949) depicts a worsening of living standards during the Pacific War, using records and interrogations with Japanese officials as a staff member of the USSBS.[10]

After Japan regained sovereignty in 1951, earlier studies such as Ohkawa (1953), Arisawa ed. (1954) and Shinohara (1958) mainly focused on assessing the postwar level of household outlay relative to the prewar level.[11] Although they did not examine the war years, a careful comparison between prewar and postwar outlays was useful for gauging

[7] Data that gauged household outlay of the 1940s directly are searched. Such data do not appear to exist.

[8] Military and government organizations gathered data separately and coordination for data sharing was poor. See Japan Statistics Research Institute (1960) and Shimamura (2008).

[9] See USSBS (1946, pp. iii, pp. 240–244).

[10] Yoshio Ando, a researcher then at the University of Tokyo and later a professor, was drafted as a Naval staff in wartime. After repatriation, he wrote a report assessing that both the maritime blockade and air attacks had a critical impact on Japan's wartime production. The report was submitted from the University of Tokyo to USSBS in late 1945. Ando (1987, pp. 377–380, 472) notes his indirect contributions to USSBS (1946) and Cohen (1949).

[11] Ohkawa (1953) analyzed prewar (1934–36) and postwar (1949) outlays of both urban and farm households, and concluded that the lower real outlay in urban households and the higher real outlay in farm households narrowed the disparity between their postwar outlays. Arisawa ed. (1954) surveyed studies and found that urban household outlay recovered more slowly. Shinohara (1958) estimated functions across urban and farm households with several income classes.

household outlay in the 1940s.

In later years, primary records during wartime were collected for republication.[12] Also, research comparing living standards and production among major countries progressed.[13] In recent years, the availability of historical materials has continued to improve gradually due to the arrangement and digitization of existing records as well as the discovery of new records. This paper builds on earlier studies and these recent developments that help to gauge household outlay at the macro level.[14]

(3) Wartime economy

To gauge household outlay in the Pacific War era, earlier studies about the wartime economy are necessary. During that war, which originated from the Sino-Japanese war (1937–1945), the coexistence of both wartime controls and the black market may make it difficult to gauge the economy properly from today's perspective that assumes the market function. Among many earlier studies on Japan's wartime economy, Oishi (1994) surveyed important studies and pointed out chronological transitions in research interests.[15] Also, various studies in Oishi ed. (1994) assessed major industries and civilian living standards of Japan from 1937 to 1950.[16] They provide contemporaneous

[12] For example, the Ohara Institute (1964) collected and compiled records about the poor living standards of workers during the war. Nakamura and Hara eds. (1970) also transcribed and arranged records from the war written by prosecutors of economic crimes, which included those about civilian living standards.

[13] Yamazaki (1979) argued that Japan enhanced its production at the expense of living standards, which were worse than in Germany. As for the U.S., Higgs (1992) argued that real personal consumption should have slightly declined in 1943 and 1944 if controlled prices for military supplies were adjusted. Rockoff (1984) also pointed out the short-term role of economic control from a historical analysis. As for differences among major countries, Hara (1995) argued that Japan's production capacity remained low with a shortage of foreign currency reserves and sea transport capacity.

[14] Nakamura ed. (1993) transcribed 25 historical household account books, which were collected by placing an advertisement in a newspaper for the general public in 1987. Several of the account books include records from the 1940s. Akagi (2011) also transcribed account books of a medium-sized farm household in 1930–1966 recorded by his father. These records contain precious wartime information although item groups were not standardized. From a rough comparison between nine outlays in Nakamura ed. (1993) and the variation width from the estimate in this paper (average $\pm 3\sigma$), there appears to be no obvious inconsistency.

[15] Oishi (1994) surveyed the shifts of research interest: the limit of Japan's national strength in the years around 1950, state monopolistic aspects in the 1960s, the realities of wartime controls in the 1970s, and institutional frameworks as origins of the features of Japan's postwar economy in the 1980s. For example, Nakamura (1974) overviewed wartime controls for comparing the price control plans for handling the oil crisis in 1974. Okazaki (1984) emphasized that the market function induced military firms to increase production under the wartime planned economy. Meanwhile, Hara (2013) argued based on vast records that controls were effective and short-lived. He also argued that, even if Japan's postwar frameworks originated in wartime, they lost their original form due to wartime damage and postwar reform by the occupying forces. Yamasaki (2011) outlined based on vast wartime records that wartime controls supported the functioning of the market, and that wartime controls were too flexible to simply regard them as the origin of postwar frameworks.

[16] In Oishi ed. (1994), Nishida (1994) assessed a worsening of civilian living standards from records by the police and prosecutor. Takamura (1994) assessed controls on civilian industries. Hara (1994) analyzed

information and sources, such as supply and demand conditions for item groups of household outlay and wartime controls affecting households. Although many records were lost during the war, there appears to be an increasing potential for interpolating household outlay by reconstructing available records on the basis of earlier studies.

3. Circumstances in the 1940s and Available Records

The wartime situation in the 1940s, including the defeat, changed Japan's institutional frameworks and the availability of records worsened. This section reviews the circumstances in the 1940s and the availability of records on household outlay.

(1) Circumstances in the 1940s and controls

In the 1940s, controls on household outlay often altered due to the volatile war situation (Chart 1). After the start of the Sino-Japanese war in mid-1937, wartime controls were introduced to boost military production at the expense of restricting private demand (while maintaining the bare necessities). Increasing military demand led to shortages of consumer goods and temporary black-market transactions, thus affecting households. Nevertheless, tighter wartime controls and the introduction of a rationing system (in addition to people's patience) maintained relative stability in Japan.[17] After the start of the Pacific War in late 1941, initial military successes in the early stage helped Japan remain relatively stable in 1942. But, from 1943, strong counterattacks by the U.S. weakened Japan's command of the seas, made maritime transport risky, and caused a growing lack of supplies in Japan. Black-market transactions became more common, and producers charged higher prices despite price controls to boost production. When full-scale air raids struck Japan in 1945, domestic transportation became vulnerable and controls became ineffective in reality. After Japan's surrender, international trade ceased and controls on necessities were reintroduced under the occupying forces.[18] Under such circumstances, living standards remained similar before and after the surrender.[19] From 1946, controls on reconstruction were introduced, and imports started again. Postwar controls remained until around 1950.

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mobilization worsening living standards. Itoh (1994) pointed out a transition of wartime controls that weakened in the later stages of the war and then strengthened under the Allied forces soon after the war.

[17] Japan maintained trade with the U.S. until July 1941 (when Japanese assets in the U.S. were frozen) except military goods. Due to the U.S. Neutrality Act prohibiting trade with belligerent parties, the Sino-Japanese war that was never declared was often referred to as the "China-Japan incident" internationally.

[18] In September and November 1945, the government abolished controls on fresh foods to promote production and supply by producers. However, production and supply remained stagnant while prices skyrocketed. The occupying forces ordered the government to reintroduce controls (MOF (1980, pp. 213–229)).

[19] The BOJ (1945) considered in autumn 1945 that production had decreased from the start of 1945 to the ceasefire, and then from August to November, economic activity stagnated in general, mainly due to uncertainty about wartime compensation, and tighter conditions such as resources, transportation and labor.

In principle, this paper assesses the periods on a yearly basis, as yearly data help to gauge long-term trends. Major earlier studies also assessed the wartime period on a yearly basis, such as Nishida (1994) for living standards, Ando (1987) and Itoh (1994) for economic controls, and Morita (1963) for price conditions.[20]

(2) Contemporaneous materials

Next, the availability and weaknesses of materials about population, household outlay and prices are examined.

a. Population

Chart 2 shows population data of Japan proper in the 1940s. The yearly data cover changes due to war damages and repatriation from overseas.[21] The data also cover urban and rural areas, as well as farm and nonfarm, although some data need interpolation. Japan's farm population accounted for 40 percent of the total, implying the importance and necessity of farm household outlay in gauging household outlay at the macro level.

b. Household survey

Two surveys, the "urban household survey" for urban households and the "farm economy survey" for farm households, are explained. Both gauge the outlays for major item groups in the 1940s (such as food and clothing) directly, although the sample biases of the two surveys differed due to their different purposes.

(a) Urban household survey

The urban household survey was intended mainly for gauging necessary expenses of low-income classes (income of less than 100 yen per month) until the year 1941 (from September 1940 to August 1941). The survey samples actually covered low-income households with monthly revenue of less than 140 yen, and did not cover all income classes containing high- and middle-income earners.[22] However, in the summer of 1941, the Census Bureau (*Naikaku toukeikyoku*) decided to conduct an urban household survey for 1942 (from October 1941 to September 1942) for "sustaining citizens' livelihood"[23] for all income classes, considering "rationalization of consumption and rationing in

[20] Gauging wartime outlay at a high frequency such as on a monthly basis remains difficult due to the lack of records, which may be a challenge for research in future.

[21] The census survey covered most urban evacuees using their connections with rural areas, but not evacuees of schoolchildren. (According to Tani (2012), evacuees from Tokyo city totaled 4 million for the former and 0.14 million for the latter.)

[22] Statistics Bureau (1984, p. 470). Also, Kase ed. (2015) assessed the urban household survey in the prewar period for each item group, although it does not cover the 1942 survey.

[23] The Director of the Census Bureau recognized in a speech (on July 9, 1941) that "under the recently developing **wartime regime**, a primary aim of the survey … should be **sustaining citizens' livelihood**." See Statistics Bureau (1984, p. 360).

wartime"[24] as one of the aims. The primary aim was to collect data to find ways of curtailing the outlays of all classes in order to conduct the entire war. The survey results of the year 1942 were mostly classified.[25] Furthermore, the survey in 1943–1945 was stopped as the war situation worsened. After the war, in the "Consumer Price Survey" which was started to calculate the consumer price index, several thousand urban households all over Japan were chosen by random sampling, and data of price, quantity and outlay were compiled from family account books for each of the items and item groups. This survey evolved into the urban household survey and then "Family Income and Expenditure Survey."[26]

The urban household survey differs between the prewar and postwar eras in terms of sample coverage and data collection.[27] For example, the prewar surveys used purposive sampling (where statisticians choose representative samples using their judgment) whereas the postwar surveys used random sampling. Meanwhile, major item groups (foods, housing, heat & light, clothing, miscellaneous)[28] were the same between the prewar and postwar periods, and the Statistics Bureau released comparable weights in items and item groups for both prewar and postwar base years. Therefore, if missing data of outlay in 1942–1945 are supplemented by using contemporaneous records, it is possible to gauge household outlay in the 1940s consistently for the prewar, wartime and postwar years.

(b) Farm economy survey

For farm households, part of the "Farm Economy Survey (*Nouka keizaichosa*)" covers the outlay of farm households. The survey has disadvantages, such as purposive sampling, the limited number of samples (several hundred), and sampling bias in farm sizes.[29]

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[24] According to the Statistics Bureau (1984, pp. 362, 364), the aim of the 1942 survey was "to obtain basic data for policy formulation such as **rationalizing consumption** and **wartime rationing** for salaried workers…" as well as for policies such as "**economizing consumption** behavior, regulating wages, and rationing."

[25] The survey of October 1941 was partially released in March 1944. See Statistics Bureau (1984, pp. 52–57). Then, the Statistics Bureau (1977) released the major tables of the 1942 survey.

[26] See Japan Statistical Research Institute (1960) and Statistics Bureau (1948, 1949a, 1956).

[27] The main differences in the prewar and postwar periods are (i) sampling of income classes (low-income classes only in the prewar era and all classes in the postwar era); (ii) higher prewar housing expenses (prewar samples were tenants only but postwar samples included homeowners, in addition to a mild increase in rents relative to other item groups); and (iii) somewhat different composition of miscellaneous expenses among subgroups (medical & health care, and culture & hobbies common in the prewar and postwar periods, and transportation & telecommunication as well as education becoming a subgroup of miscellaneous expenses in the postwar period). See Statistics Bureau (1956, p. 10) and Nagayama (1964).

[28] In 1981, mainly due to an increasing proportion of the item group "miscellaneous" (50%), five groups were revised to 10 groups (such as "furniture & household goods" divided from "housing," and separation of "medical & health care," "transportation & telecommunication" and "culture & hobbies" from "miscellaneous"). See Nakamura et al. (1996). Meanwhile, data of 10 groups were not available in and before 1946.

[29] The survey to 1941 did not contain samples of large farms. The survey from 1942 to 1948 contained

Meanwhile, the survey has advantages, such as availability of all years in the 1940s, samples from all prefectures, and room for adjusting farm sizes by using other statistics. Earlier estimates of national accounts by the ECA also relied on the Farm Economy Survey, and this paper too relies on this survey.[30] The discontinuity caused by revision is also adjusted adequately by using outlay and number of samples across farm-size classes (see Section 5 (1) below).

c. Price statistics for urban households and farm households

Lastly, prices in the 1940s for urban households and farm households are assessed separately.

(a) Prices for urban households

Several price statistics for urban households in the 1940s are available, as shown in Chart 3. First, the consumer price index was available from August 1946 and continues to today. Also, CPI in the prewar period is available until 1938, and is consistently comparable with CPI in the postwar period, thanks to the Statistics Bureau (1956) and Ohkawa et al. (1967). From 1946 to 1950, the price index was compiled as "effective prices," that is, the average of official and black-market prices using quantities in outlays as weights, because outlays in this period contained black-market transactions.[31]

In the years from 1939 to 1945 when CPI did not exist, the Census Bureau's cost of living index and the Tokyo retail sales price index were available, both based on official prices. The cost of living index was an average of 156 item prices mainly from retail stores, using outlay as weights.[32] The Statistics Bureau (1965, p. 7) regarded that "the index was reliable during the years from 1937 to 1942 when weights of the black market were not large." The Tokyo retail sales price index was compiled by the Bank of Japan (BOJ) to gauge the development of retailers' sales prices.[33] Both indexes were not able to

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samples tilting toward large farms in the samples because the wartime burden made small farms less cooperative with the survey (BOJ (1966)). Meanwhile, 60 to 70 percent of farms were small, cultivating less than one hectare, although medium-sized ones farming 1 to 2 hectares and large ones farming more than 2 hectares also existed at the time (MAF (1951b)).

[30] The Institute of Economic Research at Hitotsubashi University maintains a database from the Survey of Farm Household Economy, and has also released several research papers such as Sato ed. (2009). Unfortunately, their database is mainly up to 1941, with little data from 1942. The farm economy survey aims to cover all economic activities of farms. This paper focuses on household outlay.

[31] Statistics Bureau (1956, 1964, 1949b). The effective price of an item is calculated as outlay divided by total quantity (= official price × (quantity ÷ total quantity) + black-market price × (quantity from black-market transactions ÷ total quantity). CPI was compiled on retail prices from retail stores from 1951 following the disappearance of black-market purchases (Nakamura et al. (1996) and Statistics Bureau (1996)).

[32] The weights of each item for taking the weighted average were based on urban household outlay in 1932, 1934 and 1936.

[33] In the postwar period, after the gradual abolition of controlled official prices for each item, market prices

gauge black-market prices.

As for black-market prices, the USSBS (1946) provides wartime prices of consumption goods from December 1943 to November 1945.[34] In the postwar period, the BOJ compiled statistics of black-market prices of consumption goods from September 1945.[35] The prices of twenty-five items were available both in the prewar and postwar periods. Later, these black-market prices converged to official prices in around 1950 as argued by the MOF (1980, pp. 584–589). If CPI in the prewar and postwar periods is compared with the wartime official and black-market prices, there is a 20 percent overlap in the number of items and 40 to 50 percent in outlay weight (see Appendix (1) for details). Meanwhile, the weights of black-market transactions in total outlay remain uncertain.

In addition, Morita's price index (for retail) also exists as an indirect effective price index in wartime.[36] This index is estimated based on assumptions that retail transactions were paid by cash, and that effective prices were in proportion to banknotes in circulation, velocity of money and transaction of commodities.[37] However, Morita's index does not directly contain observed prices in the black market. Morita (1963) argued that the index would be a lower bound of actual price levels, but also noted that the index could contain measurement errors, warranting a cautious assessment. Under such circumstances, Morita's index was widely employed by the USSBS (1946), MOF (1947), ECA (1954) and Saito (2017).

(b) Prices for farm households

Price statistics for farm households (Chart 4) were less available than for urban households. An index called "farm CPI" in this paper was obtained from the MAF (1950b). The MAF (1950b) estimated effective prices for farm households using 109 items in farm household outlay (as well as other agricultural items), in both periods of the years 1934–1936 and the year 1949, for both outlays in kind and in cash, by adjusting for both official and black market prices. Although the index was only available in 1949 relative to 1934–

were adopted for compiling the retail price index (BOJ (1968)).

[34] See USSBS (1946), Table C-168. The table denotes the source as "Bank of Japan" but there appears to be no record indicating that the Bank explored wartime black-market prices. Data in the table for December 1943 fully coincide with data shown in a record about black markets for consumption goods by the Organization for Central Price Control dated December 1943, transcribed by Nakamura and Mizoguchi eds. (1994, p. 82).

[35] The BOJ constructed the black-market or free price index from September 1945 to December 1951 (for 50 items such as foods, textiles and heat).

[36] Morita (1963, p. 82) noted that he was partly involved in performing the estimation and the index was mainly estimated by a staff (Takatomo Watanabe) in the BOJ's Research Department, though the index is referred to as Morita's index, as in USSBS (1946). Morita's wholesale price index also exists.

[37] Specifically, Morita (1963, pp. 93–98) explains how it was calculated with an equation ($P = M \times V \div O$, where M: index of currency in circulation; V: velocity of currency, O: index of commodity real transaction value). BOJ Archives (1945) also show the same contents.

1936, it was the only effective price for farm households in the 1940s with granular items and the item groups.

For the period 1937–1948 without the farm CPI, two other price indexes are available. One is the farm price index (literally, the price in rural villages), calculated by an industrial organization monthly from 1937 to 1948, for three categories of household goods as well as agricultural products and inputs, with 80 items in each category. Prices of items were mainly official prices or agreed prices shared among related entities. The other one, farms' black-market price index, was calculated by the same organization from July 1943 to December 1947 for three categories with 30 items in each. The two price indexes shown in Chart 4 indicate a lag in rising farm prices relative to farms' black-market prices in 1945–1947. This paper considers the farm price index as official prices and compares it with farms' black-market prices.[38] From a comparison between the farm CPI and farms' official and black-market prices, their overlap is 50 percent both in the number of items and in outlay weight (see Appendix (1) for details). Meanwhile, the weights of black-market transactions remain uncertain.

