

Survey of Various Long-term Estimates of Japanese National Income

Harry T. Oshima

INTRODUCTION¹⁾

An interesting shift in the orientation of American economics in the post-war years has been the increasing preoccupation with problems of economic growth or development. In a short span of years, this study has come to occupy an important place in American economics, even tending to rival cyclical studies. In this field, the study of foreign economies has come to assume a central position, with particular emphasis on countries like Japan which have undergone rapid development in the past half century.

There are a number of estimates of the national income of Japan for the early decades. The rates of growth computed on the basis of these estimates differ considerably, resulting in much confusion amongst students of economic development. It is the purpose of this paper to examine critically these estimates as measures of economic growth. We will be concerned with those defects in the estimates which affect significantly and substantially the long term trends. In the first part, the estimates of Prof. Yuzo Yamada will be discussed and in the second part, other estimates will be considered.

1) This paper is a revised version (condensed) of an earlier paper presented in April 1952 to the Conference on Economic Growth held in New York City. The Conference was sponsored by the Committee on Economic Growth of the Social Science Research Council.

Section I. PROF. YAMADA'S ESTIMATES

His estimates are found in *Nihon Kokumin Shotoku Suikei Shiryo* (Toyo Keizai Shimpou Sha, 1951). This book contains a most useful summary of nearly every estimate made of Japan's national income. In addition, the author makes his own estimates of national product, income by type of payments (1919—1949) and expenditures (1913—1949). The book offers a great deal of explanation on the sources and methods used.

The discussion in this paper will be confined to his national product estimates which begin from 1875. The author's own English translation for the aggregate is "national income produced." For those familiar with the national income concepts used by the Statistical Office of the United Nations, it will be readily recognized that national income produced comes very close to the designation net geographical or domestic product at market prices. That is to say, goods and services are valued at prices inclusive of indirect taxes minus subsidies, and property incomes paid abroad are included, while those received from abroad are excluded.

For agriculture, fishing, mining and factory industry, gross value of production is first estimated, and then various expenses of production are deducted in order to arrive at the net value added. For the other half of the economy, non-factory industry and other (in-

cluding construction, transportation, communication, trade, finance, professions, public service and miscellaneous), the number employed is multiplied by average earnings.²⁾

AGRICULTURE, FISHING, MINING AND FACTORY INDUSTRY

Gross Value of Production

The gross value data for the earliest years seem to be unsatisfactory in several respects. From 1878—1918, the Agriculture Ministry's estimates cover only rice, barley, tea and cocoon production. The series for fishing begins from 1903, and that of mining from 1898. For factory production, the data begin from 1875, but from 1875—1877, only four series are included. The important textile series, together with the metal series, begins from 1878, while wood, printing and machinery begin from 1879, 1886 and 1880, respectively. Partly for these reasons there is a doubling of the gross value totals between 1877 and 1878, and two years later a doubling again.³⁾

More serious than the above is the question: how complete is the coverage of production for the years after these series begin, particularly for the period before 1910 or even 1920? The movements of the series for the earlier years are extremely erratic and suggest the need for a close examination of their underlying data. A comparison of these figures with export statistics tends to cast some doubts on their completeness. Manufactured goods exported amount to about 20 to 30%

2) The discussion below will be confined chiefly to the estimates of the Meiji period as those of the later periods do not seem to present insurmountable problems.

3) Except for agriculture, the author does not adjust for these deficiencies. For agriculture, a constant percentage (41.5%) is applied to the gross value of rice to estimate the amount for the other products. This percentage was obtained from data for the period, 1920—1930.

of gross value of factory industries in 1875, or roughly 7 to 10% of both factory and home industries. This appears somewhat large for the period around 1875 when foreign trade had not developed extensively. Or, for textiles, the export value of silk alone amounts to 96% of the gross value of textile industries, and one third of both factory and home industries in 1878 and 1879. For 1875, the export of porcelain and earthenware is 44% of the factory gross value of ceramics as a whole. Gross value of tea produced in 1880 is 5.1 million yen, while the gross value of tea exported in the same year is 7.5 million yen.⁴⁾

