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Introduction

Quantitative profiles of Japan's economic development have long been delineated by reference to the 14-volume series of *Long-term Economic Statistics of Japan since 1868* (LTES hereafter), compiled by Kazushi Ohkawa, Miyohei Shinohara and Mataji Umemura, and their associates.[1] The series covers both output estimates and the corresponding population and employment counts from 1885 onwards, thus allowing scholars to conduct historical analysis on the basis of national income accounting. The LTES series begins with Japan's take-off into a sustained process of industrialisation, which started in a period of recovery from a serious depression caused by the new Meiji government's austerity policy taken in 1882.[2] According to their estimates, gross national expenditure (GNE) per capita grew on average at 1.6 per cent per annum for the period from 1885 to 1915, 2.7 per cent from 1915 to 1940, and 8.6 per cent from 1952 to 1970.[3] What these growth rate estimates display, says Ohkawa, is a 'trend acceleration' pattern, which lasted until 1970. The early 1970s was a turning point, after which the Japanese economy entered a phase of 'trend deceleration'.[4]

Much praise was offered to Ohkawa and his associates for their painstaking initiatives and thorough examinations of materials used for estimates. Angus Maddison, for example, took the LTES set of estimates more or less as they were for his Japanese series.[5] However, there remained two areas in which estimates are either weak or still have problems. One is with their income and output estimates, and the other relates to the sectoral breakdown of the labour force. In the former area there are several problems but the major one was the possible underestimation of agricultural output in early years. There was a debate in the 1960s on this question;[6] the focus was on per-unit-of-land rice output to be used to estimate aggregates but, in retrospect, it was a false target. Far more serious was the under-enumeration of non-rice grains. Recently, Toki Settsu, Jean-Pascal Bassino and Kyoji Fukao revisited this and a couple of other problems, whose benchmark estimates are published elsewhere.[7] This allows us to concentrate

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[1] The 14 volumes were published by Toyo Keizai Shimpōsha, Tokyo, from 1965 to 1988. Much of the work was conducted at the Institute of Economic Research, Hitotsubashi University. Ohkawa and Shinohara's *Patterns*, published in 1979, is an abridged, one-volume English presentation. Note that both the 1979 English book and the volume on national income of the Japanese series, published in 1974, do not reflect the revisions made in the Japanese volume on manpower published in 1988.

[2] For a survey of the turbulent period of 1853-85, see Saito, 'Economic history'.

[3] Calculated from Ohkawa and Shinohara, *Patterns*, tables A3, A4 and A53 (their estimates do not go beyond 1970).

[4] Ohkawa, 'Aggregate growth', p. 13. See also Ohkawa and Rosovsky, *Japanese Economic Growth*.

[5] According to Maddison's published table, the average annual growth rates for the three corresponding periods are 1.7, 2.8 and 8.8 per cent (calculated from Maddison, *Historical Statistics*, table 5c), only marginally different from the rates computed from the LTES.

[6] See Nakamura, *Agricultural Production*, and Hayami and Yamada, 'Agricultural productivity'.

[7] See Fukao and Settsu, 'Japan', n. 3, p. 101, and Settsu, Bassino and Fukao, 'Meiji-ki'. See also their earlier work: Fukao *et al*., *Regional Inequality*, especially Appendix 2.3, pp. 257-75. Note that their revision is made for the series of manufacturing output as well, which looks less spectacular than for agricultural production, but nonetheless has resulted in unmistakably lowered levels of its growth rate over the pre-World War II period.

on the latter problem, i.e. the sectoral distribution of the labour force in the period before 1940.

Its problem lies in the fact that there were many who had two occupations, i.e. principal and subsidiary, in nineteenth- and early twentieth-century Japan. While virtually all tangible products of those subsidiary or 'by-employment' activities are included in the majority, if not all, of the official output statistics, comprehensive surveys of people's multiple occupation were rare. Although institutionalisation of statistics in the Foucauldian sense was not particularly backward in Japan,[8] the first national census was taken as late as 1920 in which the census bureau did ask people if they had multiple occupations. But the published census reports were tabulated with principal occupations only; as a result, the LTES estimates of the size of the labour force and its break-down into sectors and sub-sectors were made solely on the basis of information about principal occupations. The compiler of the volume on manpower, Mataji Umemura, was well aware of the problem but what he could do was to issue a warning about potential biases to the users of his estimates.[9]

Nevertheless, Umemura's warning has been ignored by many scholars. For example, economists used a standard two-sector model to find a bottleneck in the pre-World War II growth process with the LTES employment figures as given.[10] Members of the LTES team were more cautious in dealing with their own data. Yet Ohkawa did touch upon sectoral differentials in labour productivity once. He calculated sectoral NDP (net domestic product) per worker in 1885-89, to show that labour productivity in industry was 2.4 times higher and that in service 4 times higher than labour productivity in agriculture. Ohkawa offered no attempt to explain why there existed such wide sectoral differentials, saying only that his concern was 'to examine the

[8] This owes much to Kōji Sugi who brought the science of statistics into Japan well before the Meiji Restoration of 1868 and reforms that followed. His encounter with statistical tables compiled by Dutch authorities led him to conduct a small-scale pilot census of population in the province of Suruga in 1869, sponsored not by a newly formed government but by the former shogunate family of Tokugawa. Under the Meiji administration a small Section of Statistics was created and Sugi was appointed as its section head in 1875. It was this section that carried out a more properly conducted pilot census for Yamanashi in 1879, in the hope that the government would eventually take a national census of population and occupations. However, the government's attitude was never enthusiastic. Sugi was dismissed from the government office in 1885 and the subsequent cabinets remained lukewarm to the national census. In the 1890s, however, there was a call from an international organisation: the International Statistical Institute (ISI), an institutional successor to a project launched by Alphonse Quetelet under which a series of international congresses had been organised since 1853, was planning to compile a worldwide census to commemorate the year 1900, and asked Japan if she would be interested in joining the project. Japanese leaders must have received this request as something to raise the nation's self-esteem. The tide changed. In 1902, the government issued a law allowing them to take a population census regularly, according to which the nation's first census would be taken in 1905, covering both the entire Japanese archipelago as wells as newly colonised Taiwan. In the colonial island, census taking was put into effect in the planned year. For Japan Proper, however, the plan was shelved in the wake of a war against Russia and in the post-war years implementation was further delayed until 1920. See Homei, *Science*, ch. 1, and Sato, *Kokusei chōsa*, ch. 2.

[9] Umemura *et al*., *Rōdōryoku* (Manpower), p. 161. The warnings did not appear in Ohkawa and Shinohara, *Patterns*, however.

[10] Kelly and Williamson, *Lessons*, and Hayashi and Prescott, 'Depressing effect'. It is interesting to note that Angus Maddison, another admirer of the LTES achievement, never used their LTES sectoral data.

relative changes in subsequent years', especially slower productivity increases and, hence, higher relative price rises in agriculture and services[11]. However, the wide sectoral gaps in labour productivity observed from the LTES statistics have so far been interpreted as consistent with a Gerschenkronian argument. According to that argument, a latecomer industrialiser tends to place a greater emphasis on capital-intensive (hence labour-saving) manufacturing methods, thus widening a gap between lower-productivity agriculture and higher-productivity industry.[12] Similar but more institutional arguments have also been put forward, stressing institutional barriers as a factor accounting for the continuation of a dual structure in the national economy.[13]

By implication, all these arguments assume that levels of labour input were reflected in the LTES series of labour force statistics. However, it is worth remembering that the LTES series of primary, secondary and tertiary employment over the period from 1885 to 1940 are still flawed. According to the LTES volume, the share of agriculture and forestry was overwhelming in 1885, which on the face of it indicates that Japan was totally agrarian before the onset of industrialisation under the Meiji government. It is true that as long as one confines oneself to the analysis of aggregate series with the nation as a unit of observation, the margin of errors may well be small. However, if one would like to undertake a sectoral analysis of labour productivity, the problem becomes far more serious. If, on the other hand, we can quantify the spread of by-employments in the countryside for the period in question, then the overall picture of the Meiji economy may well change with a number of implications for studies of sector-specific output and productivity growth as well as labour markets.

This chapter provides new estimates of sectoral distributions of workers on a yearly basis for the period between 1885 and 1940, by taking subsidiary occupations into account, and then link the new series to the post-World War II series of sector-specific employment statistics. Before undertaking this task, however, in section 1 we will give an overview of the course of Japan's modern economic growth and place it in a longer-term, historical context. Section 2 explains how the new sectoral share estimates are made and to what extent the results are different from the LTES figures. In section 3, with the new three-sector time series and revised estimates of GDP per capita, we will examine the levels of differentials in labour productivity between the three sectors and trace how the sectoral productivity differentials changed over the entire period between 1874 and 2010.

1. Growth acceleration and deceleration since the eighteenth century

The LTES's output and expenditure series are also superseded by new benchmark series by Settsu, Bassino and Fukao of real GDP per capita for Japan,[14] and extended backwards to the pre-

[11] Ohkawa, 'Production structure', in his *Patterns*, pp. 40-43. Calculations are made in current prices. If in constant prices, the ratios become 1.5 and 5.4 respectively. Similar tabulations are found in Nakamura, *Economic Growth*, p.24, and *Postwar Japanese Economy*, p. 159.
[12] Gerschenkron, *Economic Backwardness*, ch.1 and Postscript.
[13] For a recent, more sophisticated version of this thesis, see Hayashi and Prescott, 'Depressing effect'.
[14] Settsu, Bassino and Fukao, 'Meiji-ki', and Fukao and Settsu, 'Japan', tables 4.2 and 4.3, pp. 104

Meiji period by using another series of estimates.[15] The entire series are now linked to the Maddison Project's 1955-2010 estimates in 1990 international dollars. Table 1 sets out these benchmark estimates of GDP per capita with corresponding population totals, and figure 1 shows how Japan's GDP per capita and population size changed from 1721 to 2010.