(c) Challenges of contemporaneous price statistics and their records

One of the challenges with contemporaneous price statistics is the difficulty of conducting a price survey like in peacetime, due to the clandestine nature of black-market transactions. As pointed out in Shiratsuka (1998, pp. 152–154), in peacetime, sufficient price samples from relevant retailers may be desirable for accurate price information. Unfortunately, in wartime, samples of prices on the black market cannot easily be obtained and are less accurate than those in peacetime. Under such circumstances, for both the black-market prices of consumption goods and farms' black-market prices, the black-market price of each item group was constructed as a simple arithmetic mean of sample prices in the item group.[39] From a modern viewpoint, there may be a better method than taking a simple average of samples.[40] Meanwhile, the records indicate that related parties regarded a simple average of samples as sufficiently representative, and that the authorities, including the occupying forces, similarly accepted it. Thus, item prices (a

[38] According to the explanatory notes (MAF (1950a, pp. 7–9)), farm prices were on the basis of "actual prices" where many transactions were made. Meanwhile, price samples for farm households were taken from agricultural associations and reliable brokers indirectly, instead from farms. In this regard, "actual prices" never means effective prices.

[39] For urban households, housewives' associations were mainly asked to gather sample prices of black markets in Tokyo. See Morita (1963, p. 101) or Nakamura and Mizoguchi (1994, p. 86–99)). For farms, agricultural associations in 45 municipalities of nine prefectures nationwide asked traders and farms to gather sample prices. See NAA (1948, pp. 1–2).

[40] Shizume (2018) tries to estimate black-market prices by adjusting forms of transactions such as presence of intermediate dealers and by applying a hedonic equation for black-market prices of commodities such as rice and eggs.

simple average of samples) in contemporaneous records are used.

Another challenge was quality decay in price samples. Records transcribed in Nakamura and Mizoguchi (1994, p. 84) included five items such as a bucket and shoes and noted that duration of usage without repair became shorter by one-third to one-twelfth in the years from 1937 to 1943. If the cost for replacement were regarded as a price increase, the annualized inflation rate would be from 20 to 50 percent. But, this rate is lower than the actual wartime inflation (about 50 to 400 percent increase per year). Repairs were also common in wartime. In this regard, no adjustment is made for quality decay.

A larger challenge for contemporaneous price statistics is unknown weights for outlay at official and black-market prices in or before 1945, despite the coexistence of transactions at both official and black-market prices. Specifically, for urban households in 1946–1950, CPI was usefully calculated as the effective price index from outlay and quantity at both official and black-market prices of each item using samples of several thousand households.[41] Although black-market prices in or before 1945 were partly available from records, the timing and size of transactions at black-market prices relative to the size at official prices remain unknown.

In this regard, we need to assess historical records to consider (i) the time when black-market transactions were prevalent and (ii) the size of black-market transactions relative to transactions at official prices in each phase.

d. Prevalence of black-market transactions

Earlier studies reached different conclusions as to when black-market transactions prevailed. Many studies considered that black-market transactions became prevalent in 1943. For example, the Statistics Bureau (1956, p. 7) noted that it was the period of "1937–1942 when weights in black markets were not large." The National Agricultural Association (NAA (1948, pp. 9–10)) stated that "… **black-market prices for farms started in late 1942**, … for limited items such as sugar, matches and cotton textiles. But **in the first half of 1943 black-market prices emerged** … **for most items** purchased by farms." Cohen (1949, p. 384) also stated that "**the black market was not extensive in 1942**." These materials indicate that black-market prices were not common until 1942.[42]

[41] See the Statistics Bureau (1956). Unfortunately, it shows the quantity of rationing only for some staple foods; quantity and outlay at official and black-market prices for CPI at the item level are not available.

[42] Based on records of the Ministry of Justice (MOJ), Nishida (1994, p. 383) noted that "violations of food-related controls prevailed" in 1942. But, the MOJ (1947, pp. 19–21) stated that black-market transactions in 1942 were temporarily under "tighter conditions of supply and demand for goods" but later "the conditions were alleviated by policy measures such as tighter controls and stable food supply via public cooperation." It also stated that "supply and demand conditions were smooth in general although small clandestine retailers for vegetables and fruits emerged."

Also, the MOF (1957, p. 357) considered that "**black-market transactions** in a **former period** (from October 1939 to March 1943) **were coincidental** … and **the transactions** in a **latter period** (from April 1943) **were inevitable**." Morita (1963, p. 90) also regarded that "… in a **period** from the start of war **to late 1942** … the initial success in the early wartime loosened slack of the economy and **tamed a growing inflation** in that time temporarily. In contrast, black-market transactions from 1938 to 1942 under wartime controls appear to have occurred as transactions for military-related goods and purchase of luxury goods by high-income classes.[43]

Contemporaneous records indicate that black-market transactions by ordinary households appear to have prevailed from 1943 but little affected their outlay in and before 1942. It is therefore assumed that black-market transactions for retail sales prevailed in 1943 as a benchmark.[44] On this benchmark assumption, the size of black-market transactions in 1943–1945 is assessed from historical records, thus estimating household outlay in these years. Nevertheless, black-market transactions may have prevailed in 1942 and before. The alternative assumption that black-market prices became prevalent in 1941 is also assessed, considering developments in Morita's price index.

4. Urban Household Outlay

First, the nominal outlay of urban households is interpolated from 1942 to 1945 for reconstruction. Then, real household outlay is calculated using CPI with interpolation.

(1) Nominal outlay in urban households

Considering data availability, the nominal outlay of urban households is constructed on the basis of six groups of outlay: staple food, other foods, clothing, housing, heat & light and miscellaneous. Household outlay C is given by the following equation, where P denotes price, Q quantity, subscript k item group, and m item:

$$C = \Sigma_k C_k = \Sigma_k (P_k Q_k) = \Sigma_k \Sigma_m \left(P_{k,m} Q_{k,m}\right) \qquad (1)$$

Due to insufficient records, prices and quantities for every item ($P_{k,m}$, $Q_{k,m}$) are unavailable. However, it is possible to estimate nominal outlay C if C_k and indexes of P_k

[43] Specifically, black-market transactions in metals and textiles from 1938 to 1940 were noted in Nakamura (1974, pp. 66–71). Others were military purchases in or before 1941 (Miwa (2007, p. 43), MOJ (1947, p. 90) and Nishida (1994, p. 384)) as well as clandestine purchases of high-grade foods by the rich in 1941 (Ohara Institute (1964, p. 143)) or other luxury goods by upper-class ladies in 1942 (Nakamura and Hara eds. (1970, p. 776)).

[44] Black-market prices for producers should differ from those for households. In the wartime and prewar periods, black-market prices for producers and their transaction weights do not appear to be found. Meanwhile, the MOJ (1942) reported 129 cases of illegal transactions for goods such as iron and fabrics. A simple average of unit values, for items mostly consisting of producer goods, was two to three times higher than the official prices.

and Q_k are available for each item group. First, the rediscovery of the urban household survey for the year 1942 is explained. Next, nominal outlay in 1940 and 1941 covering only low-income classes is adjusted upwards, for consistency with outlay in the year 1942 and from 1946 covering all income class. In 1943–1945, nominal outlay is estimated from the outlays on each item group for transactions at both official and black-market prices, using historical records.

a. Rediscovery of urban household outlay for the year 1942

First, historical records from the BOJ Archives (1944) were identified. The records concerned the urban household survey for the year 1942; they were classified by the Census Bureau but were shared with the BOJ for reference. The authenticity of the data was confirmed by matching with the original aggregation tables in the National Archives of Japan (1944a, 1944b).[45]

The BOJ Archives (1944) stated that "… until the year 1941 the survey covered about 550 households for salaried workers and 1,000 households for laborers, mainly targeting low-income classes with monthly revenue below 100 yen … but for the year 1942 … the survey covered a **larger sample size** with 1,400 salaried workers and 2,300 laborers and a **wider range** of **income classes**."

The 1942 survey covered all classes with mid-to-high incomes with 3,700 samples, unlike the surveys up to 1941 which covered only low-income classes. The 1942 survey also remained geographically unbiased. Thus, its samples should accurately exemplify the whole, despite purposive sampling.[46] The 1942 survey is also comparable conceptually to the surveys from 1946 covering all income classes.

b. Upward revision of outlay in the years 1940 and 1941

The surveys of 1940 and 1941 covering the low-income classes (with monthly revenue of less than 140 yen) are adjusted by employing the 1942 survey. First, it is assumed that classes uncovered by the surveys of 1940 and 1941 (revenue of 140 yen or more) should exist in proportion to the classes in 1942, as shown in Chart 5 (1). For example, the

[45] The existence of the original tables in the National Archives was publicly known from sources such as the Statistics Bureau (1984, p. 56), Ohara Institute (1964, p. 131) and Japan Statistics Research Institute (1960, p. 280). However, data in the original tables were written thinly and repeatedly by pencil, making them hard to read for ordinary readers. Later, the BOJ (1971, pp. 396–405) transcribed the BOJ Archives (1944) and the Statistics Bureau (1977) released major tables of the 1942 survey. The source has been public, but the 1942 survey is almost forgotten in earlier studies.

[46] Huff and Majima (2018, pp. 58–59) state that an economist (Isamu Yamada, later the president of the Japan Statistical Society) specializing in statistics and living standards was mainly involved in the work for the 1942 survey. Regarding the process of purposive sampling in prewar urban household surveys, Saito (2015) assessed the surveys up to 1941 and concluded that the purposive sampling was acceptable in gauging low-income classes. Modern surveys sometimes employ purposive sampling when a light-touch method is sufficient (Fukui (2013, p. 3)).

number of households in the class with revenue of 120–140 yen in 1941 (or in 1940) was 92 (or 84) percent of the number in 1942. It is thus assumed that for each class of revenue more than 140 yen (140–160 yen, …, 300–320 yen) the number of households in 1941 (or 1940) is assumed to be 92 (or 84) percent of the number in 1942 (Chart 5 (1)). Similarly, an average of monthly revenues of all income classes in 1941 or 1940 is estimated using the number of households for each class as weights.

Next, outlays in mid-to-high-income classes (with monthly revenue of 140–320 yen) in 1940 and 1941 are estimated. In the estimation, the propensity to consume with respect to each class (lower propensity with higher income) and each year (lower propensity in 1942 than in 1940–1941) is considered. Specifically, denoting each mid-to-high-income class as s (s = 140–160, …, 300–320 yen), and household outlay and revenue of class s in year t (t = 1940, 1941) as $C_{s,t}$ and $R_{s,t}$ respectively, outlay is estimated from:

$$\frac{C_{s,t}}{R_{s,t}} = \frac{C_{s,1942}}{R_{s,1942}} \times \left(\frac{C_{120-140,t}/R_{120-140,t}}{C_{120-140,1942}/R_{120-140,1942}} \right) \quad s = 140\text{–}160, \ldots, 300\text{–}320,\ t = 1940, 1941 \qquad (2)$$

In Eq. (2), it is assumed that (i) the declines of propensity in 1942 from 1940 or 1941 for each class with mid-to-high income (with 140–160 yen, …, 300–320 yen) are in parallel, and that (ii) those declines are also proportional to the decline for the income class of 120–140 yen.[47] Except $C_{s,t}$ in the numerator of the term on the left, all terms in Eq. (2) are observable. Therefore, it is possible to estimate $C_{s,1940}$ and $C_{s,1941}$ for s = 140–160, …, 300–320 (Chart 5 (2)).

The outlay of all classes in 1940 and 1941 (Chart 5 (3)) as an average of outlays in each class (Chart 5 (1)) is estimated using the number of households (Chart 5 (2)) as weights.

c. Interpolation of outlay from 1943 to 1945

The household outlay from 1943 to 1945 is estimated considering changes of price and quantity of each item group from data in 1942.

(a) Approach

From 1943 to 1945, outlay is estimated from the 1942 survey with sufficient samples, and changes in price, quantity and ratio of quantity in black-market transactions as weights. Specifically, for item group k in year t, outlay on item group k is denoted by $C_{k,t}$, price $P_{k,t}$, quantity $Q_{k,t}$, official price $P^a_{k,t}$, quantity at official price $Q^a_{k,t}$, black-market price $P^b_{k,t}$, quantity at black-market price $Q^b_{k,t}$, and weight of official-price transaction $w_{k,t}$ (as well as weight of black-market transaction $1 - w_{k,t}$). For the years until 1942, $w_{k,t}$ is assumed to be 1 and $P_{k,t}$ as $P^a_{k,t}$ because black-market transactions are assumed to be exceptional. Thus,

[47] The second term on the right in Eq. (2) denotes the ratio of propensity in year t to propensity in 1942, for the class with 120–140 yen (or how their spending changed in t relative to 1942).

the outlay in 1942 is expressed as Eq. (3), and the outlay in year *T* from 1943 to 1945 is expressed as Eqs. (4) to (6) where *T* = 1943, 1944 and 1945:

$$C_{1942} = \Sigma_k\left(C^a_{k,1942}\right) = \Sigma_k\left(P^a_{k,1942}Q^a_{k,1942}\right) \quad (3)$$

$$C_T = \Sigma_k\left(C^a_{k,T} + C^b_{k,T}\right) = \Sigma_k\left(P^a_{k,T}Q^a_{k,T} + P^b_{k,T}Q^b_{k,T}\right) \quad (4)$$

$$C^a_{k,T} = \frac{P^a_{k,T}}{P^a_{k,1942}} \cdot w_{k,T} \cdot \frac{Q_{k,T}}{Q_{k,1942}} \cdot P^a_{k,1942}Q_{k,1942} \quad (5)$$

(i) (ii) (iii) (iv)

$$C^b_{k,T} = \frac{P^b_{k,T}}{P^a_{k,1942}} \cdot (1 - w_{k,T}) \cdot \frac{Q_{k,T}}{Q_{k,1942}} \cdot P^a_{k,1942}Q_{k,1942} \quad (6)$$

(v) (vi) (iii) (iv)

Eq. (5) denotes outlay at official price in year *T* (*T* = 1943, …, 1945), comprising (i) change of official price from 1942, (ii) weight of transaction at official price in year *T*, (iii) change in total quantity in year *T* from 1942, and (iv) total outlay in 1942. For (i), statistics are available. For (ii) and (iii), information from records is added. For (iv), data are observable. Eq. (6) denotes outlay on the black market in year *T*, comprising (v) change of black-market price in *T* from the official price in 1942 and (vi) weight of transaction at black-market price, as well as the same terms of (iii) and (iv). For (v), aforementioned black-market prices are available. Also, (vi) is the other side of (iii) supplemented from records.

(b) Official and black-market prices of each item group

From 1943 to 1945, indexes of official prices and black-market prices at the level of each item from official or black-market prices at the item level are calculated using a simple geometric average. First, for example, Chart 6 shows how price indexes of official and black-market prices of the item group "staple foods" are compiled from official and black-market prices of items in the group. In this example, the black-market price of rice, potato or wheat in June 1944 (black diamonds, squares or triangles in Chart 6) was 32, 8, or 16 times as high as each official price, respectively. From a simple geometric average of these prices, the black-market price index of staple food (black circles) in June 1944 is 16 times as high as the official price index of the same group. Similarly, the black-market price of staple food in June 1945 is 36 times as high as the official price.[48]

Similarly, for the item groups of other foods, heat & light, clothing and miscellaneous, the indexes of official and black-market prices of each group *k* ($P^a_{k,t}$, $P^b_{k,t}$) are calculated from prices at the item level in either Tokyo retail sales prices or corresponding

[48] In the logarithmic graph with base 2 on the vertical axis, one scale increase (or decrease) means a doubling of value (or 1/2 = 2^{-1} = 0.5 times, respectively). Also, a half scale increase (or decrease) means a change in value of $2^{0.5}$ = 1.414 times (or $2^{-0.5}$ = 0.707 times, respectively).

black-market prices, using the geometric average. In heating or miscellaneous, some items such as electricity or newspaper had official charges and do not have black-market prices by definition. Thus, indexes of black-market prices at the item group level are calculated from both official charges and black-market prices at the item level, using both prewar and postwar weights and Irving Fisher's ideal formula (as a geometric average between an arithmetic average of a prior period and a harmonic average of a recent period). In housing, the Census Bureau's cost of living index is available until 1942, but the effective price in 1943–1945 is unavailable. Thus, it is assumed that the price index is parallel to rents and maintenance costs, and that rents and maintenance are parallel to land prices and construction costs, respectively.

Indexes of official prices and black-market prices are shown as the level of item group P_k^a and P_k^b in Chart 7. Black-market prices of staple food and other foods skyrocketed 40–45 times as high as those in 1942, and the price of clothing also surged 32 times as high. Black-market prices of heat & light including charges such as electricity increased five times as high, a milder pace than the other item groups. For miscellaneous, the black-market price of the subgroup "culture etc." (including charges for newspapers) increased nine times as high while that of the subgroup "medical & health care" skyrocketed 96 times as high. Such differences depend on whether an item group contained some items with official charge or not.

(c) Quantity of outlay and weights of black-market transactions

Indexes of the quantity and weights of the black market (ratio of quantity purchased at black-market price to total quantity of item group) are constructed for each group, mainly based on the USSBS (1947a). The following results were obtained, as summarized in Chart 8.

The quantity and weights of each item group are considered as follows (see Appendix (2) for details). For staple food and other foods, each of the quantity indexes from 1942 to 1945 is constructed based on the amount of food available per person from the USSBS (1947a). Weights of the black market in 1944 are observable, thus data in adjacent years can be interpolated. The two item groups had different trends of the quantity and black-market weights, and other foods showed mainly declining total quantity and increasing black-market weights. For heat & light, its quantity index is constructed from the supply of fuel to civilians in the USSBS (1947a) and Cohen (1949). Its black-market weight, an average between the weight of staple food and that of other foods, is assumed. For clothing, the quantity index and weight of the black market are constructed mainly from Cohen (1949). For housing, it is assumed that quantity of housing was in line with the number of houses in the USSBS (1947a), and that its black-market weight was parallel

to a decline of housing stock. For miscellaneous, the subgroup of "medical & health care" is assumed using supply of medicine, and other miscellaneous ("culture etc." such as culture & hobbies and socializing in the prewar period, as well as transport & communication and education in the postwar period) is assumed separately. It is also assumed that black-market weights were common within miscellaneous.

In each group, quantity purchased (Chart 8 (1)) declined and black-market weight (Chart 8 (2)) rose.[49] Meanwhile, the pace of change in each item group differed. The decline in quantity and the increase in black-market transactions were relatively small in staple food and housing, but large in the other four groups.

Regarding quantity purchased for each group year by year in Chart 8 (1), it declined to around 50–60 percent of the 1942 level in clothing and miscellaneous, whereas it remained at a similar level to that in 1942 in staple food and housing, and at around 80 percent in other foods and heat & light. But, in 1944, the quantity decreased further to 40–60 percent in other foods and heat & light, and to 10–20 percent in clothing and miscellaneous, while remaining at around 90 percent in staple food and housing. In 1945, the quantity declined to 80 percent in staple food and housing, 20–30 percent in other foods and heat & light, and less than 4 percent in clothing and miscellaneous. Clothing was hardly available even at black-market prices. The weight of the black market in Chart 8 (2) increased to 20 percent in other foods and clothing. In 1944, it increased to 40 percent in other foods as well as 60 percent in clothing. The weight in 1945 increased to 20 percent in staple food and housing, and to 40 percent in other foods, and to 90 percent in clothing, becoming higher in later years, although the weights placed on the black market of staple food remained low due to higher priority in rationing.