Further, to what extent do they include the output of peasant households in their supplementary and subsidiary activities?⁵⁾ Probably more so in Japan than in other countries, these activities are a vital part of the peasant's livelihood since minute land holdings force the peasants to supplement their meager earnings from the soil. No doubt, some of the products of these activities are included in the gross value series, (e. g. sericulture in textiles). But a substantial amount does not appear to be included. Examples of such output are:

1. Fish caught by peasants chiefly for their own consumption. Also shellfish, seaweed and the like.
2. Food gathered from the forests, such as mushrooms, bamboo shoots, fruits,

4) Yamada, *op. cit.*, p. 156 and *Financial and Economic Annual*, Finance Ministry, Tokyo, 1901, p. 46. Also for the same year, the physical quantity exported exceeds the quantity produced as reported by the Agricultural Ministry. See S. Hijikata, *Nihon Keizai Kenkyu*, Appendix volume, p. 83.

5) For a detailed discussion of this point for the U. S., see S. Kuznets' forthcoming study, *Long Term Changes in the National Product of the United States of America since 1870*.

nuts, etc.

3. Wood for firewood, charcoal and construction.
4. Hunting of birds, etc., during off-season.
5. Weaving of cloth, making of baskets, mats, slippers, hats rope, lanterns, etc.
6. Making of tubs, boxes, barrels, household furniture, kitchenware, pottery and other ceramics.
7. Making of foods, such as oils, *shoyu*, *miso*, etc.
8. Construction and repair of dwellings, wells, etc.

In the course of development, the self-sufficiency of peasant households declines as specialization of occupation and of industry, and commercialization increase. Formerly, the peasant was a jack-of-all-trades; now he finds less time for subsidiary activities. With increasing industrialization, he finds it cheaper to buy fish, charcoal and urban manufactures and services such as transportation and agricultural processing. In addition, with the development of new products, the peasant soon discovers their superiority over the old, and he proceeds to replace, for example, natural fertilizers with synthetic fertilizers, firewood with kerosene.

There is little doubt that Japan went through these transformations in the course of her development. Should this be the case, the resulting upward bias, due to what Kuznets terms "a shift of production from the unrecorded sphere of the family and the household to the recorded area of organized business and the public" must be of major proportions.

Statistically, it is extremely difficult to include output of the type mentioned above, not only for Japan but for all countries during the infancy of their development. Even in the estimates of underdeveloped countries

of today, most of these activities are not included.⁶⁾

Deductible Expenses of Production

Prof. Yamada is aware of the unsatisfactory nature of the basic data for the early years. For agriculture, for the first decade the average ratio between net value and gross value is estimated to be 78%, while for the years around 1930, it is estimated to be 70%.⁷⁾ It would seem that the ratio for the early years is on the low side. Off hand, 90% would be more reasonable. It should be remembered that the items to be deducted from gross value are not necessarily all expenses of production. Generally speaking, aside of seeds, they are purchases from other sectors insofar as these purchases are already included in the gross value of the other sectors. Inputs which are taken from production within agriculture and not included as part of its gross value need not be deducted. E.g., tools and equipment made by the farmer, from construction work, fertilizer such as grass, human manure, etc.

Agriculture in Japan during the '70's, '80's, '90's, and even thereafter was largely subsistence; it would seem that only a negligible portion of input, fertilizer, tools, etc., came from the outside. With the changes in the structure toward more and more commercial crops and greater specialization, there would be a tendency for the net value ratio to decline more than the amount shown in the

6) The suggestion might be advanced that rates of growth for all countries be estimated net of such output. However, the proportion of such output in the early periods of development is not the same for all countries. For countries like Japan, it is probably larger than for most Western countries.

7) The 70% is based on the sample surveys of the Agriculture Ministry and also the Cabinet Bureau of Statistics. It appears to be reliable.

estimates during the course of the half century. (Offsetting this tendency, only in part, would be the effect of increasing productivity.)