While this new series confirms that trend acceleration did take place in modern Japan, it is also revealed that this post-Meiji trend can be traced back to a pre-Meiji era, in which the economy was more or less closed to the outside world. The average annual rate of growth in GDP per capita between 1721 and 1846 was 0.2 per cent on average, which rose to 0.4 per cent in the period that saw the country entering world trade and its political systems transformed. Much of this increase is said to have been attributable to rural-centred growth. In the subsequent periods the level of growth rate went up further and exceeded the 1 per cent mark before the outbreak of World War I, reaching 2 per cent during the 1910s. From the end of the 1880s there was a surge in the corporate sector's business activities. Since it was most marked in textiles and railways, this rise of 'modern' firms is often called Japan's industrial revolution. Until about 1920, however, not just modern manufacturing but traditional industry also grew: it was after World War I when fully-fledged industrialisation started. The post-war years saw economic fluctuations becoming volatile. Following a series of recessions in the late 1920s and early 30s, there came a brief period of high growth; thanks to the government's military build-up, the economy grew at 4 per cent in the subsequent years of the 30s (reaching the pre-World War I high of real GDP per capita in 1941). But the wartime industrial drive was not sustainable. The economy shrank with an unprecedented rate of decline in real terms. However, post-war reconstruction was swift. A growth acceleration with an overall average rate of 8 per cent started, surpassed the pre-1945 level in 1957 and kept on growing throughout the next decade. This spectacular growth process ended with the 1973 oil crisis. Since then, deceleration began. The average rate of growth declined to 3 per cent in the 1973-1990 period and then to the level below 1 per cent after 1990. While the post-1885 trend acceleration was associated with the expansion of the industrial sector, the deceleration since the 1970s was accompanied by de-industrialisation and the emergence of a service economy.

Given the upward revision by Settsu, Bassino and Fukao of output estimates for early years (their 1874 estimate is one-third higher than Maddison's for the same year), it is worth noting that the average rate of growth in the pre-1955 period should be reduced accordingly. Between 1874 and 1935,[16] while Maddison put Japan's average annual growth rate at 1.7 per cent, it now becomes 1.4 per cent according to the new estimates. This revision has some important implications. One is that the catch-up with the west did not take place during the

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and 105.

[15] Saito and Takashima, 'Estimating the shares'. This work covers the early modern period of 1600-1874. The estimates are reproduced in Bassino et al., 'Japan and the great divergence', which traces Japan's growth back to the eighth century.

[16] The following comparisons follow Maddison's periodisation, all calculated from Settsu, Bassino and Fukao, 'Meiji-ki', table A-9, p. 210, and Maddison, *Historical Statistics*, table 5c. The twelve core west Europeans are Austria, Belgium, Denmark, Finland, France, Germany, Italy, The Netherlands, Norway, Sweden, Switzerland, and UK.

period before World War I. The average growth rate was 1.2 per cent between 1874 and 1913, which was lower than 1.3 per cent of the twelve core west European countries – no mention of USA's 1.8 per cent. It is true that Japan's inter-war performance was better than major countries of the west: Japan's growth rate between 1913 and 1935 stood at 1.8 per cent whereas the rate was 0.1 per cent for USA and 0.7 per cent for the twelve European countries. Even in inter-war East Asia Japan's growth performance was not exceptionally superior, either. According to Ma's comparative account between 1914-18 and 1931-36, Japan's stood at 1.4 percent while that in the three China Sea areas, i.e. the Lower Yangzi macro-region, Korea and Taiwan fell in a range of 1.1-1.5 percent. It was in China proper where economic development faltered. The overall performance of Japan's in the 1913-1955 period was thus modest – 1.3 per cent, in comparison with 1.7 per cent for USA and 1.2 per cent for the twelve Europeans. In 1874, Japan's per capita GDP was 47 per cent of the twelve Europeans' and remained in the same position until 1955. If compared with USA, Japan's relative position declined from the level of 41 per cent in 1874 to 25 per cent in 1955. Despite the post-Meiji trend acceleration, there was no catch-up until the 1950s. It was the phenomenal growth in the 1955-73 period that brought Japan much closer to the wealthy countries of the west.

Another point we can make from both table 1 and figure 1 concerns the relationship with population increase. From the 1870s on, as figure 1 makes it clear, population also picked up with the average rate of increase being 0.85 over the 1874-1920 phase. As the corresponding growth rate for GDP per capita was 1.1 per cent, it should be realised that the speed of economic growth in that early phase remained only marginally higher than the pace of population increase. In the next period of 1920-1960, both indicators went up: output growth to the level of 1.9 per cent and population increase to 1.3 per cent. The gap between the two widened as the nation's modern economic growth got on track. But as we have seen above, the second phase saw the pace of economic growth becoming unstable and that of population increase more volatile. In other words, there must have been social classes and groups who felt population pressure hard and excessive. By the end of the difficult times, however, the demographic transition had been completed. The total fertility rate in 1960 reached 2.0 and life expectancy at birth 68 years (with both sexes combined).[17] It was in the following age of strong growth when most of the nation's social classes became able to enjoy the fruit of high economic growth.

The driving force of the strong growth was investment in manufacturing.[18] In this sense, on the face of it, there was continuity from the pre-war period. However, almost all those that emerged in the 1950s and 60s were industries producing consumer durables. In the nineteenth-century West, industries producing intermediate goods for other producers led the tempo of industrialization; in the early twentieth-century, therefore, Japan made an effort to promote those industries but yielded only a moderate success. After 1950 the tide changed. The

[17] See Ito, 'Japan's demographic transition', and Saito 'Nihon ni okeru jinkō tankan'.

[18] For a general survey of this period, see Fukao and Settsu, 'Japan'. A strong growth in GDP per capita had already began in the late 1950s. It was led by a swift recovery of personal consumption, not by an increase in capital formation. It was in the period after 1960 when the role of private-sector investment played a key role in promoting economic growth. See Nakamura, 'Age of turbulence', pp. 103-104.

emerging Japanese firms in car making and electronics, targeting an expanding mass consumer market, developed an innovative model of manufacturing methods which tended to be skill-using but compatible with the American mode of mass production. Toyota, Sony and Panasonic, to name but a few, were such firms and their growth owed nothing to MITI's industrial policy. However, high economic growth was short-lived. The average rate of growth declined to 3 per cent per annum in the period from 1973 to 1990 and further to 0.9 percent in the 1990-2000 period. This phase of deceleration was accompanied by de-industrialization. Before 1973, the proportion of gross value added of the manufacturing sector to GDP stood at 35 per cent or over. Immediately after the 1973 oil crisis it declined by 5 percentage points, which went down again after the so-called bubble years. In 2008, the manufacturing sector's share in output further declined to below 20 per cent, and in 2010, the tertiary sector's share in the workforce reached 70 per cent. This transition to a service economy, however, was not occasioned by a rise in productivity in the tertiary sector. According to estimates of industry-specific total factor productivity (TFP), while an increase in manufacturing TFP is still reasonably steady, the tertiary sector's TFP growth has been sluggish since the 1970s. The level of labour productivity in services and construction remains low by international standards.[19]

2. New estimates of the sectoral distribution of the labour force

It is widely recognised that there was a pre-Meiji phase in which dual occupation in the form of farm family by-employment tended to increase, rather than decrease, with economic development. The historiography shows that rural by-employment was widespread in the late Tokugawa period. Exceptionally detailed data from Chōshū, a domain in western Japan, indicate that while as many as 80 per cent of the population were classified as farmers, the proportion of non-agricultural produce in gross regional product reached the 40 per cent mark. According to recent estimates based on the same data, it is likely that non-farm earnings amounted to 43 per cent of the total after-tax household income (and to 26 per cent of the total if calculated on a pre-tax basis) earned by farm families in the 1840s.[20] This suggests that unveiling rural by-employment patterns will have a direct bearing on sector-specific national accounting and labour productivity estimates in the period after the Meiji Restoration of 1868. In this section, therefore, an attempt to revise sector-specific LTES labour force series will be made with parameters derived from regional population surveys taken in two prefectures at two separates points of time, i.e. 1879 and 1925, that enumerated both principal and subsidiary occupations. Throughout this exercise we follow the instructions given in chapter 23 of this volume: by-employment is defined with respect to an *individual's*, not the household's, subsidiary occupation, and *intra-sectoral* by-employments are excluded from any estimation of the by-

[19] For an overview of the post-1955 period, see Fukao and Saito, 'Japan's alternating phases'.
[20] Smith, 'Farm family by-employments' and Nishikawa, 'Chōshū'. The estimated proportions of non-farm earnings to the total income is from Saito and Nishikawa, 'Tokugawa Nihon', p. 297, and Saito, 'Growth and inequality', table 1, p. 406. See also Saito, ''Pre-modern economic growth' and 'Land, labour and market forces'.

employed labour force and calculations of sectoral labour differentials.

The following sub-section sketches out the issues relating to by-employment in changing occupational structures and offers a hypothetical pattern of its spread and decline. Section 2.2 turns to technical and data issues, i.e. the ways in which sector-specific estimates of net output and the labour force were made in the LTES series. We will present data on principal and subsidiary occupations in a matrix format. This enables us to explore how the size of by-employment in the secondary and tertiary sectors changed in relation to indicators of development, such as the declining proportion of primary employment and to the increasing tempo of urbanisation. Based on this exercise, new sectoral estimates of labour force statistics will be offered, and section 2.3 discusses the results with respect to changes in the occupational structure over the course of industrialisation.

2.1 By-employment in a changing occupational structure

The importance of the concept 'by-employment' in occupational surveys was well recognised among Japanese statisticians in and outside the government departments.[21] In fact, in the pilot census of Yamanashi prefecture in 1879 as well as in the first and second national censuses taken in 1920 and 1925, the respondents were asked to write down their principal and subsidiary occupations. However, no national census reports included results on by-employments tabulated in full. It was only the two prefectural surveys of occupied population, i.e. the pilot census of Yamanashi taken at the end of 1879 and the 1925 census results for another prefecture, Shizuoka, that give us the information about principal and subsidiary occupations in a matrix form. These two are invaluable for our analysis of by-employments in the period before World War II.

Both prefectures are located in central Japan, adjacent to each other, with Yamanashi north and Shizuoka south of Mt Fuji.[22] Yamanashi's population at the end of 1879 was 397,000 and the number of districts nine, while Shizuoka had 13 districts and its population stood at 1,671,000 on 1 October 1925. In 1884, when the first prefectural population statistics was compiled, the difference between the two population totals was less marked, 415,000 and 976,000 respectively. In terms of population per km^2, it was 93 and 126: Yamanashi's density

[21] Many government statisticians of the pre-1920 period knew that the information about subsidiary occupation was often recorded in German-speaking countries' censuses. For example, in 1900 when Ayatoshi Kure in the Statistics Section of the Department of Agriculture and Commerce published a short article explaining why a proper survey of occupations should be conducted, he showed how different the German occupational structure appeared with and without subsidiary occupations (*Nebenberufe*) taken into tabulation by referring to the published results of the 1882 and 1895 censuses (Kure, 'Shokugyō'). In 1915, when the Director of the Statistics Bureau, Naosaburō Hanabusa, gave a long speech before statisticians from local governments, he talked about by-employment as a phenomenon in relation to changing phases of economic development (Hanabusa, 'Jinkō'). It is therefore no surprise to see 'by-employment' included in the survey questionnaires of the first two censuses. As for the Yamanashi survey, Kōji Sugi, the architect of that pilot census, was also knowledgeable about early censuses taken in Europe, but there is no documentary evidence which suggests why by-employment was included in the survey form as early as 1879.