(d) Estimation of nominal outlay of urban households from 1943 to 1945

Using prices (Chart 7), quantities and weights of the black market (Chart 8) as well as Eqs. (3) to (6), nominal outlay of urban households in 1943–1945 is estimated directly. The nominal outlay on each item group in 1940–1945 is also shown, using revised data for 1940–1942 (Chart 9).

Outlay in 1943 declined slightly, with a smaller outlay at official prices slightly exceeding a larger outlay at black-market prices. Then, outlay increased about 70 percent in 1944 mainly due to black-market transactions in other foods (Chart 9 (1)), and the ratio of food outlay to total outlay (the Engel coefficient) exceeded 60 percent (Chart 9 (2)). In 1945, black-market outlay significantly increased in staple food as well as other foods, total nominal outlay in 1945 doubled from the previous year, and the Engel coefficient

[49] The black bars in Chart 8 (1) are the quantity under the alternative assumptions. See Section 4 (2) c.

exceeded 70 percent. The effects of the worsening war conditions such as losing command of the seas and disrupted transportation emerged as a sharp increase in the Engel coefficient and black-market transaction in 1944 and 1945.

Among nominal outlay, outlay at black-market prices kept increasing in value and as a share of total outlay in 1943–1945 (black circles in Chart 9). Black-market transactions increased mainly in other foods, and such outlay became more than 20 percent of the total in 1943 (Chart 9 (2)). In 1944, black-market outlay increased to around 70 percent of the total under the higher weights and higher black-market prices. In 1945, black-market transactions also increased in staple food, and became around 90 percent of the total outlay.

d. Nominal outlay in the 1940s

By connecting the outlay estimated from 1940 to 1945 with the nominal outlay of urban households from 1946 by the Statistics Bureau, it is possible to construct nominal outlay in the 1940s for urban households (Chart 10).[50] Nominal outlay increased by about 50 to 400 percent from 1944 to 1949. Changes in the number of persons per household were less than 10 percent and considerably smaller than that in outlay. Obviously, changes in price and quantity caused the rapid increase in outlay.

Regarding the development of outlay on each item group, the share of outlay per item group to total outlay more clearly shows the development than nominal outlay (Chart 11). The sum of shares of both staple food and other foods increased from 40 percent in 1942 to 70 percent in 1945, and then remained at around 50 percent in 1946–1950. A high level of the Engel coefficient implies a slow recovery of living standards for urban households.

(2) Conversion into real outlay of urban households

First, the missing period of CPI across groups is interpolated, as a deflator of nominal outlay on each item group. Next, the real outlay in each group is aggregated to obtain total real outlay. Then, variations in real outlay due to changes in assumptions are assessed.

a. Interpolation of consumer prices in the 1940s

As a deflator of nominal outlay, the series of CPI in each group in each year is employed. As in Section 2, CPI is available for the years up to 1938 and from 1946. From 1940 to 1942, the Census Bureau's cost of living index is considered as an alternative for CPI, because we consider that black-market transactions did not prevail in 1940–1942. Meanwhile, the cost of living index from 1943 to 1945 cannot be used for interpolating

[50] Data of 1946 by the Statistics Bureau cover only from August to December. Outlay is constructed from other surveys by the Ministry of Health from January to March and by the Ministry of Labor from April to July (both surveys covering more than a thousand labor households). The Ministry of Health survey (from January to August, only total outlay) is from the Price Board (1946, p. 46), and the Ministry of Labor survey is from the Statistics Bureau (1950, pp. 774–775).

CPI, considering the prevalence of black-market transactions for consumers. Therefore, the following interpolation approach is used.

First, effective prices in 1942–1946 are estimated from official and black-market prices using quantity shares of black-market transactions as weights as follows:

$$P^{w}_{k,T} = P^{a}_{k,T} w_{k,T} + P^{b}_{k,T}(1 - w_{k,T}),\ T = 1942, \ldots, 1946 \qquad (7)$$

Meanwhile, as aforementioned (Section 3 (2) c), the number of available items was limited, with 40 to 50 percent in outlay or 20 percent in number of items. Consequently, estimated effective prices in 1946, $P^{w}_{k,1946}$, differ from $\mathrm{CPI}_{k,1946}$. At the same time, $P^{w}_{k,T}$ comes from a subset of CPI items. The unobservable CPI of each group from 1943 to 1945 is estimated such that CPI for each group category will be proportional to $P^{w}_{k,T}$ (T = 1943, …, 1945) in the form of a power law:

$$CPI_{k,T}/CPI_{k,1942} = (P^{w}_{k,T}/P^{w}_{k,1942})^{\boldsymbol{x}} \qquad T = 1943, \ldots, 1945 \qquad (8)$$

$$\boldsymbol{x}\text{: satisfying } CPI_{k,1946}/CPI_{k,1942} = (P^{w}_{k,1946}/P^{w}_{k,1942})^{\boldsymbol{x}} \qquad (9)$$

Chart 12 shows the interpolation of CPI in 1943–1945. First, the effective price of each group P^{w}_{k} (gray markers) is calculated, and then it is adjusted to the level (white markers) consistent with $CPI_{k,1946}$. For example, in staple food, from the value of $P^{w}_{k,1946}$ of 43.5 and $CPI_{k,1946}$ of 54.9, x can be calculated ($x = ln(54.9/1.72)/ln(43.5/1.72) = 1.072$). Then, the values of P^{w}_{k} in 1943–1945 are raised to the power of x, thus obtaining indexes such that indexes containing both official and black-market prices in 1943–1945 and their levels after adjustment become consistent with the levels of CPI in 1942 and 1946.[51] For example, in staple food, $CPI_{k,1945}$ becomes 18.3 ($= 1.72 \times (15.58/1.72)^{1.072}$). Indexes in the other item groups are obtained similarly.

b. Real outlay of urban households

The real outlay of urban households (Chart 13) is obtained from nominal outlay (Chart 10) using adjusted CPI (Chart 12) as deflator.

In Chart 13, total real outlay (white diamonds) declined about 70 percent in 1940–1945, and outlay in 1945 became around 30 percent of that in 1940. For each item group, outlay in some groups experienced a milder decline, such as staple food with higher priority in rationing, or housing with its stock that had generally remained the same as that before 1945. However, for groups such as other foods, clothing and miscellaneous, outlay rapidly

[51] CPI data of 1946 covered only from August to December. For the months from January to July 1946, other sources (Cabinet's cost of living index for clothing, heat & light, housing and miscellaneous, or average of retail prices and black-market prices using postwar CPI weights for staple food and other foods) are adopted for linking two periods and obtaining an average from January to December. Data from January to July are based on Statistics Bureau (1950), MOF and BOJ (1948) and BOJ (1968). Cost of living index in 1946–1947 is used, because the index in 1946–1947 covering transaction prices according to Statistics Bureau (1984, p. 512) appears informative, although it is inferior to effective prices such as CPI.

declined due to skyrocketed prices and scarcity of goods. Sharp drops in these groups reflected a crowding out of military demand for civilians,[52] and also difficulties in rationing these item groups.[53] After the war, except 1946 when there was a quick recovery following the ceasefire, the postwar recovery of real outlay remained slow amid rapid high inflation, and outlay in 1950 did not recover to the prewar level as pointed out in Ohkawa (1953, 1954). In item groups such as other foods, clothing, miscellaneous and housing,[54] outlay in 1950 was below the prewar level.

A sharp decline of outlay during the wartime and postwar years occurred partly due to wartime damage and the evacuation of mid- and high-income classes. From a rough comparison between income classes in 1942 and expenditure classes in 1947–1949, the mid-income class in 1942 accounted for 40 percent of the total and the lowest-income class for 10 percent, but in 1947 the share of the lowest-expenditure class increased to 40 percent of the total, then declined slowly in 1948–1949.[55]

c. Assessing variation due to changes in assumptions

Real outlay in 1940–1945 is estimated from contemporaneous data directly. Estimates under "the benchmark assumptions" in the texts until Section 4 (2) b are considered as the benchmark estimates, but the estimates may differ if the assumptions change. This possibility is also assessed.

First, within the benchmark assumptions, it is considered that the low quality of price indexes at that time might cause an upward or downward shift of real outlay, so it is simply assumed that urban CPI would additionally decrease (or increase) 10 percent per year in 1943–1945.[56] Under such circumstances, the range of upper and lower shifts of

[52] To understand the harsh crowding out of civilian demand by military demand, the description of Shimomura (1944, pp. 128–131) is helpful: "… there are various cases of conversion from civilian goods to military goods. … consumption of *sake* wine for parties all over Japan amounts to 0.2 million *koku* (≈ 36 million liters, 1 *koku* ≈ 180 liters), and it is made from 0.15 million *koku* (≈ 27 million liters) of rice, which is staple food for 158,000 people. … Also, cutting back of 1 square *shaku* of glass (1 *shaku* ≈ 0.3 meter) by every household will amount to 15 million pieces of glass … which requires 1,200 tons of soda, 6,000 tons of coal and 100,000 of labor force for yearly production. These resources correspond to 1 million bullets for field guns, 283 million bullets for rifles, and 300 million kilowatts per hour of electricity…."

[53] Many Japanese military officers conjectured that rationing except staple food would be infeasible in the summer of 1945 and completely infeasible by 1946. In some worse famines, such as those that occurred in Greece (1941–1942) and the Netherlands (1944–1945), more than 10 to 100 thousand civilians died when rationing stopped and supply was insufficient even on the black market (see Klemann and Kudryashov (2012, pp. 68, 326)).

[54] Samples excluded homeowners in the years up to 1942 but included the years from 1946, thus causing a smaller postwar outlay in housing. This difference is not adjusted, because it reflects the reality at the time.

[55] The author's estimates are based on the National Archives of Japan (1944a, 1944b) and Statistics Bureau (1956). Distribution is comparable, although expenditure data in 1947–1949 differ from revenue data in 1942.

[56] A variation of 10 percent appears arbitrary but plausible, considering earlier studies. Morita (1989) argues that a price index computed by the simple geometric mean would contain a bias of 8 percent, based on

real outlay in 1943–1945 is shown by small white squares in Chart 13. This shows that outlay in 1945 would remain the lowest in the 1940s, even if urban real outlay would be higher than the benchmark due to factors concerning price measurement.

Next, the estimates may vary under other assumptions under a different consideration of black-market transactions from other records. In this regard, "alternative assumptions" are considered by partly changing the benchmark assumptions. Specifically, it is assumed that (i) from Morita's index, black-market transactions would be prevalent in 1941–1942, and that (ii) from Nakamura (1989), the decline of quantity in outlay in 1943–1945 was moderate in general (see Appendix (3) for details). Under the alternative assumptions, the real outlay of urban households is shown in Chart 14 (1), using Chart 14 (2) as deflators. Compared with those in the benchmark assumptions (Chart 13), outlay under the alternative assumptions declined mildly in 1941–1945, and outlay in 1945 remained around 40 percent of the 1940 level, higher than the outlay under the benchmark assumptions (30 percent). Still, the alternative assumptions caused a sharp drop in outlay, as the benchmark did.

5. Farm Household Outlay

For farm households, first, nominal outlay is adjusted such that the series become comparable before and after revision. Then, real household outlay is estimated by evaluating in-kind outlay and its deflator.

(1) Nominal outlay of farm households

As for farm household outlay, the six item groups of (i) staple food, (ii) other foods, (iii) clothing, (iv) housing, (v) heat & light and (vi) miscellaneous are adopted, considering data availability and consistency with urban households. In addition, farm household outlay is divided into outlay in kind and outlay in cash, according to style of outlay:

$$C = \Sigma_k\{C^e_k + C^f_k\} \text{ (}k\text{: item group, }e\text{: cash outlay, }f\text{: in-kind outlay)} \qquad (10)$$

Household outlay is available in the farm economy survey throughout the 1940s, but users must adjust its discontinuity before and after the revisions.

a. Adjustment of discontinuity by revision and of evaluation of in-kind outlay

The farm economy survey from the year 1949 is reliable because samples were chosen randomly and sufficiently (more than 5,000 samples). For the surveys in 1940–1941 (sampling of small- and medium-sized farms only) and 1942–1948 (sampling tilted toward large-size farms), the sample biases are adjusted using the number of farms of each size

Fisher (1922). Mizoguchi and Nojima (1993) assume a variation of 10 percent in estimating agricultural production.

(MAF (1951b)) to total farms as weights.[57]

The evaluation price of household outlay in kind should also be considered. In principle, the farm economy survey evaluates cash outlay using market prices (black-market prices if prevalent, or official prices otherwise), and in-kind outlay using official prices. As an exception, in-kind outlay included the consumption of gifted products as well as self-consumption of homemade products (mainly staple food and other foods). Outlay on gifted products becomes in-kind outlay at market prices.[58] Therefore, cash outlay includes "in-house consumption" at official prices and "gifted products" at market prices by definition. For example, consumption of rice becomes outlay in kind at official prices for homegrown rice, or at market prices for gifted rice.

Regrettably, a further breakdown of in-kind outlay at market prices was not available in the farm economy survey, so a benchmark case is assumed (where the ratio of in-kind outlay at market prices for staple food and other foods is 15 percent in 1945 and 5 percent in 1946–1948).[59] Two cases are assumed, the case with a higher share of in-kind outlay at market prices (20 percent in staple food, other foods and heat & light in 1945 and 10 percent in staple food and other foods in 1946–1948) and the case with a lower share (12 percent in staple food and other foods in 1945 and 2 percent in both groups in 1946–1948)).[60] These assumptions affect real outlay but not nominal outlay in kind and in cash (as described in the following Section 5 (2) c).

b. Nominal outlay of farm households in the 1940s

Next, the nominal outlay of farm households during the 1940s is outlined in Chart 15, and then compared with that of urban households (Chart 10). First, the nominal outlay of farm households after discontinuity adjustments skyrocketed about 50 to 400 percent in 1944–1949. A several times increase of nominal outlay in 1946–1948 under skyrocketing prices was similar in both farm and urban households. There were also differences. The nominal outlay of farm households in 1944 increased (20 percent year-on-year) less than that of urban households (60 percent). The rise in outlay of farm households (tripling) under plummeting in-kind outlay in 1945 was higher than that of urban households (doubling). Under a moderate change in official farm prices in 1945, it is considered that

[57] For example, the 587 samples in total in the year 1942 contain only 58 sample farms of less than 1 *cho* (≈ 10,000 m^2) of land, but the share of farms cultivating less than 1 *cho* to the entire population was more than 60 percent, indicating the necessity for adjustment. The samples in 1943–1948 are adjusted similarly.

[58] This follows the booking rules in the farm economy survey (for years 1945–1947, MAF (1950c)). It should be noted that the barter of products (such as a farm's purchase of clothing by payment of rice) is evaluated at market prices and added to outlay **in cash** for the farm economy survey in 1945 and 1946. From 1947, the survey separates barter, but this paper adds it to outlay in cash for continuity.

[59] Akagi (2011, p. 595) and NAA (1948) are partly considered to make these assumptions.

[60] It is considered that either a higher or a lower share in addition should be unlikely, due to either the acute shortage of goods at the time, or an improbably high evaluation of real outlay in 1945.

the greater in-kind outlays on staple food and other foods in 1945 was mainly driven by a greater portion of the evaluation at market prices, rather than a greater quantity in outlay.

The share of nominal outlay in each group and outlay style (Chart 16) indicates differences between farm households and urban households. The share of outlay on staple food and other foods including both in cash and in-kind outlays, the Engel coefficient, remained at 40 to 70 percent, lower than that of urban households (60 to 80 percent in and after 1944, Chart 11). Meanwhile, the ratio of cash outlay to total outlay in farm households (outlay in cash ÷ total outlay, Chart 16) was 30 to 40 percent in 1945 and 40 to 50 percent in 1944 and 1946, all of which were lower than in other years (50 to 60 percent). This indicates that farm households also had less flexibility of cash outlay.

(2) Conversion into real outlay of farm households

Nominal outlay of farm households consists of both cash outlay and in-kind outlay. A different approach should be taken for its conversion into real outlay.

a. Preparatory works for conversion into real outlay

Here, an approach to deflating cash outlay and in-kind outlay is considered. Then, prices are calculated by deflating each style of nominal outlay into real outlay.

(a) Approach

For each item group k, with each style of cash outlay C^e_k and in-kind outlay C^f_k, they are deflated discretely as follows:

$$C^R_t = \Sigma_k\{C^e_{k,t}/P^e_{k,t} + C^f_{k,t}/P^f_{k,t}\} \qquad (11)$$

As a deflator for cash outlay $P^e_{k,t}$, the effective price farm CPI ($FCPI_k$) in 1934–1936 and in the years from 1949 are employed as in Eq. (12). Regarding the deflator in 1940–1948, first the deflator before adjustment $P^{e0}_{k,t}$ from farm price (FAP_k) in 1940–1942 and farms' black-market price (FBP_k) in 1943–1948 is employed as in Eq. (13). Then, $P^e_{k,t}$ is used as a deflator for cash outlay, consistently adjusted with data from 1949, by raising $P^{e0}_{k,t}$ to the power of z, which comes from the gap between $FCPI_{k,1949}$ and $FPP_{k,1949}$ (computed from 52 items available in both *FAP* and *FCPI*) as in Eq. (14).[61]

$$P^e_{k,t} = FCPI_{k,t} \qquad t = 1934\text{–}36, 1949, \ldots, 1951 \qquad (12)$$

$$P^{e0}_{k,t} = FAP_{k,t}\ (t = 1937, \ldots, 1942);\ FBP_{k,t}\ (t = 1943, \ldots, 1948);$$
$$FPP_{k,t}\ (t = 1934\text{–}36, 1949) \qquad (13)$$

$$P^e_{k,t}/P^e_{k,1934\text{–}36} = (P^{e0}_{k,t}/P^{e0}_{k,1934\text{–}36})^z \quad t = 1937, \ldots, 1948$$
$$\text{such that } z\text{: } FCPI_{k,1949}/FCPI_{k,1934\text{–}36} = (FPP_{k,1949}/FPP_{k,1934\text{–}36})^z \qquad (14)$$

[61] The black-market price after adjustment is employed as a deflator of farm household outlay in cash, because most of the outlay in cash by farm households appears to have been on purchases through the black market when it prevailed.