For mining from 1898—1929, for salt production from 1904—1939, for fishery products from 1903—1918 and manufactured sea products from 1903—1938, constant net value coefficients are applied to gross value. Since specialization, commercialization and the introduction of machinery have proceeded rather rapidly in these fields, it would appear that the use of constant net value coefficients for long stretches of time will understate income in the early period.

In factory industry, 40% is assumed for 1875—1929 and thereafter (except 1941 and 1942) varying percentages ranging from 38.7 in 1940 to 28.9 in 1937 taken from Factory Statistics. The impact of economic development on these percentages is probably different and more complex for factory industry than for agriculture. In the short run, the fluctuation in prices is important for both agriculture and factory industry. But for the long run, which is the relevant period under consideration, the chief factors affecting the ratios are probably changes in the relative importance of different types of industries, the changes in the degree of vertical combination and the increase in productivity. (Unlike the situation in the previously discussed industries, it may be permissible to assume that in factory industries, changes in commercialization and specialization are negligible.) As to the first factor, factory industries differ considerably in the degree to which they are material-using relative to labor-using. The Statistics Bureau's 1930 study indicates that in Japan, food and textiles are more material-using than labor-using, compared to other

industries and, therefore, have the lowest net value ratios, 28% and 18%, respectively.⁸⁾

It is difficult to see why Prof. Yamada has assumed a higher ratio for the earlier decades than for the later ones. As his table on page 56 brings out clearly, the decline in the relative importance of low-ratio industries such as textile and food would lead one to expect a rise in the ratio in the course of development as far as the first factor is concerned. Further, if it is assumed that the degree of vertical combination of establishment takes place increasingly in the course of development, this will imply a reduction in the number of inter-plant sales of raw materials with little or no change in wages paid out, so that with gross value constant, the net value tends to rise. Finally, assuming increasing productivity, the reduction in the costs of materials relative to the sum of labor and capital costs would lead one to assume a further rise in the net value ratio.

HOME INDUSTRIES AND THE REST OF THE SECTORS

The bases for the estimation were statistics of labor force and earnings. The gaps in the information on earnings are so great that the results are very conjectural.⁹⁾

The labor force data used by Prof. Yamada were taken from the *Shakai Seisaku Jiho*, Sept. 1929 issue. On examination, these data for manufacturing, trade, professions and public service, and miscellaneous, show an amazingly

8) In industries where the use of fixed capital is enormous relative to the use of material, as in gas and electric, the ratio appears to be materially affected by the extent of fixed-capital use.

9) Earnings per employed in home industries are based on earnings as computed from the factory sector. Earnings in the remaining sectors are taken from the official 1930 study and extrapolated backward to 1875 on the basis of price and wage indexes.

constant increment each year from around 1828 to 1920. For manufacturing,¹⁰⁾ each year there is an increase of about 100 thousand, for trade the increase is exactly 51 thousand and for miscellaneous, about 7 thousand. For the other two sectors, transportation and domestic service, the annual increase differs somewhat from year to year. In no case, from 1878 to 1920, is there a decline. These figures are not plausible and their use in the estimation may throw off considerably the estimates for these sectors.

Finally, taking the estimates as a whole, one may briefly make the following remarks. The use of production data for the primary sectors and employment data for home industry and tertiary sectors may cause duplications and omissions. To the extent that those employed in home industry and tertiary sectors do agricultural work during part of the year, the value they produce in agriculture are already included in the gross value data. And if the income of these individuals is estimated on the assumption that they are employed in home or tertiary industries full time, there will be duplications. On the other hand, to the extent that farmers and other primary workers are employed part of the year in home and in the tertiary industries, the value thus produced is not included in the income of these industries. Do these omissions and duplications roughly cancel off? And if they do not, is the excess of duplications over omissions apt to be greater or less in the course of Japanese history?