[22] The following is based on Sōrifu Tōkeikyoku, *Nihon chōki tōkei*, vol.1, tables 1-6, 2-5, 2-6 for population and density figures, and Saito, *Chingin to rōdō*, pp. 120-134, for migration data.

was only slightly lower than the national average of 98 while Shizuoka's exceeded it. In 1925, the gap widened: the latter's population density increased to 215, substantially higher than the nation's average, 156, whereas Yamanashi became an area whose population density, 135, was well below the average (put together, therefore, the increase of population density in the two-prefecture area over the 1879-1925 period turns out to be close to the national average: 64 per cent). These population and density figures reflect both similarities and differences between the two prefectures. Yamanashi is an inland, mountainous prefecture while Shizuoka is composed of both hilly and maritime areas. In 1879 both prefectures were proto-industrial: Yamanashi produced almost exclusively silk goods (cocoons, raw silk and fabrics) and Shizuoka had a variety of speciality goods such as tea, paper, textiles and marine products. By 1925, proto-industry declined in both prefectures. Yamanashi, specialised in sericulture, became more agricultural whereas in Shizuoka there emerged a couple of regional clusters of factory industries. Yamanashi thus saw their migration flow reversed to become a net exporter of workers to Tokyo and, to a lesser extent, the two Shizuoka industrial regions. Across the districts in the two prefectures, there were substantial variations in terms of the primary sector share, which are thought to have reflected differences in temporal change both prefectures experienced. By combining the 1879 pilot census of Yamanashi with the 1925 census of Shizuoka, therefore, we can cover much of the change in industrial structure that took place nationally from the opening of the treaty ports in 1859 to the post-World War I years.

It appears that despite this long interval both sets of occupational statistics can be re-classified according to the PSTI scheme without much difficulty.[23] The Yamanashi census takers classified occupations into nine categories: (1) agriculture, (2) food processing, (3) construction, (4) textiles, (5) metal, (6) other manufacturing, (7) commerce, (8) services, and (9) other services. In the Shizuoka census, occupations are also grouped into nine, but with somewhat different categories: (1) agriculture, (2) fisheries, (3) mining, (4) manufacturing, (5) commerce, (6) transport, (7) public service and professionals, (8) other services, and (9) domestic service. In the PSTI scheme, the primary sector includes Yamanashi's (1) and Shizuoka's (1) and (2); the secondary sector corresponds to Yamanashi's (2)-(6) and Shizuoka's (3) and (4); and the rest go to the tertiary. However, there are some instances of misfit. One is salt making, which was included in fisheries because it was traditionally made from sea water. However, even the pre-

[23] For what happened during the half-century period, see fn. 8 above. Throughout that up-and-down process, however, one thread of continuity can be found. i.e. that the classification scheme of occupations was already a hybrid from the start but was constantly updated by Japanese statisticians in line with the evolution taking place in the international arenas. i) When the 1879 Yamanashi project was launched Sugi consulted documents prepared at the 1872 International Statistical Congress held in St Petersburg and used a classification scheme similar to the one Quetelet prepared for Belgium's 1846 census; ii) After the 1902 legislation, the Cabinet Bureau of Statistics compiled and published a classification table for occupations in 1905, which was modelled on the one prepared by Jacques Bertillon and approved at the ISI's Chicago meeting in 1893; and iii) This Bertillon-type hybrid scheme was used for the first and second censuses taken in 1920 and 1925 (hence in the prefectural tabulations for Shizuoka, 1925). See Mitsuma, *Keizai tōkei*, ch. 3, Sato, *Kokusei chōsa*, pp. 33-34, and fn. 10 in Chapter 1 of this volume, for the evolution of the hybrid-type of classification schemes used in the taking of successive censuses.

Meiji method of production makes it clear that it was a processing industry in the secondary sector. Public utilities are believed to have been classified in manufacturing, and mining in the Yamanashi census is included in the metal trades. While the last does not cause a problem at the sectoral level when a compilation is made on the PSTI basis, the former two require inter-sectoral readjustment between the sectors. Unfortunately, however, this cannot be done because, while principal and subsidiary occupations were separately listed at lower-point levels, no further breakdowns in the matrix form were made in these published census reports.

Tables 2-3

Tables 2 and 3 set out, on the basis of this Japanese version of PSTI, sectoral distributions of principal and subsidiary occupations for Yamanashi and Shizuoka prefectures in the matrix table with an additional column for those having a principal occupation only. Shaded cells in each table represent cases in which both primary and subsidiary occupations are in the same sector. Although such combinations as farming with sericulture are important in their own right, they are not regarded as 'by-employments' for the purposes of this chapter.[24] Taken together, they show how occupational structures changed between 1879 and 1925. According to table 1C for Yamanashi (with both sexes combined), the overall proportion of those by-employed, defined as the sum of all the nine inter-sectoral cells *minus* the three diagonal ones in the table, was 19 per cent (= [0.13+0.093+0.063]-[0.086+0.004+0.004]). The male-female difference was not large – only a few points in the first decimal place. The Shizuoka pattern was similar: according to table 2C, the overall proportion by-employed was 11 per cent (= [0.23+0.063+0.035]-[0.206+0.002+0.009]), with a few percentage points higher in the male and lower in the female case. Clearly the phenomena of by-employment cannot be ignored in accounting for both male and female employment patterns in the pre-World War II economy.

Let us take a little closer look at each prefecture's pattern. According to the Yamanashi table for 1879 (table 1C), the share of workers – both men and women – having a principal occupation in farming was 83 per cent of the total. Of those 28 per cent (= [0.829-0.595]/0.829) had a by-employment and 63 per cent (= [0.088+0.058]/[0.086+0.088+0.058]) of those by-employments were found outside the primary sector. This supply from the primary sector represented 76 per cent of the total incidence of inter-sectoral by-employments (= [0.088+0.058]/0.192). On the other hand, flows from the secondary and tertiary sectors to the primary were not particularly large, substantially outnumbered by the number of primary-sector worker supplying by-employments to the other two sectors ([0.042+0.001]<[0.088+0.058]). Agriculture, while it was a modest receiver of workers from outside, supplied non-negligible numbers of by-employments to the secondary and tertiary sectors. However, tables 1A and 1B reveal that there are differences between the sexes; for males the ratio was as low as 1: 93 ([0.001+0.001]<[0.083+0.102]), but the female ratio came close to 1:1 ([0.094+0.001]≈[0.095+0.004]). In fact, the number of female secondary-sector workers having a sideline in agriculture was substantial and much larger than that of their male counterpart. Most of those females were in textiles, but this finding does not necessarily imply that the separation of industry from farming was taking place at the household level. Rather, it probably

[24] See chapter 23 in this volume.

suggests that a majority of wives and daughters of the farm family followed the census takers' instruction that occupations should be reported on an individual, not a household basis.

Turning to Shizuoka in 1925, its overall proportion of the by-employed was modestly lower than that for Yamanashi in 1879 (11 per cent as against 19 per cent). But structural change that took place over the 46-year period was unmistakable. A glance at table 2C reveals, first, that the weight of the primary sector in the labour force declined from Yamanashi's level of 83 per cent to 57 per cent. Second, there was a tendency for by-employment to be confined within the primary sector. Of the total number of primary-sector workers having a subsidiary occupation, 74 per cent were found in the same primary sector (= 0.206/[0.206+0.05+0.022]). Third, the separation of occupations took place between the primary and the secondary sector. While, with both sexes combined, the share of the supply from the primary sector in the total incidence of inter-sectoral by-employments remained still 65 per cent (= [0.05+0.022]/0.111) and the ratio of flows from the secondary and tertiary sectors to the primary to those from the primary to the other two still 1:3 (= [0.011+0.013]/[0.05+0.022]), table 2B shows that the ratio for females became 1:5 (= [0.005+0.006]/[0.05+0.008]). Moreover, the same table tells us that the column total of females having a subsidiary occupation in the secondary sector was substantially smaller than the number of females having only a principal occupation in the same sector (0.058<0.151), the relation of which had been just the opposite in Yamanashi in 1879 (0.103<0.088). This is undoubtedly a reflection of what happened to rural cottage industry in textiles. In contrast with manufacturing, finally, it seems that the incidence of dual occupation involving a tertiary-sector job increased over time. It was observable in tertiary-primary, tertiary-secondary, and secondary-tertiary (but not primary-tertiary) interactions. Although there must have regional and geographic factors at work, this tertiary-sector involvement may have been the reason why the overall proportion by-employed in Shizuoka of the mid-1920s still remained above the 10 per cent mark.

From all this, it is possible to hypothesise, first, that as industry and commerce grew, rural by-employment increased, but second that as economic development proceeded further, the incidence of by-employment tended to disappear. Yamanashi in 1879 was in the phase of increasing by-employment while Shizuoka in 1925 had just reached a turning point after which the incidence of by-employment started to decline. This hypothesis of an inverse-U shaped pattern of change can be tested, if district-level relationships between the proportion of the primary sector in the total labour force, a measure of the level of development, and the by-employment ratio in the two prefectures at the different dates are pooled together, and if this pooled set of data may be read as revealing a chronological variation.

Figure 2

Figure 2 displays a scatter gram of these district-level relationships. The proportion primary is defined as the share of the primary sector in the district's total number of principal occupations and measured from right to left on the horizontal axis of the graph. Against this is set the overall ratio of subsidiary to principal occupations (intra-sectoral by-employments are excluded), measured on the vertical axis. The graph shows that the extent of by-employment increased when the proportion primary was high, but it started to decline when the proportion primary decreased further. Most if not all of Yamanashi's nine districts represent the first phase

and Shizuoka's 13 the second. For this inverse-U shaped curve, there are a few exceptions: Kita- and Minami-Tsuru, especially Kita-Tsuru, had too high proportions of by-employments for their levels of the proportion primary, due probably to an unusual concentration of rural-centred silk weaving. Nishi-Yamanashi is located far left but this is because Kofu city, the provincial capital, was included in the district. The same is true for Abe district with Shizuoka city. This observation for cities suggests that the level of by-employment was also a decreasing function of urbanisation. With these findings in mind we have explored the set of district-level data in order to identify regression equations, from which we are able to generate a series of labour force data for each sector with subsidiary occupations taken into account.