As a deflator for in-kind outlay $P^{f}_{k,t}$, $FCPI_{k,1949}$ is employed as a deflator for in-kind outlay in 1934–1936 and the years from 1949 as in Eq. (15). For the deflator in 1940–1948, first farm price (FAP_k) is taken as unadjusted price $P^{f0}_{k,t}$ as in Eq. (16). Then, it is adjusted consistently by raising $P^{f0}_{k,t}$ to the power of z as in Eq. (17). For item groups that need adjustment for market price affecting in-kind outlay in 1945–1948, they are further adjusted by partially including the market price for item groups on necessities as in Eq. (18). $P^{f}_{k,t}$ is regarded as the deflator for in-kind outlay on each item group k.

$$P^{f}_{k,t} = FCPI_{k,t} \qquad t = 1934\text{–}36, 1949, \ldots, 1951 \tag{15}$$

$$P^{f0}_{k,t} = FAP_{k,t}\ (t = 1937, \ldots, 1948);\ FPP_{k,t}\ (t = 1934\text{–}36, 1949) \tag{16}$$

$$P^{f1}_{k,t}/P^{f1}_{k,1934\text{–}36} = (P^{f0}_{k,t}/P^{f0}_{k,1934\text{–}36})^{z} \quad t = 1937, \ldots, 1948$$

$$z\text{: } FCPI_{k,1949}/FCPI_{k,1934\text{–}36} = (FPP_{k,1949}/FPP_{k,1934\text{–}36})^{z} \tag{17}$$

$$P^{f}_{k,t} = \begin{cases} P^{f}_{k,t} = P^{f1}_{k,t}, \\ \quad \text{if not } \{k = \text{staple food, other foods and } t = 1945, \ldots, 1948\} \\ \gamma_t P^{e}_{k,t} + (1 - \gamma_t)\, P^{f1}_{k,t},\ \gamma_{45} = 0.15,\ \gamma_{46}, \gamma_{47}, \gamma_{48} = 0.05 \\ \quad \text{if } \{k = \text{staple food, other foods and } t = 1945, \ldots, 1948\} \end{cases} \tag{18}$$

(b) Deflator for each group category and each style of outlay

Chart 17 shows how the deflators are calculated. For example, in staple food, deflators are calculated for both cash outlay and in-kind outlay from farm prices (official prices) and black-market prices of five items. For given official and black-market prices in June 1945, the official price is calculated as 1.5 (white circle) and black-market price as 21.7 (black circle). Similarly, both official and black-market prices are calculated for the item groups in 1940–1949.

Next, if the price indexes of both official and black-market prices for staple food are annualized and linked with the farm CPI at the base year (1934–1936 = 1), the linked series deviate from farm CPI due to the composition of items (Chart 18 (1), gray and white circles in 1949). Using this deviation ($FPP_{k,1949} = 204.7$, $FCPI_{k,1949} = 170.2$) to calculate a ratio ($z = ln170.2/ln204.7 = 0.965$) for exponentiation, deflators are calculated for both cash outlay and in-kind outlay consistent with the farm CPI. For example, as a deflator for cash outlay in 1945 ($P^{e}_{k,1945}$), 46.1 is adopted (black circle) after adjustment instead of the unadjusted black-market price of 52.9 (gray circle, where $(FBP_{k,1945})^{z} = 52.9^{0.965} = 46.1$). Similarly, a deflator is calculated for in-kind outlay from the official price (3.27, gray circle) by adjusting with a power first ($3.27^{0.965} = 3.14$, white circle) and then adding 15 percent of the market price ($P^{f}_{k,1945} = 0.85(FAP_{k,1945})^{z} + 0.15(FBP_{k,1945})^{z} = 0.85 \times 3.14 + 0.15 \times 46.1 = 9.58$, small white circle).

For item groups other than staple food, similarly, deflators are calculated for cash and in-kind outlays. Each of the deflators of the six item groups in cash and in-kind outlays develops differently, as shown in Chart 18. For example, the rises in staple food in 1946–

1948 (other than 1945) were milder than those in other item groups. Meanwhile, in other groups such as heat & light or miscellaneous, the divergence of deflators between the official price and black-market price became considerably small in 1946–1947. In 1948, the divergence between the official price and black-market price almost disappeared in the item groups except staple food.

b. Real outlay of farm households

The nominal outlays of farm households on each item group (Chart 15) are deflated using deflators of cash and in-kind outlays (Chart 18), and then added up to obtain the real outlay of farm households (Chart 19).

Real outlay of farm households (white diamonds in Chart 19) declined in 1944 to 60 percent of the level in 1940, then bottomed out in 1945, but leveled off again in 1946. In short, real outlay in 1943–1946 stagnated at between 60 to 70 percent of the 1940 level. Then, real outlay started to increase solidly from 1947, regained the prewar level in 1949 and surpassed it from 1950. Real outlay of farm households reached the bottom in 1944, differently from that of urban households. In this regard, earlier studies and historical records show that farms faced stronger military demand up to 1944, then war damage in Japan proper weakened controls from late 1944 to August 1945, and the ceasefire after August helped farms to recover in-house consumption.[62] These developments are consistent with the estimates in this paper.

In addition, among outlays on each item group in Chart 19, cash outlay on other foods, clothing and miscellaneous declined from 1940 to 1944, stagnated in 1945 and 1946, and recovered from 1947 to 1949. This implies that the scope for larger cash outlay grew from 1947 for farm households, and that there was little room for increasing cash outlay in 1944–1946 for farm households although urban households suffered more severely.

c. Assessing variations due to changes in assumptions

As for real outlay of farm households, the estimates from the data at that time are considered directly as the benchmark estimates. A possible range of upper and lower shifts due to assumptions about prices is then assessed.

First, under the aforementioned assumptions (Section 5 (1) a), nominal in-kind outlay of farm households partially contains evaluations at market prices from 1945 to 1948. If a

[62] Using contemporaneous records and interviews, Kase (1995, pp. 291–299) argues that farms maintained in-house consumption for most homegrown products because the consumption of homegrown products was the largest incentive for farms, despite the government's success in controlling the supply and demand of rice. Also, regarding the evidence of weaker wartime controls, Ando (1987, pp. 367–370) refers to the government outlook in June 1945 that rationing of staple food and salt to households would cease from autumn 1945 to early 1946 due to the vanishing transportation network. Akagi (2012, p. 646) also points out a larger supply of rice on the black market in autumn 1945 under weaker controls.

higher or lower proportion of in-kind outlay at market prices is assumed, then a deflator will contain a higher or lower portion of market prices, and so the deflator for in-kind outlay will be higher or lower, thus shifting real farm household outlay downward or upward. The downward and upward shifts of real outlay are shown by small white squares in Chart 19. The level of outlay assuming a downward shift in 1945 was similar to that under the benchmark assumptions in 1944. Under various historical records, a further downward shift would be unlikely, and so the real outlay of farm households in 1945 should be at a level similar to that of 1944 at least.

It is also considered that the deflators for farm households might be lower or higher by 10 percent per year.[63] By adding this consideration to the assumptions, the upward and downward shifts of real outlay in 1944–1948 might be wider, as shown by the thin broken lines in Chart 19. Although the thin broken lines indicate a wider variation, they indicate stagnation of outlay in 1943–1946 as the benchmark estimate does.[64]

6. Estimates of Outlay in the 1940s and a Comparison with Existing Statistics

In this section, first, outlays of urban and farm households are converted into outlays per capita. Next, Japan's household outlay in the 1940s is estimated by taking the weighted average of per capita outlays using population shares as weights. Then, this estimate is compared with existing statistics in the 1940s in the super-long term.

(1) Outlays of urban and farm households per capita and per year

Outlays of urban and farm households are per household per month. Meanwhile, many series in existing statistics such as household consumption expenditures in the national accounts are shown per person per year. For comparison with the existing statistics, the estimates are converted into data of per person per year.

As for the number of persons in urban or farm households in the 1940s (Chart 20), it was approximately 4–5 in urban households and 6–7 in farm households. The variation in number of persons per household, 10 percent at most, was smaller than the variation of nominal outlay (about 50 to 400 percent) for both types of household, and so its effect on

[63] Considering that a bias of low quality may occur in official and black-market prices of farm households, it is assumed that prices of farm households might be 10 percent higher or lower from 1943 to 1948 separately in each year. It is also assumed that the bias would not be cumulative across years for farm households, considering the actual developments of nominal outlays in cash and in-kind.

[64] Regarding the alternative assumptions for farm households, consideration of black-market transactions in 1941–1942 is sufficient for calculating the weighted average of outlays of urban and farm households (because for farm households no assumptions are made for quantity in outlay). It is assumed that the upswing of farm prices in 1941–1942 was half of that of prices for urban households. Under this assumption, real outlay of farm households shifts downward by about 10 percent (small white triangles in Chart 19). Although records such as NAA (1948) support this assumption indirectly, the assumption does not contradict other historical records, and is consistent with data in the other years.

outlay per person should be limited. Using the number of persons per household, the outlay per household per month is converted into outlay per person per year. In Chart 21, the most likely estimate under the benchmark assumptions is shown by the markers with a solid line (as well as the alternative estimates in small markers).

In nominal outlay per person (Chart 21 (1)), outlay of farm households remained at 60 percent of that of urban households in 1940. But, outlay in 1950 increased to 90 percent, catching up fast and narrowing the prewar gap with urban households.

In real outlay per person (Chart 21 (2)), outlay of urban households declined sharply in 1942 reflecting sluggish nominal outlay, declined further in 1943–1944 due to a surge in black-market prices, and fell in 1945 to 30 percent of that in 1940 due to wartime damage. After recovering in 1946, urban real outlay remained stagnant from 1947 to 1950. At the same time, outlay of farm households per person was 60 percent of that of urban households in 1940, and then declined by 1944 to 60 percent of that in 1940. But, farm household outlay worsened less severely than urban household outlay in wartime, and recovered solidly in the postwar years. Farm household outlay in 1949–1950 first achieved and then surpassed the prewar level, ahead of urban household outlay.

Also, under the benchmark assumptions with variations in prices (Sections 4 (2) c and 5 (2) c), the variations in real outlay per person in urban and farm households are shown as the shaded area or the area between broken lines in Chart 21 (2). The upper and lower variations are also shown under the alternative assumptions if they differ from the benchmark, as small white diamonds and triangles. Regardless of these variations, the trends appear to be similar to the benchmark estimates. For example, the level of real urban household outlay with an upward shift in 1945 (upper boundary of the shaded area) is similar to the level of real farm household outlay (white triangles) in 1945. Also, the variation of real farm household outlay in 1943–1948 (thin broken lines) indicates the stagnation in 1943–1946 and recovery from 1947 in farm household outlay, as the benchmark does.

The difference in behavior between urban and farm households may also be assessed by comparing ex-post prices that both types of household faced. Chart 22 shows an implicit deflator (P_{ID}) obtained from nominal outlay divided by real outlay, and an ideal price index by Irving Fisher's formula (P_{FF}) obtained from the prices of each item group (Chart 12 for urban households and Chart 18 for farm households) using both prewar and postwar weights. There is little divergence between P_{ID} and P_{FF} for urban households. For farm households, however, P_{ID} was several tens of percent lower than P_{FF} from 1943 to 1948. The formula of P_{FF} uses fixed weights and does not include changes of weights in item groups during wartime. Meanwhile, P_{ID} includes changes of weights in wartime, because

it is nominal outlay divided by real outlay each year. It appears that farm households adjusted outlay from item groups with higher inflation (cash outlay) to groups with lower inflation (in-kind outlay), whereas urban households had little room for adjustment.

(2) Estimates of outlay per capita and comparison with existing statistics

Household outlay per capita in the 1940s is estimated by taking the average of outlays per capita in urban and farm households, using shares of urban, farm and non-farm rural population in Chart 2 as weights (where non-farm rural outlay is assumed as the average of urban and farm household outlays per person). This estimate is then compared with existing statistics (household consumption expenditures in national accounts divided by population) as shown in Chart 23.

For nominal outlay in Chart 23 (1), the benchmark estimate coincides well with the existing statistics in 1940, 1941 and 1950. This indicates that the data, records and assumptions behind the estimates should be consistent with the existing statistics.

For real outlay as shown in Chart 23 (2), the benchmark estimate declined in 1940–1944 to a little over 50 percent of the 1940 level (145 yen in 1944, 54 percent of 1940). The estimate in 1944 was below the existing statistics in 1944 (189 yen, 71 percent). The estimate in 1945 further declined to a little under 50 percent (127 yen, 47 percent). The estimate depicts the worsening of household outlay more clearly than the existing statistics during wartime where military demand severely crowded out civilian demand.

A range of possible shifts in real outlay per capita due to assumptions about prices is also shown in Chart 23 (2), from the weighted average of estimates using population shares. Although outlay with upward shift (the shaded area's upper boundary) declines more mildly than the benchmark, it was still below the trends of existing statistics (white circles) in 1943–1944. It is highly likely that household consumption declined more severely during wartime than the existing statistics did, even if the upward shift is considered.[65]

In addition, the estimate of outlay per capita is assessed under the alternative assumptions (Chart 23 (3) (4)). Nominal outlay in 1940–1942 is observable and unchanged under the alternative assumptions (Chart 23 (3)). Meanwhile, as for real outlay under the alternative assumptions in Chart 23 (4), it declined by more than that of the

[65] A further downward shift may also be considered. For example, if set-up costs of urban evacuees are considered, outlay of non-farm rural households may be a lower value (either urban or farm household outlay, whichever is lower) than the assumed value (the average of urban and farm household outlays) in the text (and a lower boundary of outlay in 1945 will shift downward in this case). However, it is not adopted in the text because a comparison with existing statistics would be more complicated. In addition, if quality decay were considered, the lower boundary of real outlay would shift downward due to upward shifts of deflators.

benchmark in 1941–1942 due to a higher deflator assumed from Morita's retail price, then also declined in 1943–1944, and remained at a similar level in 1945. The alternative estimates reached the lowest of 140 yen in 1944 (52 percent of 1940) and were the near-lowest of 141 yen in 1945, both of which were higher than the lowest of the benchmark estimate (127 yen, 47 percent). At the same time, for both the benchmark and the alternative assumptions, the estimates in 1945 declined to roughly 50 percent of those in 1940, and the estimates in 1944 were considerably lower than the existing statistics.

The estimate, of which household outlay per person in 1945 was just under 50 percent of that in 1940, does not contradict contemporaneous records and earlier studies. For example, in late September 1941, several major Japanese economists such as Hiromi Arisawa reported the results of contract research to Japan's imperial army, where the report presumed that Japan's civilian consumption would decline 50 percent if Japan were to start the war with the United States.[66] This presumption was not an objective projection. Meanwhile, the pace of decline in civilian consumption in the worst scenario presumed by academics at that time happens to be almost the same as the pace of decline estimated by the author.[67] Also, the decline in real outlay in the author's estimate from 1940 to 1945 mainly occurred in and before 1944. This is also consistent with the USSBS (1946) and Cohen (1949) emphasizing the effectiveness of both the maritime blockade and the full-scale air attack on economic activity.

(3) Assessment of wartime consumption outlay with super long-term data

Lastly, the estimates in this paper are compared with the existing statistics traced back in the super long-term from a current viewpoint.

The existing series of statistics are traced back by linking a former series with a recent series using the ratio of the averages of two series in the overlapping years (Chart 24). By linking five existing series, from the most recent series with the base year of 2015 to the series of Shinohara (1967) with data in the 1870s, real household outlay per capita is traced back to the year 1874. A recent series (by the EPA) and a former series (LTES, vol.

[66] A team of top economists under Colonel Akimaru assessed national strength for war (see Wakimura (1998) or Makino (2018)). Arisawa (1957) reflects in his memoir that "… a 50 percent reduction of civilian consumption was necessary in Japan to satisfy wartime military demand but a 15 to 20 percent reduction of civilian consumption was sufficient in the United States" (p. 164 in reprint). Arisawa assessed the extent of curtailing civilian consumption by rearranging national expenditure into military demand, minimum civilian expenditure, and civilian consumption convertible for the military (Wakimura (1988, pp. 198–199)). A similar reduction of civilian demand occurred as wartime "patriotic compliance" in the United States (Rockoff (1984, p. 8)).

[67] An emergency mobilization plan (*Oukyu butsudou shian*) in August 1940 by the Cabinet Planning Board also presumed that the supply for civilians defined as the total supply except for the military was 50 percent or less for most necessities. See Nakamura and Hara eds. (1970, pp. lxx-lxxii, pp. 535–595) and Yamasaki (2012, pp. 282–291). In fact, civilian industries were ordered to abandon their equipment for military production (Yamasaki (2016, pp. 918–920)).

1) slightly differ in the 1930s, and retrospective data may slightly differ due to the ratio of overlapping years. Retrospective series linked with longer overlap (in 1930–1939) are considered as standard, and the series with lower values (with overlap in 1935–1939) for reference.

The estimates in this paper are adjusted to a recent base year for assessment from a current viewpoint. Fortunately, the author's estimate of nominal outlay in 1950 almost coincides with the existing series, and the author's estimate of real outlay (Chart 23 (2)) is compared with the existing statistics traced back from the base year of 2015, by linking both series in 1950.[68]

From Chart 24, portions in the 1940s and 1870–1890s are enlarged and adjusted in Chart 25 to compare the existing statistics of real household consumption per capita with the estimate in this paper. The benchmark estimate of real outlay in Chart 25 (1) indicates that its level of consumption in 1945 (127 thousand yen, black broken line) was lower than the level of the standard retrospective series (white circles) in 1875. Thus, about four years (from December 1941 to August 1945) of the Pacific War caused Japan's household outlay to plunge to the 1875 level. Even compared with series with the lower retrospective values (black triangles), the benchmark estimate (white squares) in 1945 becomes lower than the level of the lower retrospective series in 1879.

Next, to check robustness, the alternative estimates are compared with the retrospective data as shown in Chart 25 (2). The alternative estimates (white squares) reach the lowest in 1944 (140 thousand yen, black broken lines), although the near-lowest was in 1945. The lowest of the alternative estimates was below the standard retrospective series (white circles) in 1880, and was at a similar level with the lower retrospective series (black triangles) in 1880 (or below that in 1887). They indicate that Japan's household outlay during World War II plunged to the level in 1875–1880. Considering the range with further shifts, the lowest value during World War II may be similar to the level in 1874–1891, but it should be noted that the lowest value is less supported by historical records.[69]

In short, it is highly likely that Japan's real household consumption per capita in 1945

[68] More meticulously, it is possible to adjust real outlay of urban and farm households in each item group to the base year of 1950, take the weighted average, and trace the series back to 1940. In this case, real outlay in 1945 becomes slightly lower (124 thousand yen). This does not affect the conclusion of the text.