ESTIMATES IN CONSTANT PRICES

The author uses the Bank of Japan Tokyo wholesale price index as deflators, except for

10) Income in home industry is estimated by deducting the number occupied in factory industry from the total occupied in manufacturing.

the period 1875—1886. The approximate adequacy of the deflator will depend on the extent to which the detailed product prices and their weights composing the price index match those in the national income aggregate. Without some modifications in the price index, it will be hazardous to assume they do, in fact, match.¹¹⁾

There are also questions concerning the extent to which Tokyo price movements in the long run reflect price movement in the other cities, town and villages, especially in the Meiji period when the national market cannot be said to have been sufficiently developed. Without a national market, the relationship in the price movements of various regions may be haphazard and irregular.¹²⁾

Lastly, the percentage of the population residing in the urban areas (defined as communities with more than 10,000) more than doubled from the 1880's to the 1940's. Those who were formerly producing in the rural areas shifted their locale of production to the city. But since price levels are higher in the urban areas, their output will now be valued at higher prices. The use of an urban price index (like that of the Bank of Japan index) will probably fail to deflate out a large part of this kind of price increases.

Section II. OTHER ESTIMATES

CLARK-HIJKATA-JAPAN ECONOMIC FEDERATION ESTIMATES

Colin Clark in his book, *The Conditions of Economic Progress* (Second Edition), brings

11) Before 1931, this index is described as a "simple arithmetic mean of 56 commodities in Tokyo."

12) The writer has treated this problem in detail in an article entitled "The Price System and National Income and Product" in the *Review of Economics and Statistics*, Harvard University, Aug. 1951.

together estimates made by Penrose, Sale, Hijikata and the Japan Economic Federation, to give a series that starts from 1887. Estimates from 1930—1939 are taken from the monograph of the Japan Economic Federation, *National Income in Japan*; estimates from 1914 to 1930 are taken from Prof. S. Hijikata's, *Kokumin Shotoku no Kosei*, 1933. For the year 1887, 1897 and 1908, Hijikata's 1914 estimate for net income in agriculture and fishing (in 1925 prices) is extrapolated backward by means of an index of production taken from E. F. Penrose, *Food Supply and Raw Materials in Japan*, University of Chicago Press, 1929, and some other (unspecified) data. For non-agricultural incomes, using wage and price data from articles by C. V. Sale and G. C. Allen¹³) to estimate real wages, Clark extrapolates backward Hijikata's 1914 average income (in 1925 prices) per head of occupied non-agricultural population. These estimates are then multiplied by Hijikata's occupied population figures to obtain aggregate non-agricultural income in 1925 prices.

It will be convenient to discuss first the estimates (in 1925 prices) from 1887 to 1914. From the all too brief description given, it appears that aggregate agricultural income was extrapolated by the index of "all agriculture and fishing" to 1908, and this, in turn, was again extrapolated by the index of "cereals and fish" to 1897. How the 1887 figure was obtained was not explained. A survey of Penrose's indexes shows that the large increase registered between 1908 and 1914 is due primarily to indexes of fishing and animal products, vegetables and fruits. Though an increase of this magnitude is by no means improbable, it should also be recognized that

the statistics for these products are not as adequate as those for the cereals. One half of the series in the vegetable group begins from 1909. In fishery, while the Penrose index shows a 220% increase between 1908 to 1914, Hijikata's employment series indicates only a 38% increase. The tendency toward underreporting discussed in section I applies to these figures which are taken from the same source, and Clark recognizes the understatement for the early years. On the other hand, the method of extrapolating "all agriculture and fishing" by an index of "cereals and fish" between 1908 and 1897 may overstate fruits, vegetables and industrial crops.

Finally, since the weights used are gross value of production in the years 1921—1925, it is assumed implicitly that the ratio of net to gross was constant between 1914 to 1887. As pointed out in Section I, this assumption probably produces a persistent upward bias.