2.2 Revising the LTES estimates

Before the first census of population, there existed no nationwide statistics of occupations that allows us to make a comparison with the 1920 census. Other information which could be usable for tracing the changing structure of the labour force was annual statistics about the number of farm households and business establishments, and urbanisation records. By using these pieces of statistics, Umemura, the compiler of the LTES volume on population and the labour force, was able to estimate the size of the total labour force and that of the primary sector back to 1872. For the secondary and tertiary sectors, he found causes-of-death statistics, which started in 1906 and cross-tabulated with occupations, useful to estimate changes in the labour force of the non-primary sectors. These statistical data he had recourse to did not allow him to separate the tertiary from the secondary sector for the 1872-1905 period; it was not possible either for him to disaggregate the non-primary sectoral total into males and females before 1906, or the total labour force into age groups before 1920.[25]

However, one major problem with this approach is that the causes-of-death statistics enumerated principal occupations only. The 1879 census of Yamanashi prefecture and the 1925 one of Shizuoka prefecture contained information about subsidiary employments, so did the first two national censuses as well as the second census. The published reports of the former two contained cross-tabulation tables for principal and subsidiary employments, but not the published reports of the two national censuses. From the two prefectural censuses, we can make an analysis of flows of subsidiary employments between sectors, but there are no nationwide records which were published in a way for us to be able to tabulate principal and subsidiary employments in a matrix form.[26] Given this asymmetry in data availability, Umemura

[25] See Umemura et al., *Rōdōryoku*, pp. 77-141, and Umemura, 'Population and labor force'. Umemura made several revisions over a prolonged period until 1988, when the LTES volume on population and the labour force was published (which means neither the LTES volume on national income, published in 1974, nor the English-language publication of LTES estimates in 1979 reflected such changes in the labour force statistics). Whenever we refer to the Umemura estimates in this chapter, they are the 1988 ones.

[26] Even today in Japan, there exist no official arrangements under which census enumerators'

seems to have thought that the two prefectures were too small and hence unrepresentative to make the whole nation's occupational statistics adjusted for the spread of by-employment.[27] Our view, however, is that by employing a proper statistical technique it is possible to enhance the extraction of information from such a prefectural-level data sample and to make necessary adjustments to the nation's labour force statistics.

In order to get on this task of revision, we have to decide where to start. For data to be filled in panels 1, 5 and 9, Online appendix table 2, we have chosen the LTES estimates, rather than government statistics. This is because Umemura made a good deal of necessary adjustments to source data before the publication of the LTES series. First, he took a close and careful look at changes made in relation to categories of occupations from one census to another; the estimates are presented at aggregation levels which were thought most appropriate. Second, the labour force Umemura defined excludes occupied people living on unearned incomes (who represented only 1.3 per cent of the total having a principal occupation in 1920 and 0.6 per cent in 1930). Third, since pre-World War II censuses relied on usual rather than actual status information about occupations, those temporarily unemployed are assumed to have been included in the statistics of 'gainfully occupied workers' (*yūgyōsha*). Fourth, the category of unspecified general labourers appeared only in the 1920 census (representing 1.6 per cent of the total number of principal occupations). They are distributed into sectors according to the actual shares derived from the 1930 census, and those 'not elsewhere classified' are placed in the tertiary sector.[28] According to one of the few pre-World War II surveys of the unemployed, the rate of unemployment was 4.5 per cent in 1925 (5.3 per cent for males and 1.4 per cent for females), covering twenty-two cities and two mining towns only. What seems certain is that the national level of unemployment must have been substantially lower than those urban figures suggested.[29] On the other hand, it was the urban informal sector that absorbed people sacked by employers in the other sectors; this was particularly the case in Tokyo immediately after the 1929 collapse.[30] Fifth, there was an inconsistency between the pre-1920 and post-1920 series: the former referred to Japanese residents living in Japan proper only while the latter covered foreign residents as well, for which the necessary adjustments have been made. Probably the only adjustment Umemura failed to make is about the placement of salt making. In the LTES's classification scheme, it was in the primary sector despite the traditional Japanese way of making sea salt being a processing activity. We will include salt making in the secondary sector.

Thus the question that remains unresolved is how to take by-employment into estimation. In this respect, the previous section's findings concerning district-level by-employment patterns provide us a new basis for the estimation of the numbers of subsidiary

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schedules are released in hundred years' time.

[27] It should be noted, however, that he did touch on the issue of by-employment by exploring those source materials. See Umemura, 'Agriculture and labor supply'.

[28] Umemura et al., *Rōdōryoku*, p. 95.

[29] Odaka, *Rōdō shijō bunseki*, pp. 141-142.

[30] Settsu, 'Kindai Nihon', ch. 5.

workers for each PSTI sector at the national level. For this purpose, we need the proportion of the labour force in the primary sector and a measure of urbanisation. The former is available for the whole nation as well as for regional districts of the two prefectures. For the latter, however, it is difficult to apply the same measure for both national and regional levels. Having explored several measures of urbanisation, we have decided to use the crudest of all measures, population density, for it is easy to calculate for individual districts while the annual series for the whole nation is readily available.

Our goal is to estimate all the matrix cells in tables 2-3 (with the diagonal cells excluded). The method we use is regression analysis, with all Yamanashi and Shizuoka districts pooled, of the sector-specific data. Then, the coefficients derived from the estimated regressions are applied to the national data series in order to compute the number of those having a subsidiary occupation in each of the three sectors, for six data-points between 1874 and 1940. This PST-level calculation is conducted for males and females combined. Then, the results are allocated year after year to males and females according to ratios derived from the corresponding LTES estimates. The estimates for the entire 1874-1940 series are re-adjusted by referring to annual variations in the labour force calculated from the LTES statistics.[31]

The true size of the labour force in each sector is thus calculated by weighting the numbers of those having a principal and a subsidiary occupation in the following way:

> The size of the labour force (both sexes combined) in sector *i*
> = 1 × the number of all workers having a principal occupation in sector *i*
> + 0.5 × (the number of workers having a principal occupation in sector other than *i* but having a subsidiary occupation in sector *i* - the number of workers having a principal occupation in sector *i* but having a subsidiary occupation in sector other than *i*).

This formula enables us to generate a new annual series of labour force statistics from 1874 to 1940 in the primary, the secondary and the tertiary sector respectively. Then, these national-level PST estimates are disaggregated according to the sex ratio and to the sub-sectoral composition at second-point levels within the sector, both derived from the source data. Note that here we have simply applied the multiplier of 0.5 – we will see in section 4 below to what extent the results would change if 0.25 be chosen. Whichever is used, in fact, our new estimates of the secondary-sector and tertiary-sector shares are higher than the LTES's, particularly for early years.

3 Changes in the occupational structure

3.1 Patterns of sectoral change

[31] Note that we changed the first benchmark year from 1872 to 1874. For other details including regression results, see Online appendix 1a.

Figure 3

Figure 3 sets out the changes in occupational structure with both sexes combined for 15 data-points from 1874 to 2010. This set of figures is based on information derived from censuses and other surveys of occupations. Between 1874 and 1940 the estimates are all subsidiary employment-adjusted, whereas the 1947-2010 figures are not. However, for a period from 1970 on, another set of estimates is available. The estimates are products of the Japan Industrial Productivity Database Project 2015, compiled in a collaborative effort between RIETI, a semi-governmental research agency, and Hitotsubashi University.[32] Their aim is to compile, on the basis of sample surveys, internationally comparable, firm- and establishment-level productivity estimates for Japan. While the framework is fully industrial, neither occupational nor hybrid, the JIP project provides us with a series of labour input measured in terms of person-hours. Their focus on hours actually worked gives us a unique opportunity to compare the JIP estimates with those from the population censuses, in a similar manner to the case with and without by-employment adjustment for the pre-1940 period. The post-1970 comparison between the census and the JIP series of sectoral shares reveals a couple of interesting facts. In 1970 there were non-negligible differences between the two. Compared with the JIP series, the census-based primary-sector share derived solely from principal occupation data overstated the level by 3 points while the secondary sector's level of understatement was 2 points and the tertiary sector 1 point. This resembles the pattern we have seen for the late nineteenth century. Given a 10-percentage point reversal of the declining trend in the share of primary-sector employment immediately after the collapse of the early 1940s wartime economy, conspicuous in figure 3, one can speculate that there was a re-emergence of by-employment following the collapse of the wartime industrial economy, and that agriculture absorbed a redundant labour force released from the shrinking manufacturing sector. It is difficult to assess how widespread it was in 1950 or 1960, but the level of such dual employment is likely to have declined as the economy picked up again. By 1980 when the primary-sector share reached 11 per cent, the extent of farm-sector by-employment must have become negligible.

According to figure 3, Japan's industrialisation started some time before the first Sino-Japanese War of 1894-95 under the new Meiji government. Since then, however, the industrialisation drive was not particularly strong except for a short-lived boom in the late 1930s. An increase in the level of the secondary-sector share was not fast and the level reached by 1940, 26.5 per cent, was not impressive either. This is largely the result of our revisions of the LTES estimates. According to the LTES series, the share of the secondary sector in 1885 was 14.5 per cent and there took place an over 10 percentage-point rise by 1940, but now that the estimate has been upwardly revised the 1890 share stood at 19 per cent and, hence, the gain between 1890 and 1940 was 7 percentage points, lower than previously thought. After a serious setback under the wartime regime in the early 1940s, the post-war growth was unprecedentedly strong, especially between about 1955 and 1973, the year of oil crisis, which left a clear mark on the

[32] The successive JIP databases form part of the European Union's World Input-Output Database project, successor to the EU KLEMUS project. For more information about JIP 2015, see RIETI's website: https://www.rieti.go.jp/en/database/JIP2015/index.html.

graph of the secondary sector in figure 3. In the graph the peak came in 1970, with the secondary-sector share being 34 per cent according to the census-based series but its industry-based estimate was even higher, i.e. 36 per cent.