[69] If an upward shift of real outlay is fully considered, the lowest value during World War II becomes similar to the level in 1889–1891 of the existing series. Specifically, the lowest of the upper boundary of the shaded area in Chart 25 (1) (152 thousand yen in 1945, black dotted line) is below the lower retrospective series (black triangles) in 1889. Similarly, the upper boundary in Chart 25 (2) (161 thousand yen in 1944, the same as above) is below the lower retrospective series in 1891. Meanwhile, the lowest of the lower boundary of the shaded area in Chart 25 (1) (2) becomes obviously lower than the existing series since 1874, in both the benchmark assumption and the alternative assumptions. These years with lowest values are included in the first half of the Meiji era (1868–1912).

plunged to the level of 1875–1880 in the early Meiji era. The estimate in this paper indicates that the increase in Japan's real consumption in the decades from the period of 1875–1880 to the year 1940 was lost during just the four years of the Pacific War.

7. Conclusion

In this paper, Japan's household consumption in the 1940s is reconstructed using historical records about household outlays and black-market transactions, and interpolating missing values in the existing statistics. First, nominal outlays of urban and farm households are estimated as directly as possible, and then converted into real outlays by effective price indexes containing the official price, black-market price, and its weight. Real outlay of urban households in 1945 declined to 30 percent of 1940 (or 40 percent under the alternative assumptions). Although real outlay of farm households declined more mildly than that of urban households due to farm households' in-house consumption, real outlay of farm households still stagnated at 60–70 percent in 1943–1946.

Next, household outlay per capita is estimated by taking the average of urban and farm household outlays using population shares as weights, and then this estimate is compared with the existing statistics of household consumption per capita. Regarding nominal outlay, the estimates in 1940 and 1950 generally coincided with the existing statistics. Meanwhile, regarding real outlay, the estimates developed differently from the existing statistics. The estimate in 1944 declined to a little over 50 percent of the 1940 level, and was lower than the level of the existing statistics in 1944. The estimate in 1945 further declined to a little less than 50 percent, while the existing statistics are missing for 1945. Even considering alternative estimates using other records under alternative assumptions, it is confirmed that real outlay in 1945 is a little more than 50 percent compared to that in 1940. Comparing the estimates in this paper with the existing series of real consumption per capita in 1874–2016, it is concluded that Japan's household consumption in 1945 declined to the level in 1875–1880.

In the existing statistics, household consumption in 1940–1944 is estimated from production data at official prices, with additions and subtractions such as exports and imports as well as military demand. Then nominal outlay is converted to real outlay using the effective price index estimated indirectly. The estimate in this paper differs from the existing statistics in three aspects. First, by rediscovering the urban household survey in 1942, household outlay is gauged more adequately. Next, instead of indirect effective price indexes, effective price indexes are estimated directly from the official price, black-market price and transactions across each item group for deflating nominal outlay. In addition, urban household outlay in 1940–1941 covering the low-income classes is adjusted upwards by employing the 1942 survey.

The estimates in this paper are partly based on assumptions and there may be room for improvement, such as the additional discovery of historical records. Nevertheless, the estimates in this paper more clearly and quantitatively reveal the wartime decline of household outlay in the 1940s by employing historical records more extensively. I believe that historical research can contribute to modern economic research too, through the proper discovery and utilization of historical records.

Charts

Chart 1: Circumstances in the 1940s and controls affecting household outlay

Year	Events	Controls affecting households
1937–1938	Jul 1937: Lukouchao incident (outbreak of the Sino-Japanese war)	Apr 1938: National Mobilization Law (**basis for price controls**) Aug 1938: Police empowered for enforcing economic controls
1939	Sep: Start of World War II (1939–1945)	Oct: Price Freezing Ordinance (**fixing** price level on Sep 18)
1940–1941	**Relative stability in Japan**; black-market transactions for military supplies and luxury goods Dec 1941: Start of Pacific War (1941–1945)	Mar 1941: **Rationing of rice** (controls by ration books)
1942	**Relatively stability under early war success**	Jan: Rationing of textiles
1943	Early year: Withdrawal from Guadalcanal Autumn: Augmented U.S. aerial forces → **weakening Japanese sea command** → smaller imports → black markets widening	Apr: Emergency price controls (allowing higher prices for promoting production)
1944	Jul: the fall of Saipan, Oct: the battle of Leyte Gulf → **loss of sea command** → interdicted imports → **frequent suburban purchases** Nov: Start of **full-scale air raids** on Japan	Purchase by munitions firms ignoring official prices → **larger black-market transactions** and **higher black-market prices**
1945	**Full-scale air raids on Japan → severe interruption of domestic transportation** After war: Rise in extra government spending, inflation	**Controls nullified in reality** (rationing working only in staple food) After war: Controls under occupation (for preventing famine)
1946–1948	High inflation (with a recovery in production on a priority basis)	Mar 1946, Jul 1947, Jul 1948: raising official prices
1949–1951	Spring 1949: the Dodge plan → containing inflation	Streamlined rationing, **Abolition** of official prices

Sources: Oishi ed. (1994), Ando (1987), MOF (1980, 1957, 1951), Nakamura (1974), Morita (1963), Toyo Keizai (1954)

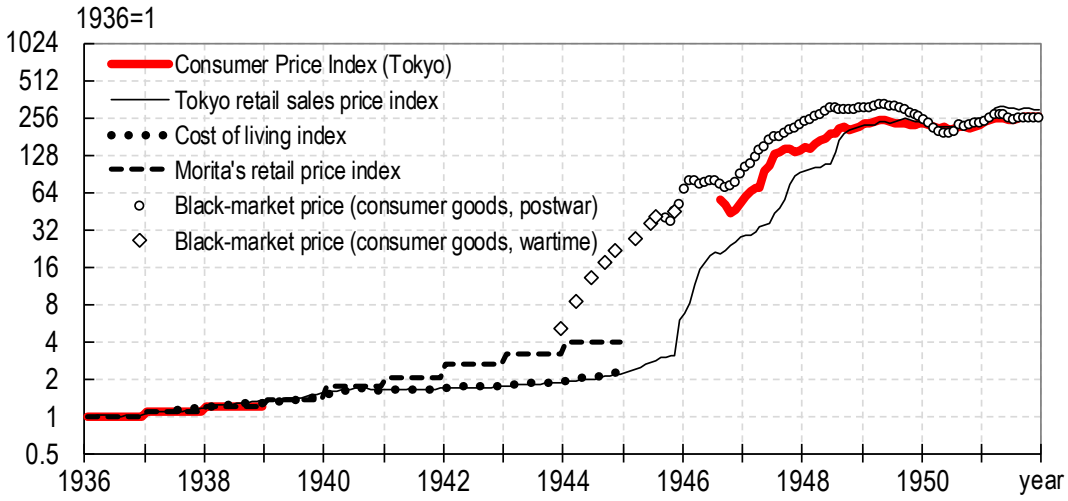
Chart 2: Population in Japan proper by municipality and farm

year	Total population (mil.)	Urban	[%]	Nonfarm town & village	[%]	Farm	[%]	(Ref.) Tokyo	Osaka	Town & village
1940	71.933	27.615	[37.8]	12.472	[18.0]	31.846	[44.3]	7.284	4.737	44.318
1941	71.678	——	*[38.7]*	——	*[17.7]*	——	*[43.6]*	7.358	4.662	——
1942	72.386	——	*[39.6]*	——	*[17.4]*	——	*[43.0]*	7.333	4.659	——
1943	72.887	——	*[40.5]*	——	*[17.2]*	——	*[42.3]*	7.333	4.508	——
1944	73.064	30.244	[41.4]	*12.357*	*[16.9]*	*30.463*	*[41.7]*	7.271	4.413	42.820
1945	71.998	20.022	[27.8]	*17.013*	*[23.6]*	*34.962*	*[48.6]*	3.488	2.801	51.976
1946	73.114	22.205	[30.4]	16.664	[22.8]	34.245	[46.8]	4.183	2.976	50.909
1947	78.101	25.857	[33.1]	16.328	[20.9]	35.916	[46.0]	5.001	3.335	52.244
1948	80.003	——	*[34.6]*	——	*[19.6]*	——	*[45.8]*	5.475	3.518	——
1949	81.773	——	*[36.0]*	——	*[18.3]*	——	*[45.6]*	5.896	3.713	——
1950	83.200	31.203	[37.5]	14.186	[17.1]	37.811	[45.4]	6.278	3.857	51.997
1951	84.541	——	*[37.5]*	——	*[17.1]*	37.562	*[45.4]*	6.712	4.072	——

Note: As of October each year (except February 1944, November 1945 and April 1946). Japanese residing abroad are excluded. In 1944 and 1945, farm population and non-farm population in towns and villages (rural areas) are estimated from the rural population and the population ratio of non-farm households and farm households in a recent available year (1940 or 1946). The ratios of each municipality in the years 1941–1943, 1947–1948, and 1951 are linearly interpolated from data in recent years. Umemura et al. (1988) provides the farm population in 1940.

Sources: Statistics Bureau, *Population Estimate*, *National Census*; Statistics Bureau (1950), MAF (1951b), Umemura et al. (1988)

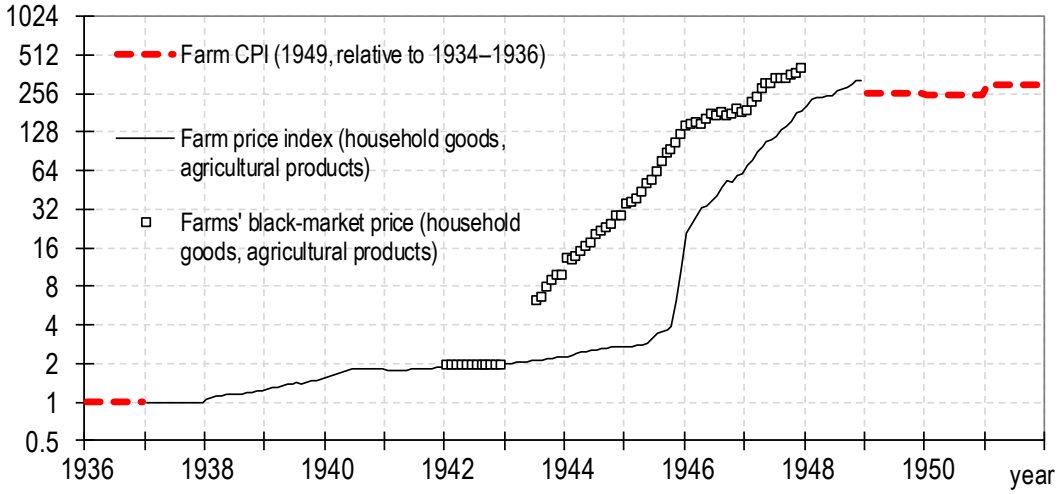
Chart 3: Prices for urban households



Note: CPI, Tokyo retail sales price index, and Morita's index are adjusted such that the value in 1936 is equal to 1. Cost of living index and retail sales price index are linked in July 1937. Postwar black-market price and CPI are linked in 1950. Wartime black-market price and postwar black-market price are linked in November 1945. Items in each price index differ. See Appendix (1) for details.

Sources: MOF (1978), BOJ (1968), Ohkawa et al. (1967), Toyo Keizai (1954), MOF (1951), MOF and BOJ (1948)

Chart 4: Prices for farm households

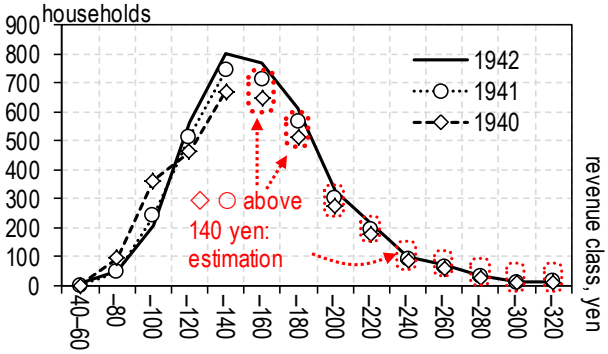


Note: The farm CPI is adjusted such that the value in 1934–1936 is equal to 1. The farm CPI in 1950–1951 is extrapolated from the farm economy survey featuring farm prices (MAF (1953, p. 18)). Farm price index is a simple average such that the value in 1937 is equal to 1. Farms' black-market price is linked with farm price index in 1942. For details about overlapping items, see Appendix (1).

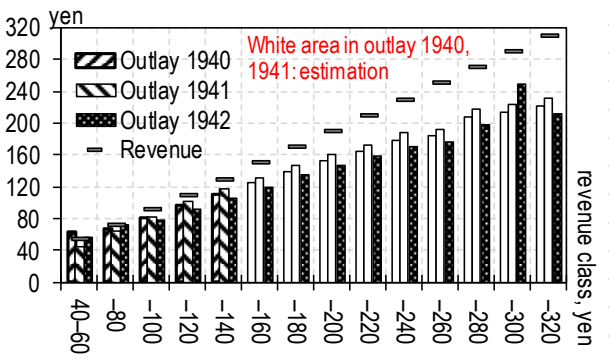
Sources: *Farm Price Report* in each year (MAF and IAA (1941, 1942, 1943), MAC and CAA (1944), MAF and NAA (1946, 1947), MAF (1950a, 1950b, 1953)); NAA (1948)

Chart 5: Upward revision of outlay in 1940 and 1941 based on the 1942 survey

(1) Number of households per revenue class

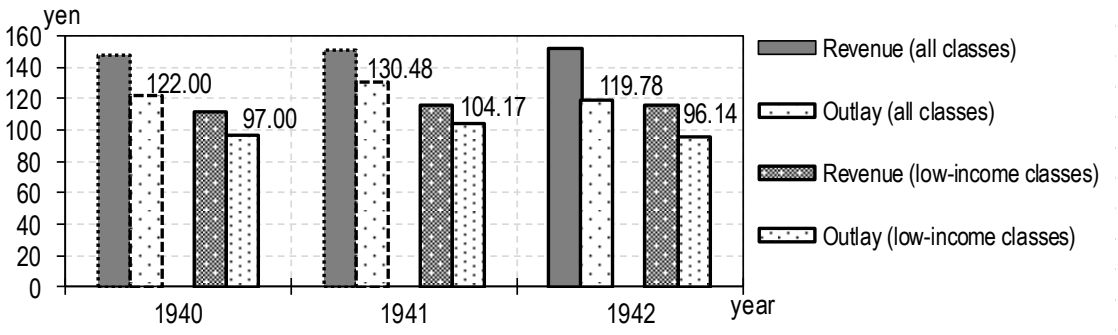


(2) Outlay per revenue class



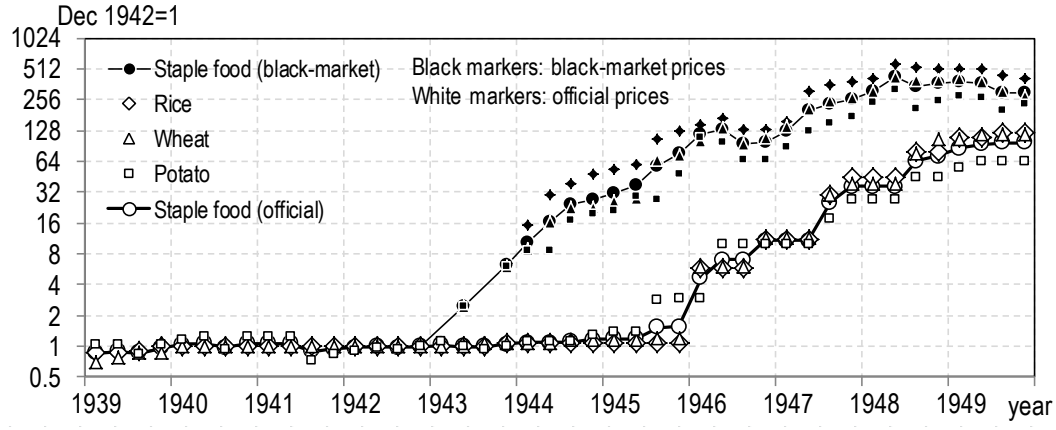
Note: In Chart (2), outlay in 1942 for the revenue class of 300–320 yen was very high relative to adjacent classes. The original outlay in 1942 for the class is shown, although the number of households is only 12 and hardly affects the weighted average of the total. Outlay of that class in 1940 and 1941 is estimated consistently with adjacent classes.

(3) Revision of outlay in 1940–1941 (weighted average across income classes)



Note: The bars marked by broken lines in 1940 and 1941 are estimated values.

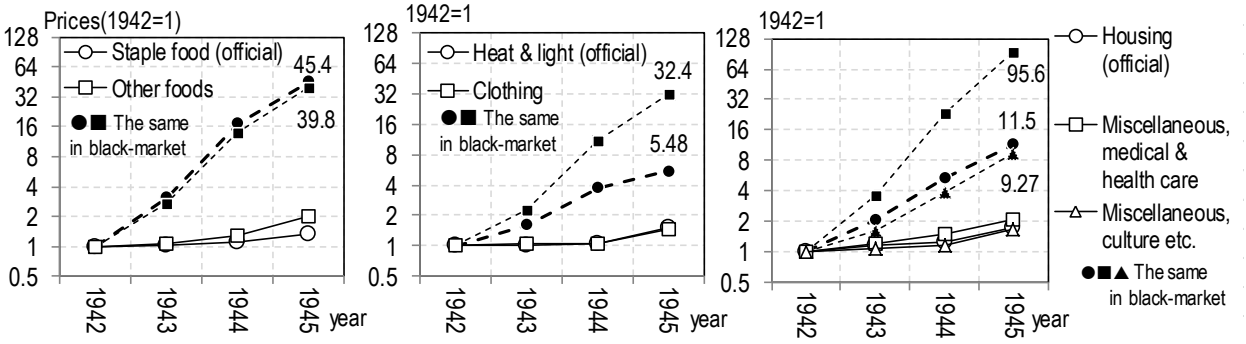
Chart 6: Official and black-market prices of staple food for urban households



Note: Official and black-market prices are adjusted such that indexes are equal to 1 in December 1942. Black-market prices for retail are available quarterly (March, June, September and December except November 1944). Data in June 1943 are interpolated.

Sources: USSBS (1946), Cohen (1949), MOF and BOJ (1948), MOF (1951, 1978), BOJ (1968)

Chart 7: Prices of official transactions and on the black market by item group



Note: As for the item's name in each group, see Appendix (1). Official prices and black-market prices at the group levels are aggregates of those at the item levels by a simple geometric average. Black-market prices are linked with official prices in 1942. Some item prices are imported to a group with insufficient price quotations of items (potato to staple food, as well as matches, iron kettles and umbrellas to other miscellaneous). Black-market prices in retail start from December 1943, and prices in June 1943 were interpolated from those in December 1942 and December 1943. Prices are mainly quarterly, due to the frequency of black-market prices. Yearly data is the average of quarterly data, and quarterly data is the average of the start and the end of the period (for example, the average of the previous December and March as a proxy for the first quarter, and that of September and December as a proxy for the fourth quarter).