The method used in obtaining the index of real wages per worker in the non-agricultural sector is not explained. C. V. Sale's article is cited; this article reproduces the table of "average prices of commodities throughout the country", and the table of "average daily wages of laborers throughout the country." Both tables are taken from the *Financial and Economic Annual* of the Ministry of Finance, 1902 volume and thereafter. The first table gives average prices of 21 commodities and the second table, average wages of 29 occupations. In both tables, the averages are not made into a composite index. It is therefore necessary to construct both an index of money wages and an index of wholesale prices in order to obtain his index of real wages. The difficult part in the construction of these indexes would be in the selection of weights. (Further, it is not clear what weights were used

13) *Journal of the Royal Statistical Society*, 1910—11, p. 480, and *Economics*, 1926, p. 173, respectively.

to obtain the individual average prices and average wages in the *Financial and Economic Annual* tables themselves.) Without these details, it is hard to assess the reliability of these estimates.

It was pointed out in Section 1 that these average prices and average wages covered, not the whole of Japan, but mainly twelve or so of the leading cities. It thus appears that Clark's real wage index applies chiefly to the large urban centers where the increases in productivity can be expected to be very much greater than in the smaller urban centers and rural areas.

The daily wages reported in the *Financial and Economic Annual* refer only to manual laborers. They do not cover wages in commerce, professions and various miscellaneous groups, which together make up roughly one-half of the occupied population in non-agriculture. In these fields not covered, the increases in productivity are not likely to be as rapid as in manufacturing, construction and mining; and the use of the reported daily wages is likely to overstate the rate of growth in this period. The use of this real wage index for the non-agricultural population as a whole may produce a major upward bias for the period in question.

Finally, as in the case of the Yamada estimates, Clark's estimates omit the subsidiary and supplementary output of peasants discussed in detail above. In this respect, also a major upward bias is indicated.

From 1914 to 1940

The estimates for the period 1914—1930 are based on Prof. Hijikata's book, *Kokumin Shōtoku no Kōsei*. Since Clark's adjustment of Hijikata's estimates significantly affects the totals, both series, together with Yamada's estimates, are given below for three years:

(Billions of Current Yen)

Year	Hijikata	Adjusted Estimates	Yamada
1914	2.7	2.9	4.2
1919	10.7	8.8	12.8
1930	10.5	11.7	11.2

The adjusted series is presented in Clark's table as national income at market prices, while Hijikata's estimates are presented as national income at factor cost. There is no explanation on the nature of the adjustment made, but since the usual procedure in converting factor cost valuation to market price valuation is the addition of indirect taxes and the subtraction of subsidies, it may be permissible to assume from Clark's adjustment that in 1919, subsidies exceeded indirect taxes by 1.9 billion yen. This would mean that total subsidies would be over 2.5 billion yen, or about one-fifth of national income at factor cost. When compared with the total budget for the year, it is two and a half times larger. It is, therefore, important to know how such a large sum was obtained. (Possibly this may be a computational error.)

Estimates before 1919 were obtained by Prof. Hijikata by extrapolations of his 1919 results. Used in the extrapolating series were: (1) an index of gross value of agricultural production, (2) an index of manufacturing production obtained by multiplying the index of industrial production by an index of industrial prices, and (3) an index of commerce obtained by averaging the index of foreign trade and an index of "total value of bill of exchange". The upward bias in the first index has already been discussed. The other two indexes cover mainly the highly organized establishments, partly because they cater less to home consumption than do the small firms. The rates of growth of the larger establishments are usually greater than those of the

smaller ones, so that an upward bias also exists in these indexes.

Prof. Hijikata's estimates for 1919 to 1930 are carried out in great detail in his book which is a pioneer work of inestimable value to students of Japanese national income statistics. Since the book was never revised, the author had no opportunity to bring the book up to data on such matters as changes in concepts and methods, and additional sources of data since its publication (1933).

The estimates for 1930—1940 are taken from the study by the Japan Economic Federation entitled *National Income in Japan 1929—1939*. As a whole, these estimates are more or less in line with those of Prof. Yamada and of the Economic Stabilization Board.

Estimates by K. Mori of the Cabinet Bureau of Statistics

These estimates are extrapolations of the Bureau's 1925 estimate back to 1887 by means of an index based on the income taxable under the personal income tax.