On the other hand, the new estimates confirm a set of other features. One is the decline in the share of primary-sector employment. Over the period of 1874-1940 it declined by more than 20 percentage points, although in 1940 the share was still over 40 per cent, a level which was not particularly low considering the pace of industrialisation since Meiji times. If the size of the agricultural sector is measure by the number of farming units, it turns out that the total number of farm households remained at the same level of 5.5 million as in 1874. This suggests strongly that outflow of the labour force from agricultural was 'limited to the incremental part of the agricultural population'.[33] In other words, the primary sector retained its core labour force despite the stimulus coming from the processes associated with industrialisation and urbanisation. As we will see below, it was in the post-World War II period of 1955-1970 when this structural feature disappeared.

Another point concerns the tertiary sector. The size of commercial and service employment in the 1870s and 80s was already larger than that of secondary-sector employment, suggesting that this was the legacy from the Tokugawa past,[34] and the tertiary-sector labour force expanded faster than that of the secondary sector during the period up to 1940 and then over the 1950-1970 period of growth. De-industrialisation set in after the oil crisis of 1973, slowly first and then more markedly after 1990, when tertiarisation of the economy gathered momentum. In 2010, more than two-thirds of the working population were in service employment. Moreover, the gap between the census-based and industry-based estimates of the secondary- and tertiary-sector shares seems to have widened from one percentage point to two since the 1990s, suggesting that the share of employees assigned with service-related tasks within manufacturing firms has been on the rise.

These two issues may be approached from a different angle by referring to urbanisation, a close correlate of industrialisation or tertiarisation, or both. If the secondary sector is combined with the tertiary, then the residual, i.e. the primary-sector share is expected to have an inverse correlation with the pace of urbanisation. The measure of urbanisation adopted here is based on the so-called 'densely inhabited districts' (DIDs) with both density, 4,000 per km^2, and the minimum size of population of 5,000 adopted as the criteria.[35] With this proportion of people living in the DIDs in the total population and the share of the non-primary sector in the occupational structure, figure 4 shows that there was a good correlation between the two over the entire period of 1874-2010. In the period before 1940, both series exhibited a gradual, upward trend, followed by a sudden drop between 1940 and 1947, a consequence of a serious urban food crisis during the years before and after the nation's surrender to the Occupied Forces.

[33] Umemura, 'Agriculture and labor supply', p. 189. Statistics of farm households are taken from Umemura, *Agriculture and Forestry*, table 33.
[34] See Settsu and Takashima, 'Labour productivity growth', table 3, for the period before 1874.
[35] The concept of DID was introduced by the Statistics Bureau of Japan at the time of the 1960 census. For the background of the adoption, see a 'note on measures of the urban share of population, 1874-2010' below.

Recovery began in the 1950s and the onset of strong and sustainable growth in the 1960s and 70s eventually pushed the levels of both shares up to a new height: in the 1990s, the non-primary sector's reached the 90 per-cent mark while the DIDs' surpassed the level of 60 per cent. In this later stage, it is often assumed, growing urbanity came to mean tertiarisation as the economy de-industrialised. However, it should be noticed, first, that the slope of the urbanisation curve was apparently steeper in the post-1945 than in the pre-1945 period, and second, focusing on the two industrialisation periods of 1909-1940 and 1950-1970, we find that in the 1909-1940 period a 7-point rise in secondary-sector employment was associated with an 8-point rise in the tertiary-sector share and a 10-point increase in urbanisation, while in the 1950-1970 period it was an association of 12 points to 17 points and 20 points. Apparently, the rural sector remained intact in the period before 1940 and it was after 1950 when the traditional rural sector began to shrink in absolute numbers. Second, in comparison with the graph for the tertiary sector in figure 3, its changing share was closely associated with the pace of urbanisation in figure 4 even before the commencement of de-industrialisation; hence, third, it is likely that the process of industrialisation was linked in a rather complex way to changes in the share of tertiary-sector employment.

Table 4

In order to examine this complex relationship between the secondary-sector share and that of the tertiary sector in total employment a little more closely, table 4 gives break-downs into eight sectors for males and females in the period between 1906 and 2010. With the primary sector not disaggregated, the secondary sector is divided into mining, manufacturing, and construction (including building and public utilities as well), and the tertiary into commerce, services and professions, government and armed forces, and transport and communications (note that services and professions here do not cover public-sector services but include the activities of buying and selling as far as the 1906-1940 period is concerned). This eight-sector framework allows us to separate manufacturing growth, a better measure of industrialisation than that of the secondary sector as a whole, from changes in other non-primary sub-sectors such as mining, construction and transport. According to the table, the share of both males and females working in manufacturing gradually rose from 14 per cent in 1906 to 17 per cent in 1930, after which there was a sudden acceleration to 21 per cent in 1940, followed by an equally sudden drop to 16 per cent in 1950. It peaked in 1970 at 26 per cent, and then declined to 16 per cent in 2010. To examine these industrialisation processes in more detail, table 5 sets out disaggregated percentages within manufacturing (note that the percentages shares of the five

Table 5

industrial groups are expressed in relation to the total labour force, not to the manufacturing total). According to panel C of this table, the leading industry changed over time. Initially, it was the textiles, whose labour force occupied more than a third in the manufacturing total;[36] but by

[36] Here, textiles are grouped with clothing and footwear (with males and females combined). This industrial group was dominated by textiles, largely because clothing was underdeveloped. In traditional Japan, it was the consumer who bought a piece of full-length cloth and then sewed a *kimono* for herself. According to the 1920 census, therefore, the size of the clothing industry with footwear combined was one-third of the labour force in the textiles-clothing-footwear group, which is in contrast with England and Wales where clothing alone accounted for 35 per cent in 1851 (with textiles 46 per cent and footwear for 19 per cent, all calculated from Online appendix 2 for England

1940 the textile industry was overtaken by machines and tools. The same overtaking took place again in the 1950-70 period, indicating that the growth of mechanical engineering underpinned the renewed drive of industrialisation. There were some noticeable differences between the pre- and post-war industrialisation periods. The industrial growth in the inter-war years was fuelled by an increased demand for munitions and other war-related goods and a large proportion of their supplies came from mechanical engineering, whereas the strong industrial growth in the 1950-70 period was more balanced, taking place across the three non-textile groups of industries – metal and metal working, machines and tools, and the rest of manufacturing (including chemicals), reflecting that the underlying force was a strong increase in the demand for consumer durables such as passenger cars, electric appliances and household goods.

Also, there were gender differences in manufacturing growth. At the beginning of the 1906-1940 period, the female share in the manufacturing labour force was considerably high, at 40 per cent, which declined to 28 per cent by the end of this first phase. Women's share increased again in the post-war phase of industrialisation, reaching 36 per cent in 1970. One factor behind this rise-and-fall pattern was the changing importance of textiles. According to panel D of table5, the female share was always high in the textiles, clothing and footwear group, above the 60 per cent level until 1970. But the weight of that industrial group in the labour force declined from 1920 onwards (panel C of the same table). Another factor is a contrast in the growth mechanism between the two periods, i.e. 1920-40 and 1950-70. As noted above, the industrialisation of the first phase was associated with the inter-war government's military build-up, whereas the post-war industrial spurt was led by private businesses producing consumer durables. In the former regime, the industrialisation was accompanied by masculinisation of the manufacturing labour force, but in the latter the demand for both male and female workers increased. This was particularly the case in mechanical engineering of the 1950-70 period. Panels A and B of table 5 confirm that this industrial group's share in male employment increased from 3.5 to 8 per cent while its share in the female counterpart jumped from a less than 1 per cent level to 5 per cent; as a result, the female share in its labour force went up from 10 to 28 per cent (panel D of the same table).

After the 1970s, the nation's economy started to de-industrialise. The share of the secondary sector in total employment with both males and females combined fell from 34 in 1970 to 26 per cent in 2010 and that of manufacturing from 26 to 16 per cent over the same period (panel C of table 4). A service economy was on the rise, accompanied by the feminisation of the labour force. Between the same 40-year period, although the corresponding female share declined by 4 points in the secondary sector, it increased by 9 points in the tertiary and overall by 4 points with all the sectors put together (panel D of table 4).

However, it should be remembered that the process of tertiarisation was not occasioned with the onset of de-industrialisation in the late twentieth century. The level in 1874 of the tertiary-sector share with both males and females combined stood at 17 per cent when the level of the secondary was 13 per cent. By 1940, the peak year in pre-war industrialisation, the

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and Wales).

tertiary-sector share increased to 30 per cent and further to 46 per cent in 1970 when the post-war high was reached for the secondary sector. As the urban share of population increased steadily, industrialisation and tertiarisation went hand in hand as far as the period before the 1970s is concerned (figure 3 and panel C of table 4). Moreover, a similar pattern of parallel development can be detected between manufacturing and construction, another sub-sector in the secondary sector, on the one hand, and transport in the tertiary sector, on the other. These patterns are a little more marked if focused on men in the post-war period: in 1950, the share of construction and that of transport were 7 and 6 per cent respectively, which increased to 12 and 9 per cent in 1970. Japan's peculiarity lies in the finding that mining never occupied a central place in her industrialisation path (panels A and C of table 4).

4. Sectoral labour productivity analysis

The final task of this chapter is to determine the levels of sectoral labour productivity differentials and their changes over time. As noted in the introduction of the chapter, it has been argued that this labour productivity differential tended to be wide throughout the early stages of Japan's industrialisation since the Meiji government had adopted a development policy to promote capital-intensive manufacturing industries, i.e. industries contemporary statesmen and historians called 'modern' as against 'traditional' labour-intensive industries and trades. The sectoral labour productivity differential refers to the ratio of one sector's labour productivity to another sector's labour productivity; and in this analysis of Japan's industrialisation period up to 1970, the ratio of the secondary or the tertiary sector is calculated in relation to the primary sector's output over the labour force. Now that we have the new PSTI-specific series of labour force data for its denominator as well as the revised estimates of sector-specific output for the numerator,[37] we are in a position to re-calculate the sectoral labour productivity differentials and to examine how the sectoral productivity differentials changed over time.

The comparisons with the corresponding figures derived from the LTES series are shown in table 6. The LTES estimates of the differentials are taken from Ohkawa's contribution to their team's 1979 publication,[38] which do not reflect the revisions made by Umemura in his 1988 volume on population and the labour force. We could have revised Ohkawa's figures on the basis of Umemura's revisions to calculate an alternative set of the LTES series, but since Umemura's revisions were not substantially large and it is Ohkawa's sectoral analysis that has been quoted, discussed and interpreted, we will compare our results with their 1979 estimates. The first comparison is made between Ohkawa's and our new estimates without by-employments taken into calculation (in formulas I and II of table 6). By focusing on the new estimates, this tabulation is also intended to show how the sectoral labour productivity differential figures will change if the alternative multiplier is switched from 0.5 to 0.25 (see the table's formula III).