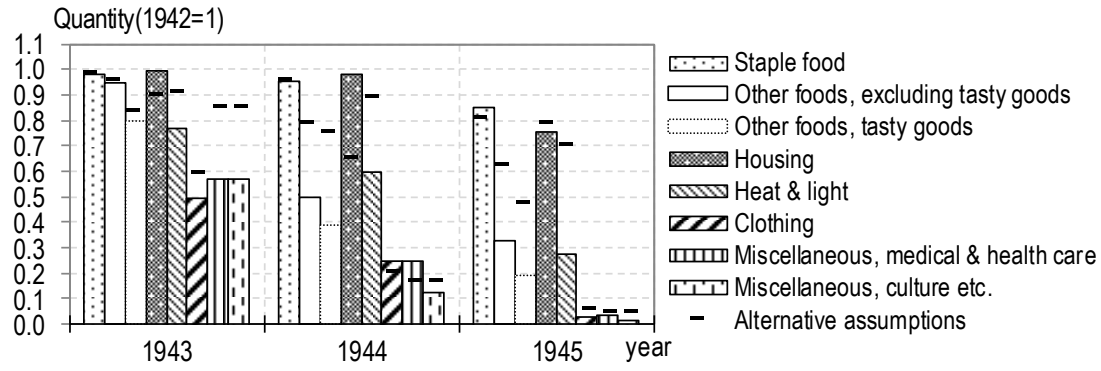
The group "heat & light" accounts for more than 50 percent (57% in prewar or 53% in postwar) of official charges in the group's weight of CPI, and "miscellaneous" for more than 30 percent (39% in prewar or 35% in postwar) in a similar manner. Then, black-market prices of items without charges ($k1$) and official prices of items with charges ($k2$) are aggregated into black-market prices of group k, using both prewar and postwar weights under Irving Fisher's ideal formula.

For housing, indexes (for official prices and black-market prices) are compiled from the weighted average of construction costs and urban land price index (proxy for rents) by using weights (43.5 : 56.5) obtained from those in the prewar and postwar CPI. Construction costs are aggregated from the prices of six items (zinc, wire, nail, tile, hand cart, cement) available at farm prices and farms' black-market prices by a simple geometric average. It is assumed that black-market rent was exceptional (or reflected in higher construction cost).

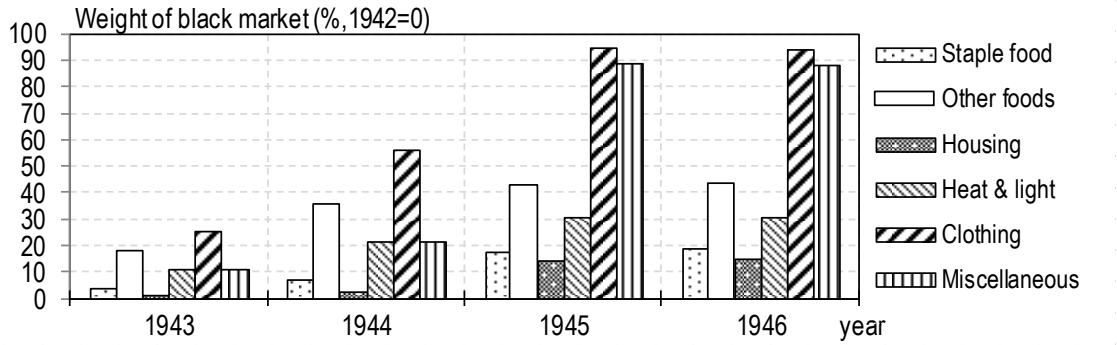
Sources: USSBS (1946), Cohen (1949), MOF and BOJ (1948), MOF (1951, 1978), BOJ (1968), Statistics Bureau (1956), *Farm Price Report* (forecited), NAA (1948)

Chart 8: Quantities and weights of the black market by item group

(1) Quantity in outlay



(2) Weight of black-market transactions



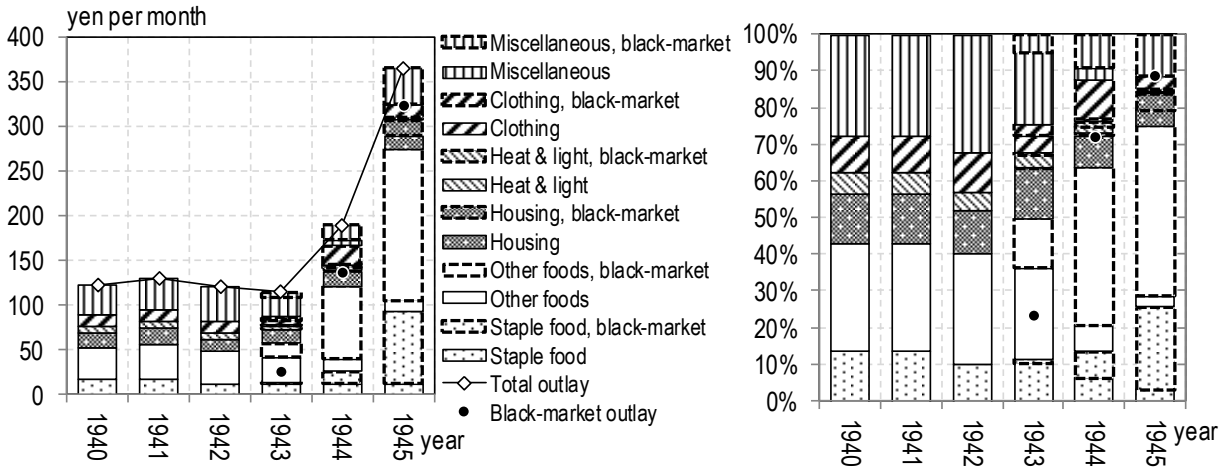
Note: See Appendix (2) for details regarding the quantity purchased for each group and weight of black-market transactions, from 1942 to 1945. Weights of black-market transactions in 1946 are observed in staple food and extrapolated for other groups based on the year-on-year change in staple food. For the alternative assumptions, see Section 4 (2) c and Appendix (3).

Sources: Ohara Institute (1964), Cohen (1949), USSBS (1947a, 1947b)

Chart 9: Nominal outlay of urban households and its share of item groups

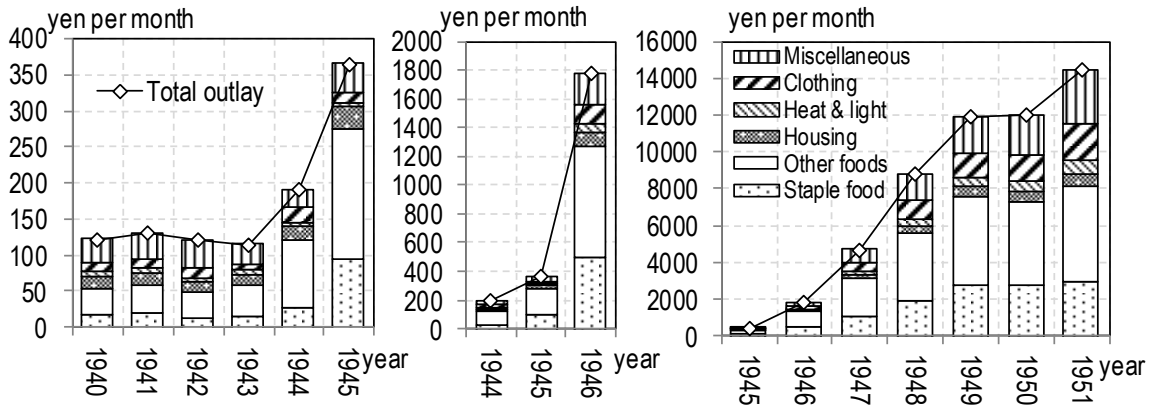
(1) Nominal outlay on item groups

(2) Share of item groups



Note: Areas marked by thick broken lines show group outlay on black-market transactions. Areas marked by thin solid lines denote group outlay at official prices.

Chart 10: Nominal outlay of urban households in the 1940s



Note: Data from 1946 are from the Statistics Bureau (1956, 1964). Among items at the group level, tobacco in miscellaneous in postwar is moved to other foods with the subgroup "tasty goods" following the prewar definition. Some items aggregated in other foods and miscellaneous in 1946 are divided in proportion to 1947 values.

Chart 11: Share of item group in nominal outlay

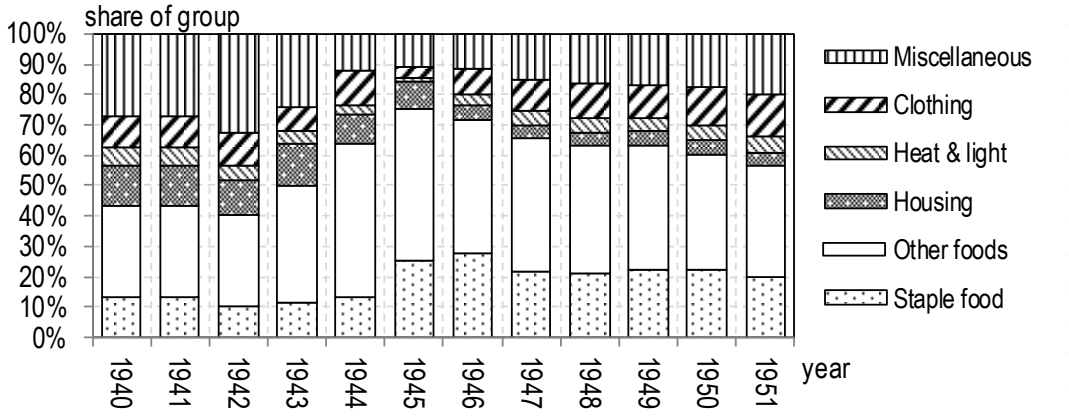


Chart 12: CPI of each item group for deflating nominal outlay of urban households

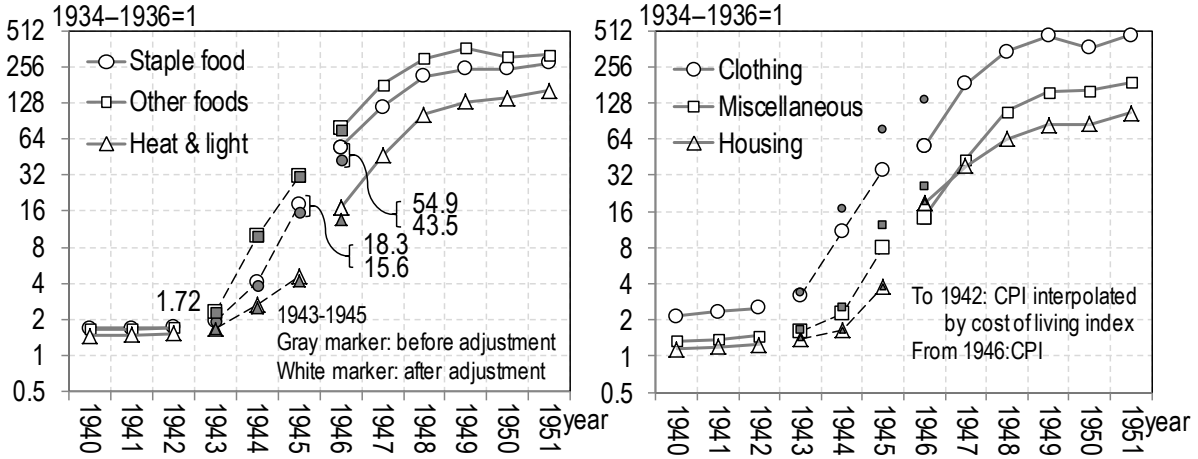
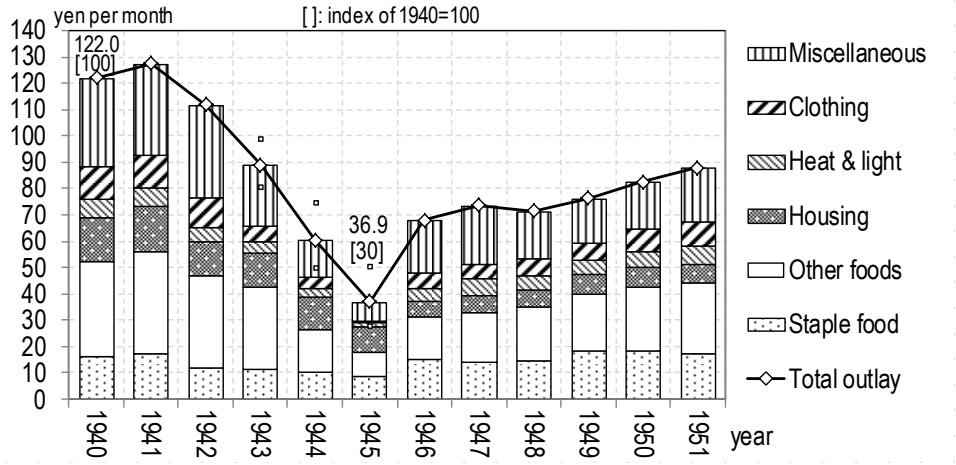


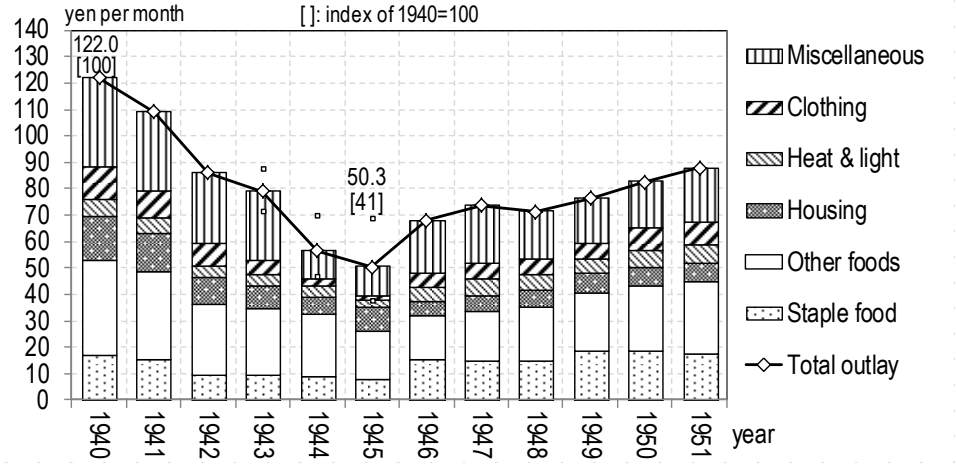
Chart 13: Real outlay of urban households on each item group



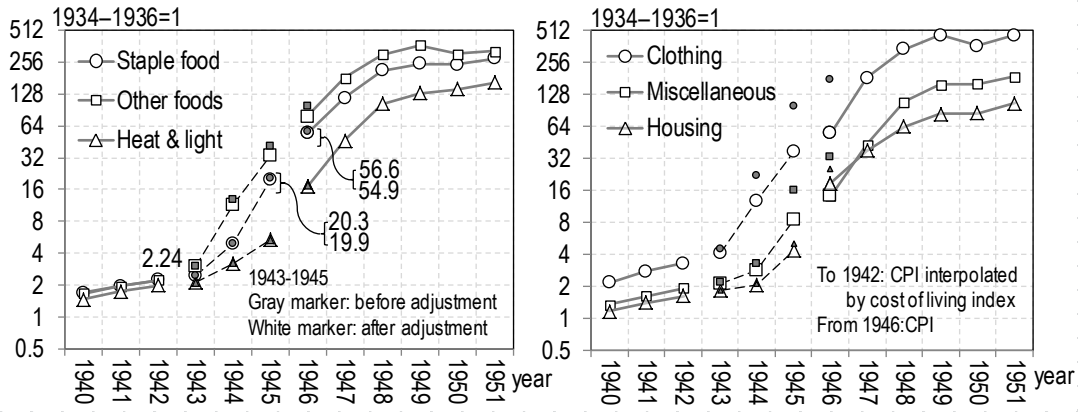
Note: White diamonds indicate the estimate under the benchmark assumption. Small white squares indicate the upper and lower variation of real outlay from 1943 to 1945. For a variation of outlay, it is assumed that prices had a 10 percent shift either upward or downward per year from 1943 to 1945 cumulatively. If this had occurred, real outlay would have been 25 percent higher or 37 percent lower than the benchmark, due to the price index in 1945 varying from $0.9^3 = 0.729$ times to $1.1^3 = 1.331$ times the benchmark.

Chart 14: Real outlay and CPI of item groups under the alternative assumptions

(1) Real outlay of urban households

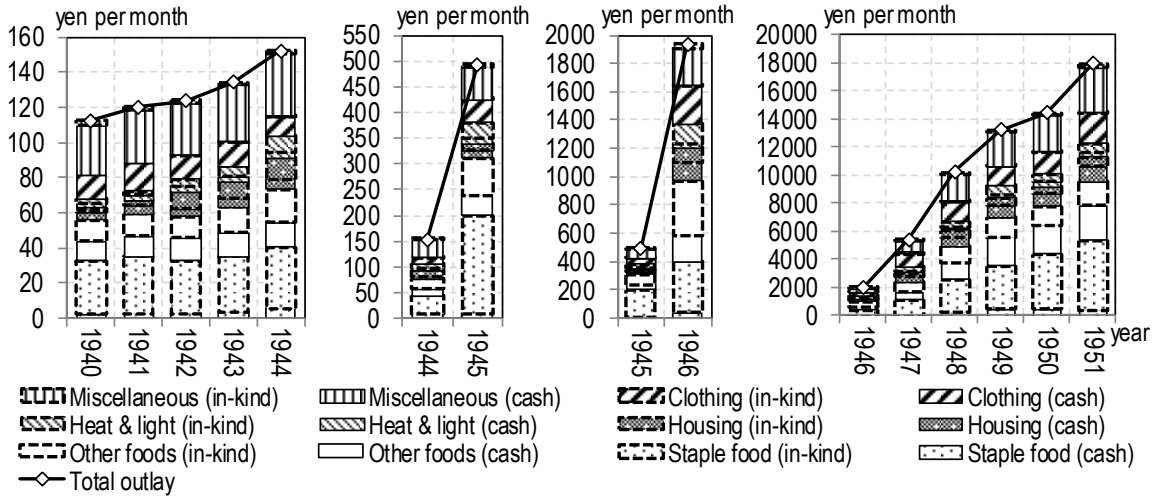


(2) CPI of each item group under the alternative assumptions



Note: Regarding the alternative assumptions, see Section 4 (2) b and Appendix (3).

Chart 15: Nominal outlay of farm households



Note: Areas marked with a thick broken or thin solid line indicate in-kind or cash outlay, respectively. Outlay in miscellaneous is partly adjusted (tasty goods are reclassified as other foods and public dues are excluded).