The results of this extrapolation illustrate the dangers of persistent biases which, though small in the short run, cumulate into large magnitudes over a long period of time. For 1925, Prof. Yamada's total is only 7% larger than K. Mori's, but by 1887 the former's total is four times greater. The latter's estimate for 1887 is no greater than the reported gross value of rice and wheat production in that year.

One of the chief defects in the use of an index of taxable personal income is that it gives undue weight to the sectors and establishments which are growing rapidly, in contrast to those declining, remaining static or growing slowly. In the course of development, the rates of growth of different firms and sectors vary considerably. Large firms gene-

rally grow more rapidly than the small ones. Agriculture and traditional industries grow slowly and even decline, while factory industries grow rapidly. Since less than 4% of the gainfully occupied are liable under the tax, there will be a strong tendency for the incomes reported under the tax to be those of the more rapidly growing entrepreneurs and of officials of corporations.

Estimates of Growth Based on Production Indexes

An index of physical production comprising agricultural, fishery, forestry, mining and manufacturing products has been compiled by the Industrial Research Department of the Nagoya Commercial College, covering the period from 1894 to 1931.¹⁴⁾

An advantage of this approach to the measurement of growth is the elimination of valuation and deflation problems. However, the Nagoya indexes probably overstate the rate of over-all increase, the overstatement being particularly large for the earliest decades. Briefly the reasons are:

1. Like the previous estimates, supplementary and subsidiary output of the peasants is omitted.
2. A large proportion of the output of home industries appears to be omitted in the index of manufacturing output.
3. As a measure of over-all growth, the index excludes commerce, professions and other tertiary industries whose rates of growth were probably lower than the composite Nagoya indexes show.
4. The assumption is implicit in these indexes, as in Penrose's, that the ratio of net to gross output did not change throughout the years. With the develop-

14) *Hompo Seisan Suryo Shiso Soran*, Report No. 14, Nagoya, 1933.

ment of commercialization, specialization and internal exchange, the proportion of intermediate products embodied in the finished product of primary production probably increases.¹⁵⁾

CONCLUDING REMARKS

It is hoped that the foregoing discussion has succeeded in bringing out some of the major limitation in the existing estimates when used as measures of long-term growth.

It seems to this writer that the possibility of obtaining reliable measures of economic growth for the Meiji period lies in developing adequate occupational distribution data. If roughly reliable totals and major breakdowns can be had, these can be used as controlling totals, instead of production data which do not seem to cover output comprehensively.

Such figures together with all the scattered data that can be brought together on production, wages, incomes, consumption expenditures, prices, etc., and non-quantitative infor-

15) See comments on Prof. Yamada's agricultural estimates above. Also for the United States, real farm output net of intermediate products increased 20% from 1910 to 1950, while real farm output inclusive of intermediate products increased 60% in the same period. *Survey of Current Business*, U. S. Department of Commerce, Sept. 1951, p. 15.

mation of various sorts, may yield estimates capable of measuring the rate of growth of Japan.¹⁶⁾

16) Due to the very approximate nature of the figures, the discussion of fine conceptual points did not seem worthwhile. However, one may briefly say that (if statistics permit) the concept of national income of residents, rather than domestic or geographical product, appears more appropriate for the measurement of economic growth, particularly since per capita incomes will have to be calculated by use of the total resident population. Also, the duplication of output resulting from including both total government wages and salaries and output in other sectors before taxes may produce a significant upward bias. It may be interesting to attempt a division of government output into three groups: final, intermediate, and social (or general purpose). Two alternative measures of growth may be computed, one including only final government output and the other including both final and social output. See, for criteria defining each group, Carl Shoup, *Principles of National Income Analysis*, New York, 1947, Ch. 7, and paper by Simon Kuznets, "Government Product and National Income", presented before the International Association for Research in Income and Wealth in 1949 and published in the Association's *Income and Wealth*, Series I, Cambridge, 1951, pp. 178—244. Also Gottfried Haberler and E. E. Hagen, "Taxes, Government Expenditures, and National Income", *Studies in Income and Wealth*, Conference on Research in Income and Wealth, Vol. 8.