[37] For the PST-specific output data, see Online appendix 3B.
[38] Ohkawa, 'Production structure', ch. 2 of Ohkawa and Shinohara, *Patterns*. See also note 1 above.

Several points may be made from table 6. Firstly, a few words about the choice of the by-employment multiplier are in order. The differences between the two alternative estimates with the multipliers of 0.5 and 0.25 in the table are not great, ranging from 0.1 to 0.2 for secondary-sector employment and from 0.1 to 0.3 for tertiary-sector employment. This is a little surprising but assuring result, because it suggests that the choice of a multiplier might not be critical in comparison with the magnitude of impact that the inclusion of by-employments in the counts would exert on the estimates of sectoral labour productivity.

Secondly, according to formulas I and II of the table where estimates are made on the basis of information about principal occupations only, the pre-World War I level of secondary-primary sectoral productivity differential was well above 2. In contrast, our new estimates with subsidiary labour taken into calculation indicate that the secondary sector's labour productivity in 1874 was on a comparable level with the corresponding estimate for the primary sector (hereafter, all the cases are with the multiplier of 0.5). In the next 35 years the sectoral differential increased but the level still remained below 3, suggesting that before World War I, in many category industries of the secondary sector the labour productivity levels must have remained on a par with that in agriculture. It was during the inter-war years when the sectoral differentials widened noticeably, raising the level above 4. This temporal pattern seems to fit well with what we know about the periodisation of pre-World War II economic history. The pre-war era was an age of 'balanced growth' between traditional agriculture and a 'modern' industrial sector equipped with imported technology from the west. In-between, however, there were two separate groups of manufacturing industries. One was a sector of traditional industry and trade with much of labour supplied from the farm household in the form of by-employment.[39] This traditional sector was labour-intensive and produced finished and semi-finished goods, eyeing both domestic and Asian consumer markets, and thus expanded steadily during this period. Another is a hybrid type of industries in textiles, particularly in silk. While silk weaving remained largely traditional, reeling transformed itself from a hand technology-based putting-out system to a machine-using workshop operation – but it remained more or less labour-using and stayed in the countryside.[40] In cotton spinning, where the technology came from Manchester and certainly more capital-intensive than in silk reeling, it is demonstrated that firms deliberately chose the ring-frame, a technologically advanced but more labour-intensive production method than the mule.[41] Interestingly, even the newly established, state-owned iron

[39] Nakamura, *Economic Growth*, ch. 1. See also Tanimoto, 'Role of tradition'.
[40] See Kiyokawa, 'Transplantation' on the Tomioka Model Filature. From the late-seventeenth century onwards, reeling and weaving were geographically separated in the silk trade. During the eighteenth reeling took root as a by-employment in the agrarian countryside. While weaving had long been an urban enterprise in the metropolises such as Kyoto, the early nineteenth century saw weaving centres spreading across the provinces. Even when a package of mechanised silk filature was introduced from the West, i.e. Italy and France, in the late nineteenth century, the geographical pattern of the silk trade remained more or less unchanged. One important difference that emerged in the Meiji period is that reeling became increasingly export-oriented while weaving stayed largely with the domestic market, with throwing done mostly within the comparatively more labour-using weaving sector.
[41] See Kiyokawa, 'Technology choice'.

and steel industry turned out to be labour-intensive until about 1920.[42]

Moreover, a recent, phase-specific growth accounting study by K. Fukao, T. Makino and T. Settsu has provided us with a fresh set of evidence on factors associated with sector-specific labour productivity growth. Although the non-primary sector cannot be disaggregated, the results from this two-sector exercise are nonetheless relevant and suggestive.[43] According to their findings, strong growth of labour productivity in the post-World War II period was led by capital accumulation and technological innovation, as measured by total factor productivity (TFP) growth; labour productivity of the non-primary sector grew at 7.2 per cent per annum during the 1955-1970 period, of which 94 per cent was accounted for by interactions between an increase in the capital-labour ratio and the growth in TFP. But between 1885 and 1940 the corresponding rate of growth was 2 per cent and as much as one-third was explained by labour quality growth. For the pre-war phase, an interesting contrast is found between the two sectors: before World War I the primary sector's performance in labour productivity growth was comparable to that of the non-primary sector – it was 1.6 per cent for the primary, only 0.4 points below the level for the non-primary sector. While the former sector's growth performance deteriorated to 0.3 per cent in the 1926-1940 period, the corresponding rate of growth in the latter remained at the same level as in the pre-World War I phase, although the non-primary sector's total factor productivity growth shifted upwards marginally from 0.5 per cent in the pre-1899 phase to 0.8 per cent in the phase after 1926. All this seems to suggest that before 1940 industries and trades outside the farming sector were generally labour-using, and that in those traditional sub-sectors too, productivity growth took place. Given this and a few other fact-findings such as the steady growth performance of agriculture in that period, the labour market between the primary and the non-primary sector must have worked rather well, thus keeping the sectoral labour productivity differential levels lower than otherwise.

The structural relationship between the sectors changed in the inter-war years. As noted above, the primary sector's performance of both real output and TFP growth deteriorated in the inter-war period, there was a gradual acceleration in the trend of real output and TFP growth in the non-primary sector, with which an unmistakable move towards the so-called 'heavy' industry took place. However, the pace of increase in the secondary sector's employment was not particularly impressive if compared with the pre-World War I period. While the inter-war level of the average annual growth rate of the secondary-sector labour force stood at 1.9 per cent, which was only marginally higher than the 1874-1920 level of 1.6 per cent (calculated from Online appendix table 2). The growth accounting results for the two pre-World War II phases, 1885-1899 and 1926-1940, reveal that the above-mentioned increase in the TFP growth rate from 0.5 to 0.8 per cent was counterbalanced by a fall in the growth rate of capital input per unit of labour input from 0.8 to 0.5 per cent. One reason for this is that the denominator increased substantially: with secondary- and tertiary-sector employment combined,

[42] Okazaki, 'Import substitution'.
[43] The following account is based on Fukao, Makino and Settsu, 'Human capital', table 1. Note that they chose 1913 for the benchmark year dividing the 1874-1940 period, whereas it is 1920 in Online Appendix table 2.

the number of workers grew at 1.9 per cent per annum as compared with 1.5 per cent for the pre-World War I period. This contrast between the two phases becomes greater if labour input is measured in person-hours: the annual growth rate was 2.6 per cent for the inter-war phase as against 0.8 per cent for the pre-World War I years, reflecting compositional changes over the entire 1874-1940 period, especially the substantial decline in the share of female secondary-sector workers whose hours worked were on average shorter than their male counterparts. As it is revealed that the level of labour productivity differential between the primary and the secondary sector widened from 2.16 in 1908-14 to 4.32 in 1936-40 (table 6, formula III), it is probably safe to interpret this inter-war process as a period in which the rise of a top group of industries whose TFR growth accelerated was surrounded by many other manufacturing industries as well as construction, transport and other service trades, all those which absorbed increasingly more labour. The industrialisation of the inter-war years, therefore, should be characterised as an unbalanced growth and was associated with a widening dual structure.[44]

Turning to the tertiary sector's labour productivity differentials with the primary sector's in formula III of table 6, the levels in early years turned out to be substantially higher with no obvious trend over the entire period of industrialisation. This finding is puzzling. It could be that the estimates of output per worker in the early years were too high because value-added data in commerce, transport and services were overstated, or because our estimates of the number of subsidiary labourers in branches of the tertiary sector were under-enumerated, or both. There is also a piece of evidence that petty commerce swelled in the city of Tokyo in the Great Depression period, presumably by absorbing people who had been sacked by employers in the other sectors, causing economic and social problems and conflicts within the city.[45] This is a finding which may suggest that the equation used for by-employment adjustment in this chapter was not able to adequately account for its urban phenomena, causing implausibly high productivity differential estimates for the tertiary sector at large.

Notwithstanding these quibbles, it is worth reiterating that Meiji Japan's industrialisation started with the tertiary-sector share higher than that of the secondary, and that tertiary-sector employment expanded at a similar rate initially and, later, at a faster rate of growth than secondary-sector employment (figure 3 and table 4). The tertiary sector's share was 17 per cent in 1874, which rose to 22 per cent in 1906 and then to 30 per cent in 1940. Given the recurring supposition about Japan's growth records that the performance of pre-1940 industrialisation was closely related to what the state did, there is one issue which can be checked here. The question is concerned with the level of public-sector employment and its rate of increase over time. According to panel C of table 4, the share of national and local government services in the total labour force stood at 5 per cent in 1906 and increased to 8 per

[44] Growth accounting estimates in this paragraph are taken from Fukao, Makino and Settsu, 'Human capital', table 1, and the sector-specific growth rates of workers are computed from Online appendix table 2 (with the 1913 figures interpolated). For interpretations of industrialisation and the widening of the dual structure between farming and manufacturing and within manufacturing that took place in the inter-war period, see Nakamura and Odaka, 'The inter-war period', and Odaka, 'Dual structure'.

[45] Settsu, 'Kindai Nihon', ch. 5.

cent in 1940. These pre-World War II levels were high in comparison with Japan's own records in the post-World War II period, which remained at 3 per cent from 1955 to 2010. As a note to table 4 makes it clear, this is because the pre-war estimates for this sub-sector included non-governmental professionals (a format chosen by the LTES compilers based on the causes-of-death statistics). Judging from post-1920 census data, the number of public-sector workers in 1906 could have been 491,000, revealing that the true share of national and local government services in the total labour force had been a marginally lower than 2 per cent and increased to the level of 3.5 per cent in 1940.[46] Should this be the case, the link with the post-war levels does no longer look particularly discontinuous, and the comparison with the estimates for contemporary France and Germany, around 4 per cent for 1911,[47] suggests that pre-war Japan's government share was low by international standards. That said, however, an increase in the share of non-governmental services was indisputable for the 1906-40 period and thus may still matter. In order to assess the latter's possible importance, therefore, let us carry out a simple counter-factual test. Suppose that the share of Japan's government sector in the total labour force was on a par with France and Germany in the period before World War I, i.e. at 4 per cent, and kept at that level until 1940. The 1906 share of the tertiary sector must have been 21 per cent, larger than the secondary sector's, and the gain to 1940 would have been 6 percentage points, still non-negligible as a rise in the tertiary-sector share. It is therefore concluded that the tertiarisation of the private sector did occur irrespective of the government services' expansion, suggesting that commerce, transport, financial services, and all other business-to-business services responded to the stimulus derived from manufacturing growth.