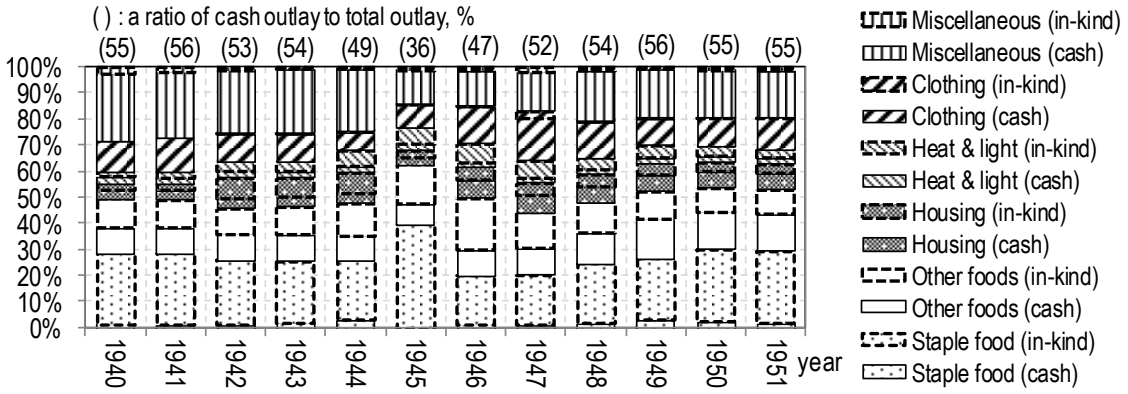
The original data of farm household outlay in 1940–1941 (farming less than 2 *cho* (≈ 20,000 m^2)) is revised upward by 5 percent (for example, outlay in 1940 from 107.29 to 112.42 yen per month), considering the enlarged sampling.

Outlay in 1942–1948 is a weighted average of outlays of farm households across size, using shares of farms across size in 1941, 1946 and 1947 as weights. For example, the survey in 1942 contains a sample of small farms cultivating less than 1 *cho* accounting for 10 percent (58 small farms among 587 farms in total), whereas the population contains small farms accounting for 64.4 percent (3,479 thousand small farms among 5,405 farms in total). Considering this, the total outlay across each farm size is recalculated from outlay for each farm size (less than 1 *cho*, 1–1.5 *cho*, 1.5–2 *cho*, 2–3 *cho* and 3–4 *cho*) using their shares as weights. For example, the original data in 1942 is adjusted 20 percent downward (from 157.08 to 123.75 yen) considering the upward bias in large farms' weight.

The benchmark assumption was that the ratio of in-kind outlay at market prices was 15 percent in 1945 and 5 percent from 1946 to 1948, for staple food and other foods. Among the in-kind outlay of 314 yen in 1945, 184 yen corresponds to in-kind outlay at market prices. In the assumption with a higher ratio, the ratio of in-kind outlay at market prices was 20 percent for staple food, other foods and heat & light, and 10 percent from 1946 to 1948, for staple food and other foods, and in-kind outlay at market prices in 1945 becomes 215 yen. In the assumption with a lower ratio, the ratio of in-kind outlay at market prices was 12 percent in 1945 and 10 percent from 1946 to 1948 for staple food and other foods, and in-kind outlay at market prices in 1945 becomes 168 yen.

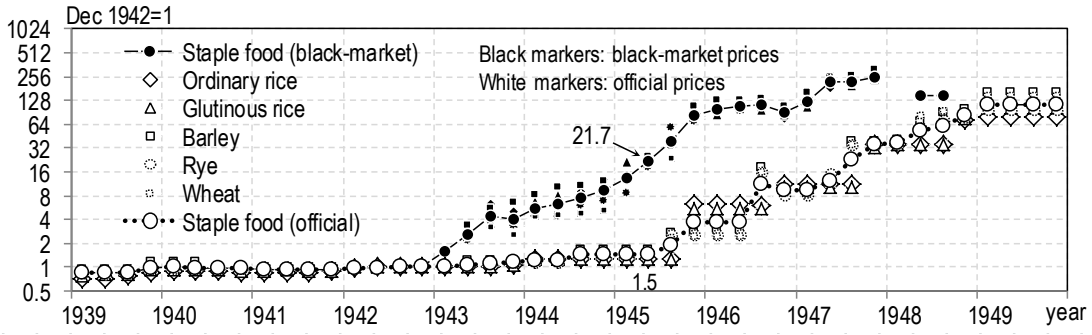
Sources: *Farm Economy Survey* (MAC (1944), MAF (1943, 1948, 1950c, 1950d, 1951a, 1952, 1954)), MAF (1951b), Umemura ed. (1963))

Chart 16: Share of nominal outlay of farm households on each item group and outlay style



Note: Areas marked with a thick broken line and thin broken line indicate in-kind and cash outlay respectively.

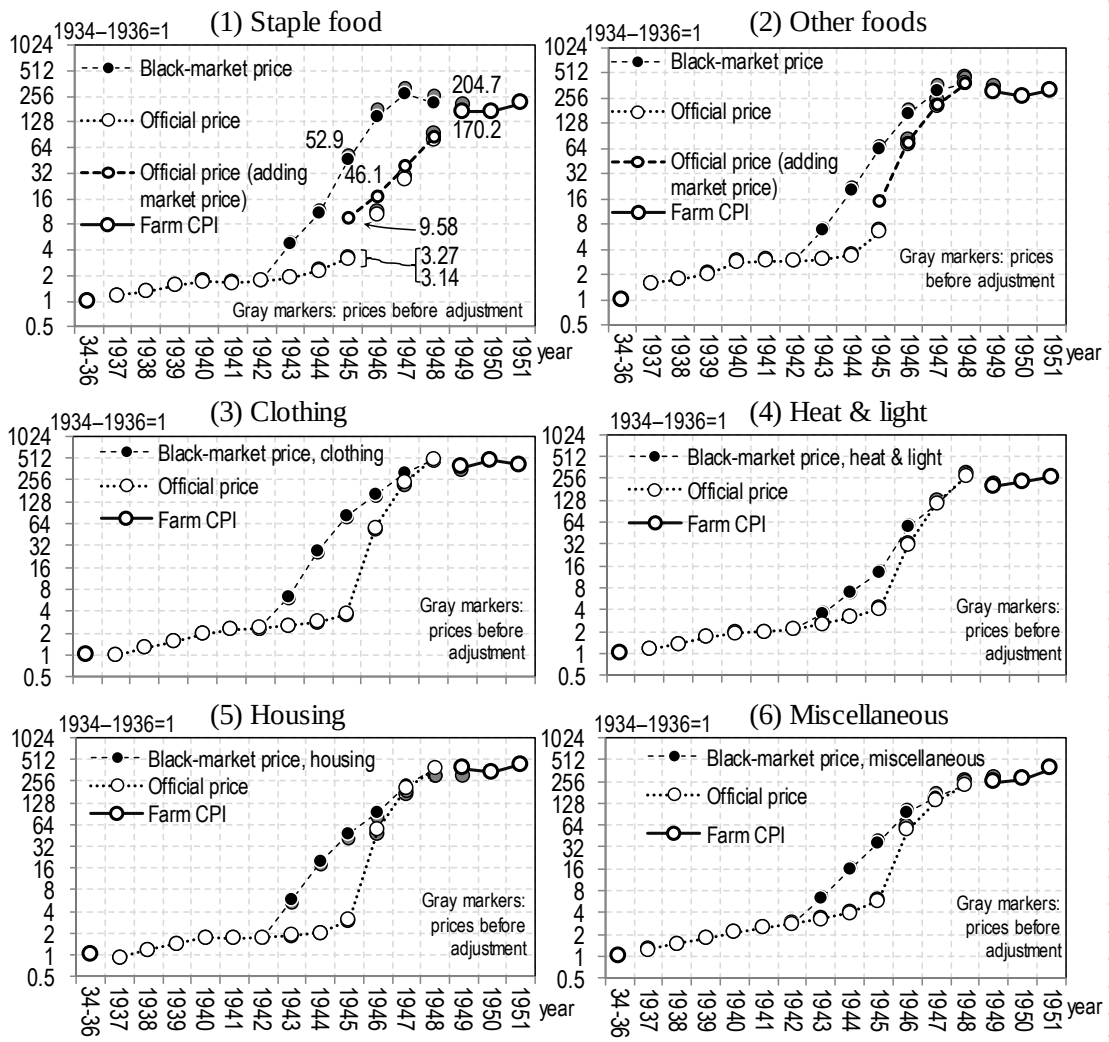
Chart 17: Official and black-market prices of staple food for farm households



Note: Prices in 1949 are farm CPI. Black-market price in 1948 is interpolated with either the geometric mean of 1947 and 1949 or the official price of 1948, whichever is higher. Quarterly data are in March, June, September and December.

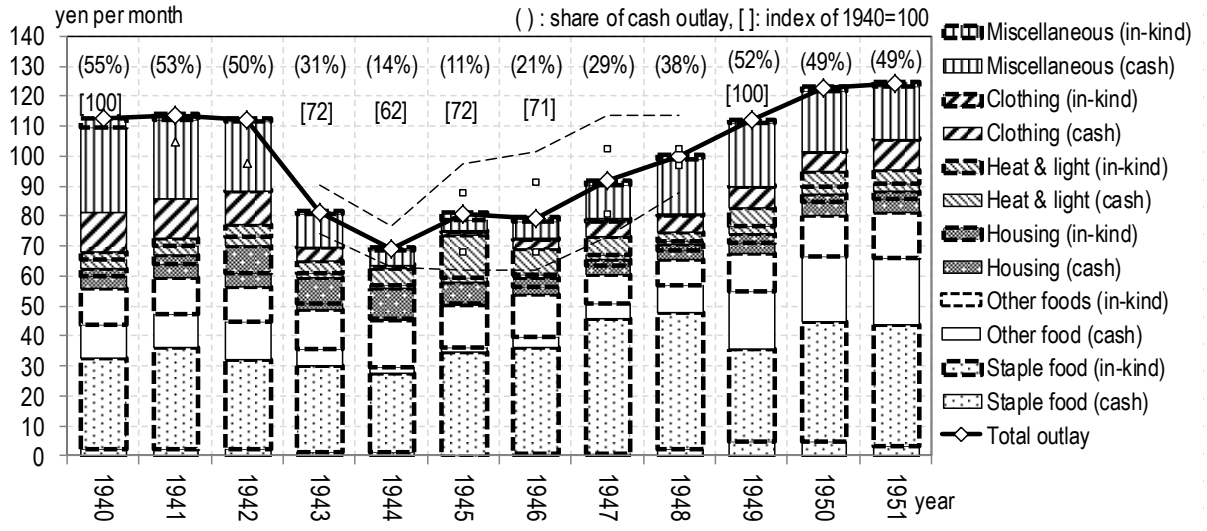
Sources: *Farm Price Report* (forecited), NAA (1948)

Chart 18: Calculation of deflators on item groups for nominal outlay of farm households



Note: Gray markers lie behind black or white markers if prices remain similar before and after adjustment. Additional adjustments in staple food and other foods (from white circles to small white circles from 1945 to 1948) are based on benchmark assumptions in the body text. Yearly data is based on quarterly data based on the average of the start and the end of the periods.

Chart 19: Real outlay of farm households on each item group

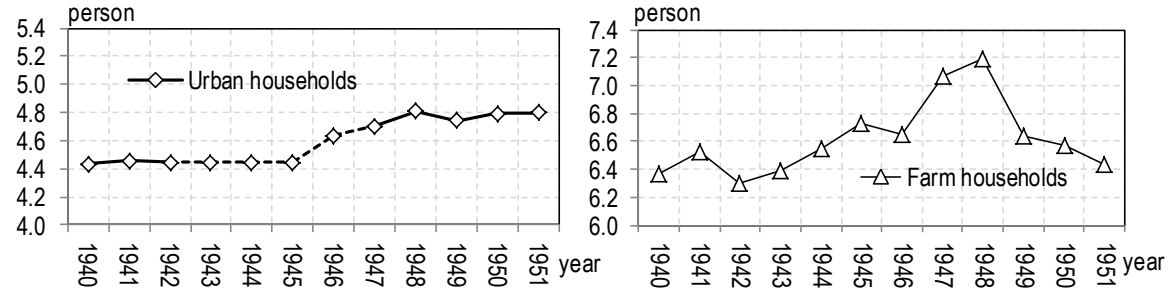


Note: Outlays are based on the benchmark assumption about in-kind outlay partly at market prices. Small white squares from 1945 to 1948 are the upward or downward shift of total outlays (assuming a lower or higher ratio of in-kind outlay at market prices to total outlay respectively). Thin broken lines from 1943 to 1948 indicate a further upward or downward of total outlay (additionally assuming a 10 percent upward or downward shift of the deflator per year respectively).

Small white triangles in 1941–1942 denote real outlay under the alternative assumptions (assuming a higher farm price by 8.3 percent in 1941 and by 15 percent in 1942). The alternative assumptions do not affect the years other than 1941–1942 (because nothing is assumed about the quantity in farm household outlay and the assumption about black-market transactions affects only the years 1941 and 1942).

Sources: Author's calculation, based on *Farm Economy Survey* (forecited) and MAF (1951b)

Chart 20: Number of persons per household in urban or farm households

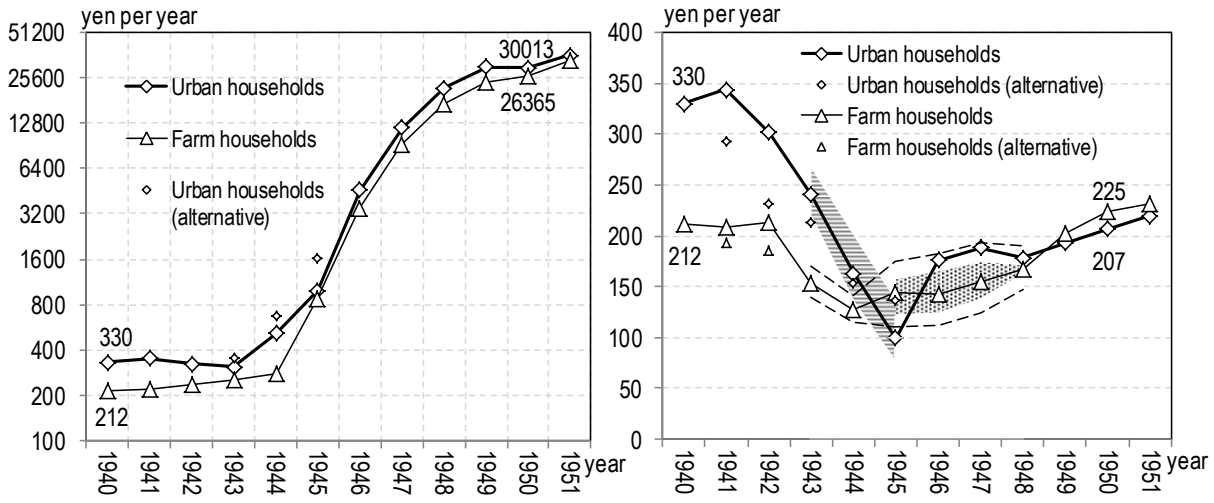


Note: Data of urban households from 1943 to 1945 the same as in 1942 are assumed. The data in 1946 are interpolated as 4.64 (about 1.4% smaller than in 1947) based on the Statistics Bureau (1949b, 1950). The former denoted data in 1947 to be unchanged from 1946, and the latter denoted persons per household in low-income classes as a 2.8% increase in 1947 from 1946. The average of both is taken.

Sources: Statistics Bureau (1949b, 1950), *Farm Economy Survey* (forecited)

Chart 21: Comparison of outlays per person in urban and farm households

(1) Nominal outlay (2) Real outlay

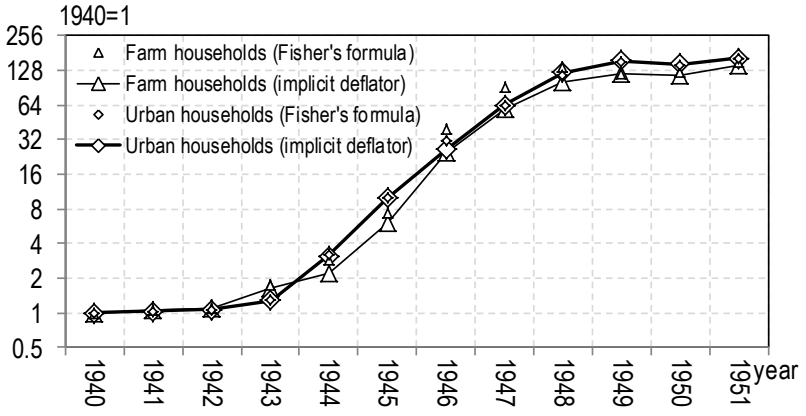


Note: For comparison, real outlay was adjusted such that it equals nominal outlay in the year 1940.

The shaded area of real outlay in 1943–1945 shows an upward or downward shift of urban households (under the assumption of lower or higher prices respectively).

The shaded area of real outlay in 1945–1948 shows an upward or downward shift of farm households (under the assumption of lower or higher ratio of evaluations at market prices of in-kind outlay respectively). The thin broken lines from 1943 to 1948 indicate a further upswing or downswing of total outlay (additionally assuming a 10 percent upward or downward shift of the deflator per year respectively). The notes in Charts 13 and 19 apply. Shaded areas under the alternative assumptions are omitted for brevity.

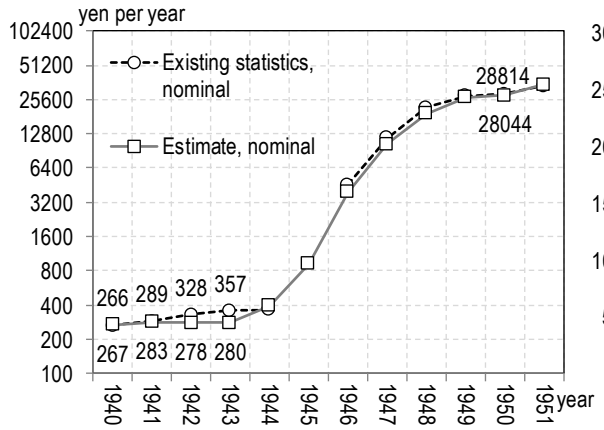
Chart 22: Comparison of prices faced by urban and farm households



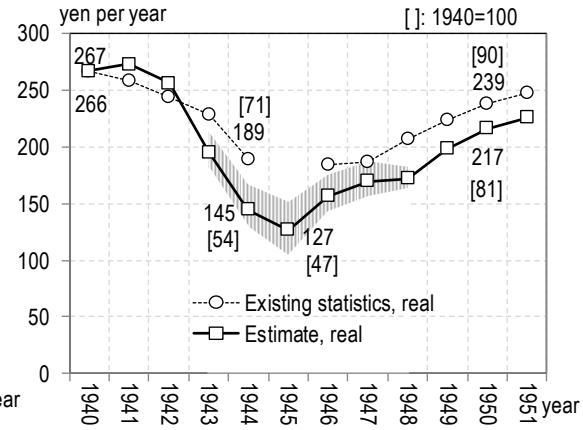
Note: Regarding prewar and postwar weights for Fisher's ideal formula, CPI weights for urban households from the Statistics Bureau (1956) and outlay in kind and outlay in cash from the *Farm Economy Survey* in 1940 and 1949 for farm households are used. The same prices of item groups as shown in Chart 12 for urban households and Chart 18 for farm households are used.