Finally, a few comments are in order on the post-World War II period of industrialisation. In that period the non-primary sector's real output grew at 11 per cent per annum. For this phenomenal growth, Fukao, Makino and Settsu's growth accounting confirms that TFP growth and intensified investment in physical capital, as well as labour force growth, were all crucial.[48] Also established is that a major source of the growth of the non-primary sector's employment was an increased outflow of labour from agriculture, which took the form of rural-to-urban, inter-regional migration, fuelling the pace of urbanisation. All this, undoubtedly, is best fit to manufacturing. What remains unclear is to what extend this picture fit with non-manufacturing sub-sectors within the secondary-tertiary grouping. Although detailed break-down is not tenable, there is suggestive evidence from studies based on the manufacturing vs non-manufacturing framework, according to which non-manufacturing's TFP level and its growth were substantially lower than manufacturing's over the period since 1970. While in the 1970s and 80s, manufacturing enjoyed much higher TFP growth than the non-manufacturing sector, manufacturing's TFP growth became stagnated from the 1990s onwards but nonetheless

[46] Based on tables included in Umemura et al., *Rodōryoku* (Statistical tables 8-9, pp. 204-11), the share of the number of genuinely public-sector employees in the sub-sector total for 1920 stood at 37.0 per cent, which increased marginally to 38.2 per cent in 1930 and then jumped up to 46.6 per cent in 1940, suggesting that the share had remained close to 37 per cent before 1920. Calculated on this assumption, we get the estimate of 1.9 per cent for 1906.

[47] Calculated from Online Appendix Two tables for both countries.

[48] Fukao, Makino and Settsu, 'Human capital', table 1.

non-manufacturing's TFP hardly grew either. As a result, the gap between the two sectors remained wide.[49] Moreover, another work suggests that in the 1990s Japan's productivity differentials were internationally low if services and construction are singled out.[50]

Tables 4 and 5 have revealed that between 1906 and 1970 the manufacturing sector expanded its share in the labour force as capital-intensive industrialisation proceeded, but in terms of absolute numbers more labour was absorbed by non-manufacturing trades other than agriculture: over the 64-year period, manufacturing's labour force increased 3.8-fold while the factor of increase for the rest of the non-primary sector was 4.2. When the economy began to de-industrialise from the 1980s onwards, even more labour was absorbed by this comparatively low-productivity group of non-manufacturing sub-sectors. Given the above findings from productivity analysis, therefore, it is not surprising to see that the nation's performance in per-capita GDP growth keeps falling as the rise of a service economy continues.

4. Concluding remarks

This chapter has set out our revised estimates of labour force statistics in the primary, secondary, and tertiary sectors for the period between 1885 and 1940. The revision was made for the pre-World War II period in which the phenomenon of by-employment was non-negligible. Based on the new PSTI series and also on the separately estimated series of sectoral outputs, we have explored the patterns of occupational structural change as well as the issue of sectoral differentials in labour productivity over the entire period in question.

According to our revised table, the size of tertiary-sector employment was comparatively large at the start of Meiji industrialisation and its expansion steady over the entire period since the 1880s. Turning to secondary-sector employment, its overall growth in the period before 1920 was also steady, but slower than previously assumed, and performance in terms of labour productivity over the entire pre-World War II period was not particularly impressive if compared with the post-World War II period of 1955-1970: it remained at 2 per cent on average with sub-period estimates never exceeding a level above the 3 per cent mark. This pre-war achievement of 'industrialisation' was not occasioned by a strong investment capital stock nor by TFP growth. There was an unmistakable improvement in productivity but it was supported more by a gradual advance in the quality of labour (which is likely to have absorbed benefits of improved school enrolment). It is true that the pace of post-Meiji industrial growth quickened from the late 1920s on, but it was short-lived as the nation went for total war and the industrial core that adopted capital-intensive methods of manufacturing remained small in size and surrounded by thick layers of small-sized, labour-intensive workshops.

Compared with the previous LTES estimates, on the other hand, our revised estimates of the labour force at both sectoral and sub-sectoral levels have revealed that more men are now found in manufacturing and tertiary-sector activities in the form of by-employment, while

[49] Fukao and Saito, 'Japan's alternating phases', pp. 151, 155.
[50] Baily and Solow, 'International productivity comparison', quoted in Fukao and Saito, 'Japan's alternating phases', p. 157.

differences in the female sectoral shares between the estimates with and without information about subsidiary occupations are not particularly large, suggesting that much of the female involvement in proto-industrial activities was captured by the early Meiji official statistics. Those updated estimates have an important implication for labour productivity analysis at sectoral levels, however. Scholars in the LTES group, except perhaps Ohkawa himself, seldom ventured to do sectoral analysis of labour productivity and its changes over time, presumably because they knew that the widespread phenomena of rural by-employment would make such an analysis difficult and misleading, especially for the early years of development. Now it is evident that any calculations of sectoral differentials in labour productivity derived directly from the LTES volumes are misleading. Differentials in average labour productivity between primary and secondary industry were not as wide as both Gerschenkronian and dual structurist arguments have assumed. In the early stages of Japan's industrialisation, the traditional sector of manufacturing was larger than previously thought. Initially, the overall level of average labour productivity in the secondary sector was more or less comparable to that in the primary sector. This interesting finding suggests, first, that the whole manufacturing industry in the Meiji period was not overwhelmed by the imported modes of capital-intensive and that labour-saving production methods spread only slowly as industrialisation proceeded, and second, that levels of labour productivity in agriculture were higher than previously imagined. There has been a consensus that in Japanese agriculture land productivity was high but it was very labour intensive; what our estimates suggest is that yields per worker were not as low as some of the users of the LTES thought, as far as the period before World War I is concerned. The productivity gap between the sectors widened as industrialisation proceeded and it was in the inter-war period when the tempo of sectoral segregation quickened, which resulted in the emergence of a dual structure in the nation's economy of the 1930s and 40s.

By having explicitly taken by-employment into consideration, we are now in a position to take a number of steps towards a better understanding of sectoral differentials in labour productivity in the early phases of development.

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Table 1. Japan's real GDP per capita and population, 1721-2010

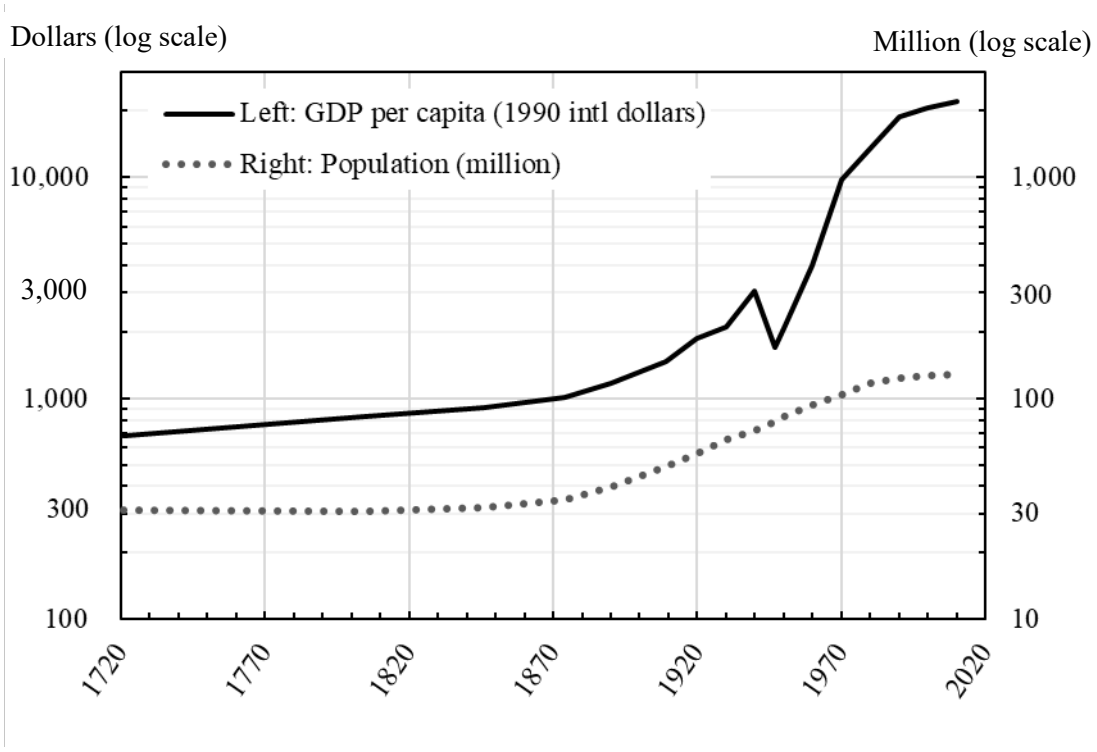
	GDP per capita (1990 intl dollars)	Population (million)	Average annual rate of growth from previous benchmark year (%)	
			GDP per capita	Population
1721	676	31.3		
1804	828	30.7	0.24	-0.02
1846	904	32.2	0.21	0.12
1874	1,013	34.8	0.41	0.28
1890	1,166	39.9	0.88	0.85
1909	1,467	48.9	1.22	1.08
1920	1,870	56.1	2.23	1.25
1930	2,097	64.7	1.15	1.44
1940	3,071	71.9	3.89	1.06
1947	1,705	78.1	-8.06	1.20
1950	2,076	83.2	6.78	2.13
1960	3,986	93.4	6.74	1.17
1970	9,714	103.7	9.32	1.05
1980	13,428	117.1	3.29	1.22
1990	18,789	123.6	3.42	0.55
2000	20,497	126.9	0.87	0.26
2010	21,990	128.1	0.71	0.09

Sources: Settsu, Bassino and Fukao, 'Meiji-ki', table A-9, p. 210, combined with Saito and Takashima, 'Estimating', table 2, p. 380, for the 1804-1874 period and Maddison Project Database [http://www.ggdc.net/maddison/maddison-project/data.htm] for the period after 1955.

Note: 1) The new Japanese estimates are in 1934-35 yen, which are linked to the Maddison series in 1990 international dollars. The link is made in 1955.

2) The growth rates are compound annual rates of growth calculated from two adjacent benchmark years.

Figure 1. Changes in Japan's real GDP per capita and population, 1721-2010



Source: Table 1.