Chart 23: Household outlays per capita in existing statistics and by the author's estimation

(1) Nominal outlay, benchmark estimate

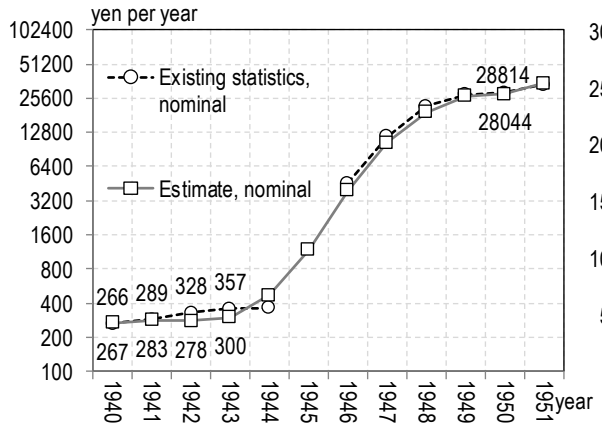


(2) Real outlay, benchmark estimate

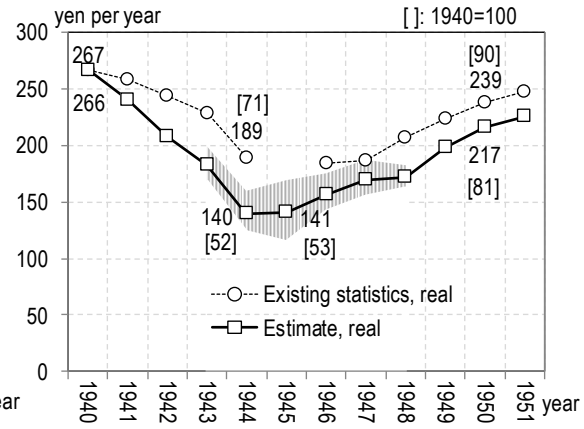


Note: The existing statistics of household consumption per capita are data of personal consumption expenditure divided by total population, using EPA (1964) and ECA (1954). The shaded area indicates a range of possible shifts under different assumptions, by taking the average of the upper and lower thresholds of urban and farm households (Chart 21 (2)) using population shares as weights. The real outlay is adjusted such that both nominal and real outlays become equal in 1940.

(3) Nominal outlay, alternative estimate

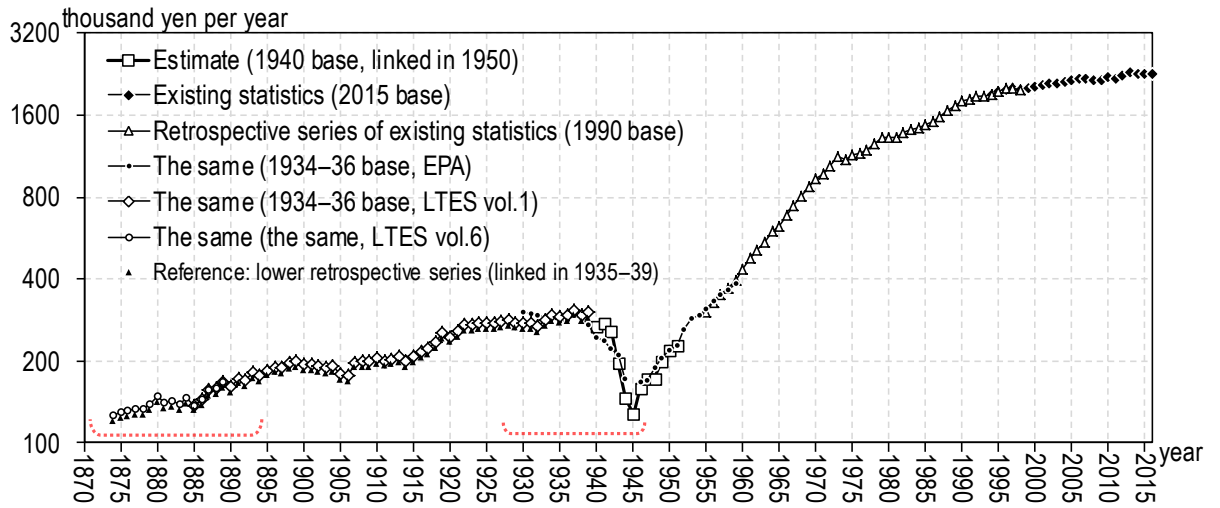


(4) Real outlay, alternative estimate



Note: For the alternative assumptions, see Section 4 (2) in the text and Appendix (3).

Chart 24: Real household outlay per capita in the super-long term

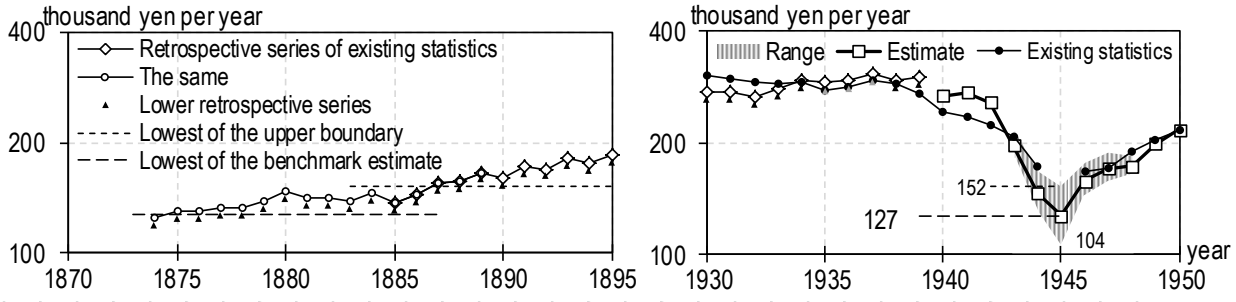


Note: The existing series of real household consumption per capita (2015 chain price base, 1990 base, 1934–1936 base of EPA, LTES vol. 1 and LTES vol. 6) are linked using the ratio of the average of two series in overlapping years (1994–1998, 1955–1959, 1930–1939 and 1885–1889).

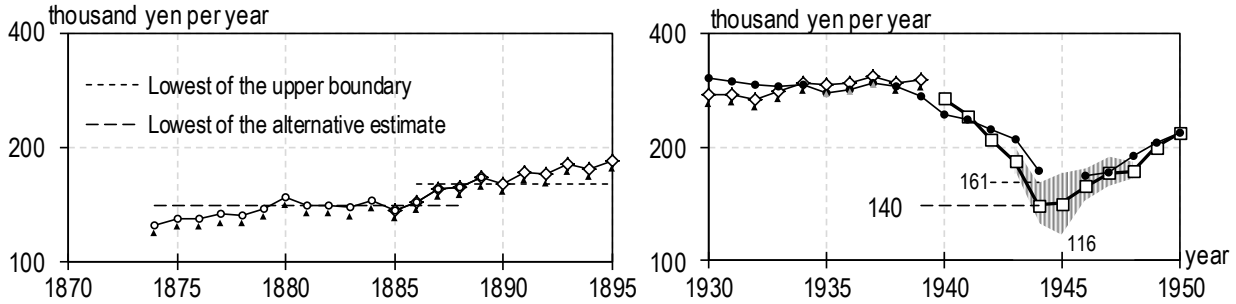
Sources: Statistics Bureau, *Population Estimates* and *Population Census*; Cabinet Office, *National Accounts*; EPA (1964), Ohkawa et al. (1974), Shinohara (1967)

Chart 25: Real household outlay per capita in the 1940s and 1870–1890s

(1) Benchmark estimates



(2) Alternative estimates



Note: For the benchmark assumptions, see the text up to Section 4 (2) b. For the alternative assumptions, see Section 4 (2) c and Appendix (3).

Appendix: Details of assumptions and data for estimation

The appendix explains the data and assumptions employed for estimation.

(1) Prewar and postwar CPI and its items overlapping with wartime items

Among the price indexes in Chart 3, many item prices of CPI in the prewar and postwar periods were often missing in the wartime period, but some of those items had both official and black-market prices. The items in prewar and postwar CPI and the items with both official and black-market prices during wartime overlapped about 20 percent in the number of items, and 40 to 50 percent in prewar and postwar CPI weights (Chart A-1).

Chart A-1: Weights of CPI and overlap between CPI and wartime prices

	CPI weight			Weight and number of items with official & black-market prices				CPI 1951 (1934-36=1)		
	prewar	postwar	number of items	prewar	postwar	number of items	items with black-market prices	prewar arithmetic	postwar harmonic	Fisher's formula
Total	10000	10000	188	5100	3884	37		274.43	237.88	255.50
Staple food	1382	1938	6	1239	1428	3	Rice, flour, potato	290.51	262.71	276.26
Other foods	2731	3947	85	909	1162	12	Beef, pork, egg, dried bonito, salt, soy sauce, miso or fermented soy paste, cooking oil, apple, sake wine, beer	346.40	302.71	323.82
Clothing	1231	1280	33	211	142	4	Common silk stuff, towel, women's socks, men's leather shoes	509.93	428.50	467.44
Heat & light	478	490	8	166	178	2	Charcoal, firewood	190.96	140.02	163.52
Housing	1883	458	17	1520	165	4	(Nail, wooden board, timber, rent)	109.85	102.80	106.27
Miscellaneous	2295	1887	39	1055	809	12		205.21	176.67	190.41
Medical & health care	915	766	16	186	213	4	Soap, pan, match, umbrella	254.04	248.13	251.07
Transportation & communication	353	233	7	352	220	6	(Fees for trolley, suburban train, long-distance train, bus, and postal service)	146.08	123.89	134.53
Culture & hobbies	829	600	8	517	376	2	(Fees for newspaper and radio)	187.45	174.16	180.68

Note: Among 37 items, 25 items had black-market prices. 12 items in housing and miscellaneous in parentheses denote items where official charges or farm prices are considered.

Source: Statistics Bureau (1956)

Similarly, for farms' price indexes in Chart 4, how items in the farm CPI overlapped those of farms' official and black-market prices is confirmed. They overlapped about 50 percent in the number of items, and about 50 percent in prewar and postwar CPI weights of farms (Chart A-2).

Chart A-2: Weights of farm CPI and overlap between farm CPI and farm prices

	Farm CPI			Weight and number of items with official & black-market prices				1949 (1934-36=1)			Ref.
	prewar	postwar	number of items	prewar	postwar	number of items	items with black-market farm prices	prewar arithmetic	postwar harmonic	Fisher's formula	same year CPI
Total	10000	10000	109	4871	5278	52		278.83	229.20	252.80	235.70
Staple food	2620	2652	6	2521	2522	5	Rice, glutinous rice, barley, rye, wheat	170.17	170.18	170.17	246.27
Other foods	2608	2868	44	1418	1552	25	Sweet potato, potato, soybean, azuki bean, cucumber, Chinese cabbage, welsh onion, cabbage, white radish, burdock, taro, egg, sardine, salt, sugar, soy sauce, oil, Rapeseed oil, dried fish for broth, sake wine (pumpkin, milk, Asian pear, orange, meat)	333.98	275.18	303.15	369.11
Clothing	1013	1191	28	184	216	6	Breached cotton, towel, thread, beaten cotton, wooden clogs (heavy-cloth shoes)	386.59	367.02	376.68	464.43
Housing	681	766	11	95	106	6	Hand cart, cement, tile, nail, wire, sheet zinc	389.78	363.29	376.30	83.54
Heat & light	526	762	6	453	657	4	Charcoal, firewood, match, candle	210.05	184.96	197.11	130.62
Miscellaneous	2552	1761	14	200	225	6	Pot, pan, rice bowl, umbrella, tatami facing (rope)	275.82	216.05	244.11	158.18

Note: Among 52 items, items in parentheses take samples from agricultural products and inputs.

Sources: MAF (1950b)

(2) Urban households' quantity and weights of the black market of item groups

The quantity and its black-market weight of each item group in 1942–1945 shown in Chart 8 are calculated mainly from the USSBS (1947a) as well as other records, and assumptions are made where the records are insufficient. Details are as follows.

Staple food and other foods: Quantity of each item group is based on the indexed data of per capita consumption per day (e.g., 444 grams of staple food in 1942 and 385 grams in 1945), in the USSBS (1947a), Tables 32, 37, 39, and the Ohara Institute (1964, pp. 145–146).

Regarding weight of black market, data in 1944 are assumed as 6.7 percent in staple food and 35.5 percent in other foods, considering the USSBS (1947a), Table 48 with 4 percent in staple food and 32.5 percent in other foods in March 1944, as well as Cohen (1949, p. 385) with 9 percent in staple food and 38 percent in other foods. Data in 1942 (as 0 percent for both) are assumed from historical records, and then interpolated linearly for data in 1943. Data for 1945 are estimated considering smaller rationing (declining by 12 percent per year).

Heat & light: Quantity of the item group is based on the indexed data of charcoal, briquette and coal, using the sum of quantities supplied for civilians in the USSBS (1947a), Table 67, and Cohen (1949, pp. 410–412).

As for weight of black market, it is assumed as the average of staple food and other foods, considering Cohen (1949, p. 410) that "… urban residents had to make time-consuming trips out of the countryside to obtain firewood and charcoal."

Clothing: Quantity is the indexed amount (in lbs.) that was actually rationed to civilians in 1942–1944 from Oishi ed. (1994, pp. 220–223). In 1945, it is estimated as 13 percent ($1 \times 0.4/3 = 0.133$) of 1944, considering Cohen (1949, p. 405) that "per-capita cloth consumption in 1944 was 3 square yards while the maximum for 1945 … would have been no more than two-fifths of a square yard per capita."

As for weight of black market, it is estimated from the shortage of points of ration tickets, decreasing from 500 points in 1942 to 220 points in 1944. For example, it is assumed that weight of black market in 1944 is $1 - (220/500) = 0.56$. As for 1945 data, the weight is estimated as 0.94 ($= 1 - 0.44 \times 0.13$) considering the reduction in rationed quantity (13 percent of 1944).

Housing: Quantity is indexed from the stock of dwelling units in the USSBS (1947a), Table 64.

As for weight of black market, it is assumed that the shortfall in the number of units was provided through black markets. For example, the number of units in 1944 was 98 percent of the 1942 level, thus assuming the weight in 1944 as 0.02. It is assumed that

the weight in 1945 was 0.14, from the shortage of units (25 percent) times the ratio of the urban population remaining in urban areas (about 60 percent).

Miscellaneous: As for quantity, the subgroup of medical & health care (common both in prewar and postwar years) and that of other miscellaneous are considered separately. The indexed quantity of medical & health care is obtained from the USSBS (1947a), Table 69 in 1942–1944, and estimated in 1945 considering the change of actual drug production from the USSBS (1947b, p. 228). As for the quantity of other miscellaneous, the same quantity index as that of medical & health care in 1942–1943 from the war situation before worsening is assumed, and also half of medical & health care in 1944–1945 of a nonessential nature relative to medical & health care or clothing.

As for weight of black market, for both medical & health care and other miscellaneous, the same data as heat & light are assumed in 1943–1944, and a higher value in 1945 considering the nullified controls and the smaller output.

As for the weight in 1946 in Chart 8 (2), it is obtained from actual data for staple food, and extrapolated data for the other item groups using the change in staple food from 1945. These weights are employed for adjustments in Chart 12.

(3) Alternative assumptions

As for the alternative assumptions forecited in Section 4 (2) c as well as Charts 14 and 8 (1), the details are examined below.

a. Degree of prevalence in black-market transactions

Under the alternative assumptions, it is assumed that black-market transactions prevailed from 1941 instead of 1943, considering that Morita's retail price index in 1941–1942 increased higher than official retail prices. Under this assumption, unobservable CPI was higher than the cost of living index in 1941–1942, consistently with the year-on-year rate of Morita's retail price index (16.6 percent in 1941 and 30.1 percent in 1942). This rate is employed for all item groups because Morita's index is not available for each item group (Chart 14 (2)).

Meanwhile, the year-on-year rate of Morita's retail price index in 1941–1942 was not necessarily consistent with materials such as the Statistics Bureau (1956), NAA (1948) and Cohen (1949) cited in Section 3 (2) d, and Morita (1963) himself noted that the favorable war situation in 1942 tamed inflation. At the same time, the alternative assumptions are useful for assessing the solidness of the benchmark assumptions.

b. Quantity index of urban households in 1943–1945

It is assumed that the development of staple food, other foods, heat & light and clothing in 1943–1945 from 1942 follows the quantity indexes by Nakamura (1989). For housing

and miscellaneous which are unavailable in Nakamura (1989), quantity indexes of item groups are estimated such that the index is consistent with the nominal outlay of the EPA (1964) from 1942 to 1944 (with 1945 interpolated from adjacent years) and the price index of item groups estimated in the text. The thick black dashed markers in Chart 8 (1) show the development of quantity indexes of item groups under the alternative assumptions in 1943–1945. As for the quantity index of the alternative assumptions in comparison to that of the benchmarks, it is similar in staple food and clothing, is moderately higher (twice in 1944–1945) in other foods and heat & light, and has small differences in housing and miscellaneous (except a 30 percent lower value in housing in 1944 and a 50 percent higher value in miscellaneous in 1943). A lesser decline of quantity under the alternative assumptions is primarily in other foods. As for weight of black market, the same values as the benchmark assumptions are used, because no alternative materials are available.

Although various records were researched, there appear to be no data directly gauging household outlay in the 1940s when a discrepancy existed between output and outlay.[70]

Under such circumstance, Nakamura (1989) calculates the indexes of supply per capita for consumer items consistently over the prewar, wartime and postwar periods. Nakamura (1989) also employs the indexes to show the worsening of civilian living standards. Meanwhile, it should be noted that (i) the index was calculated indirectly from data such as production and military demand, not from household outlay directly, and that (ii) the index may differ significantly when erosion to the black market and consumption of hidden stocks were large. In this regard, the USSBS (1947a) also relies on supply statistics, but obtained the support of many contemporaneous staff for reflecting the reality of household outlay at that time. Therefore, the USSBS report is employed for the benchmark assumptions in the text.

[70] For example, one might consider the usage of calorie intake per person as a proxy for staple food and other foods. Data exist in a survey from 1946 (National nutrition survey by the Ministry of Health and Welfare, also available in MAF (1976)) containing several thousand samples. Other data are available from the Economic Stabilization Board (1947, 1952) and MAF (1976) as estimates from macro data such as national food production and net exports, over the prewar (except 1940), wartime, and postwar periods. But, 1946 values significantly differ by 30 percent between the survey data (1,903 kcal) and macro estimate (1,448 kcal). The two series have different trends especially for the data in 1945 and 1946. Thus, calorie data are not employed.

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