Table 2. Occupational matrix: men and women in Yamanashi, 1879

A. Males

Principal occupation	*Subsidiary occupation*			Principal only	Total
	P	S	T		
Primary	12.2	8.3	10.2	55.6	86.4
Secondary	0.1	0.0	0.2	4.7	4.9
Tertiary	0.1	0.1	0.6	7.9	8.7
Total	12.4	8.5	11	68.2	100
Proportion by-employed				31.8	

B. Females

Principal occupation	*Subsidiary occupation*			Principal only	Total
	P	S	T		
Primary	4.2	9.5	0.4	64.4	78.5
Secondary	9.4	0.8	0.0	8.8	18.9
Tertiary	0.1	0.0	0.1	2.3	2.5
Total	13.7	10.3	0.5	75.5	100
Proportion by-employed				24.5	

C. Males and females combined

Principal occupation	*Subsidiary occupation*			Principal only	Total
	Primary	Secondary	Tertiary		
Primary	8.6	8.8	5.8	59.5	82.9
Secondary	4.2	0.4	0.1	6.5	11.2
Tertiary	0.1	0.1	0.4	5.4	6.0
Total	13.0	9.3	6.3	71.5	100
Proportion by-employed				28.5	

Source: See Online appendix table 2A.1, taken from Tōkei-in, *Kai no kuni*.

Table 3. Occupational matrix: men and women in Shizuoka, 1925

A. Males

Principal occupation	*Subsidiary occupation*			Principal only	Total
	P	S	T		
Primary	19.8	5.0	3.3	23.0	51.0
Secondary	1.7	0.3	0.5	21.1	23.5
Tertiary	1.8	1.4	1.2	21.1	25.5
Total	23.2	6.6	5.0	65.2	100
Proportion by-employed				34.8	

B. Females

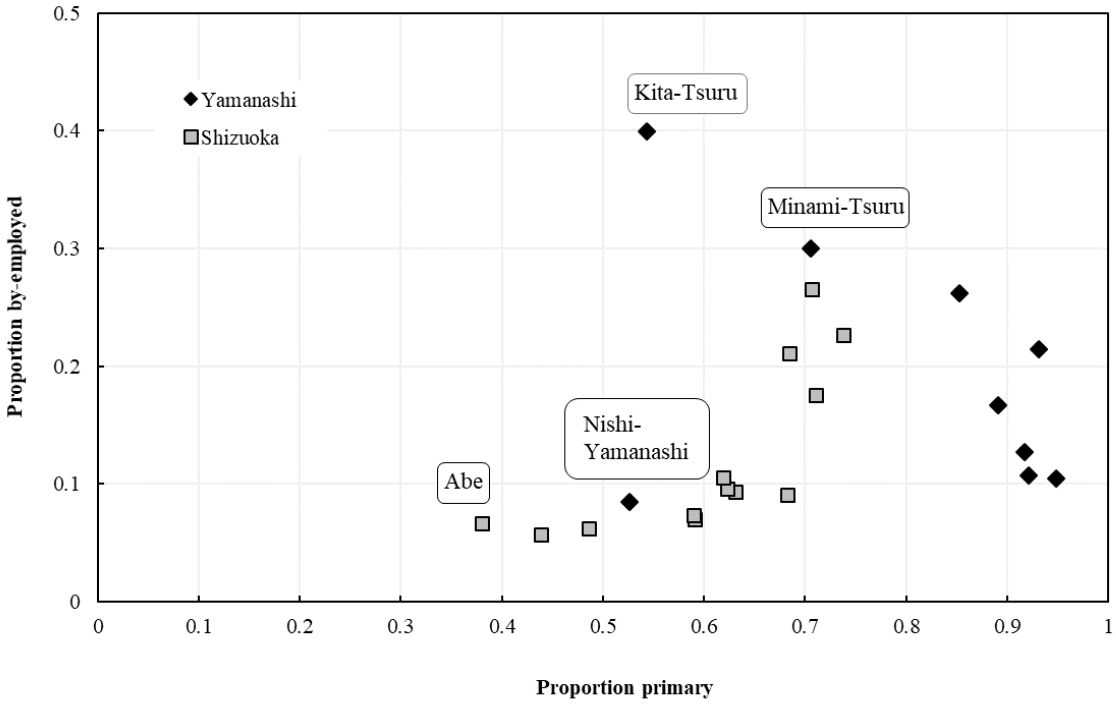
Principal occupation	*Subsidiary occupation*			Principal only	Total
	P	S	T		
Primary	21.7	5.0	0.8	36.6	64.1
Secondary	0.5	0.1	0.1	15.1	15.8
Tertiary	0.6	0.6	0.5	18.4	20.1
Total	22.7	5.8	1.5	70.1	100
Proportion by-employed				29.9	

C. Males and females combined

Principal occupation	Subsidiary occupation			Principal only	Total
	Primary	Secondary	Tertiary		
Primary	20.6	5.0	2.2	28.8	56.6
Secondary	1.1	0.2	0.3	18.6	20.2
Tertiary	1.3	1.1	0.9	20.0	23.2
Total	23.0	6.3	3.5	67.3	100
Proportion by-employed				32.7	

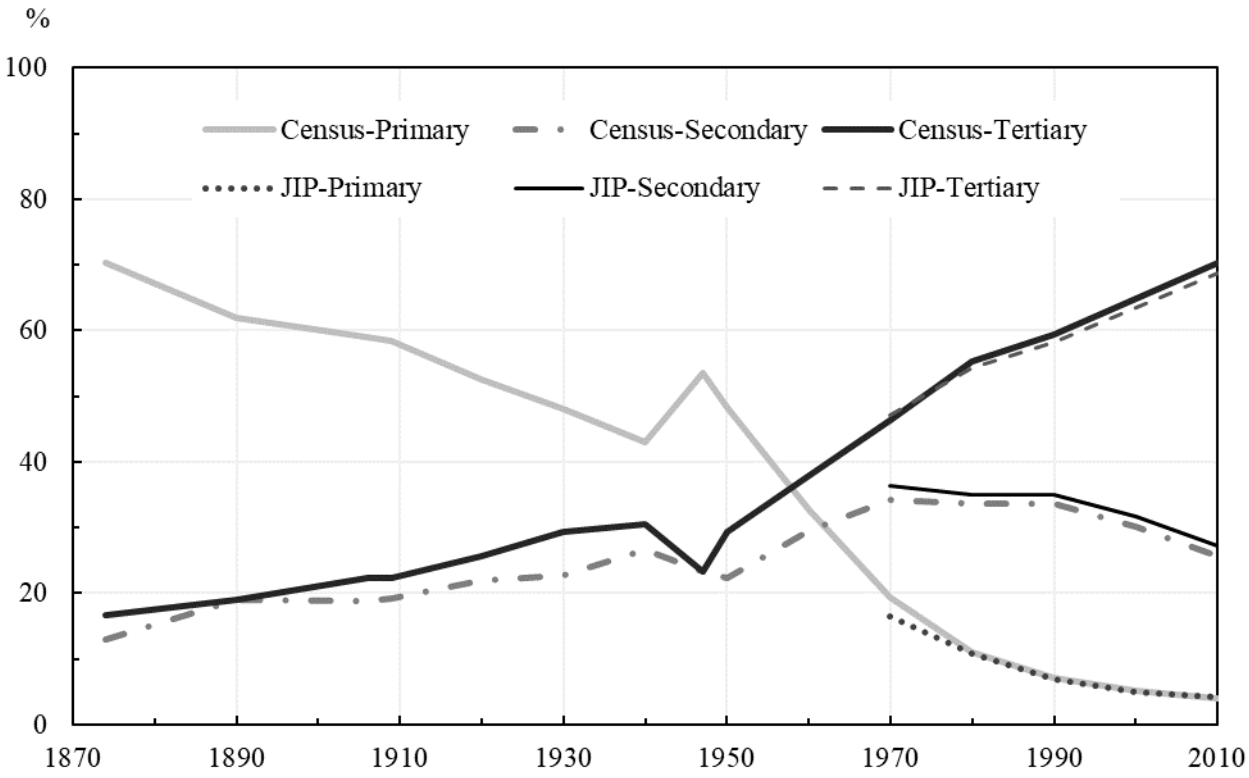
Source: See Online appendix table 2A.2, taken from Shizuoka-ken, *Taishō 14-nen*.

Figure 2. By-employment and the level of economic development: pooled district-level data for Yamanashi, 1879, and Shizuoka, 1925



Source: See tables 2-3.

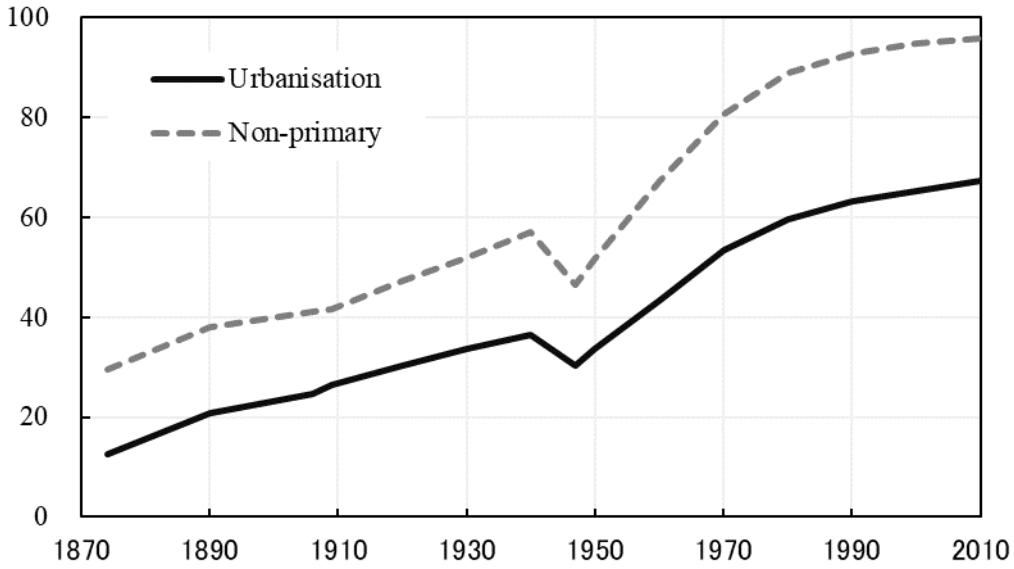
Figure 3. Changing sectoral shares in Japan, 1874-2010 (both sexes combined)



Sources: Online appendix table 2 for the census-based series. The JIP estimates are taken from https://www.rieti.go.jp/en/database/JIP2015/index.html, Table 3-8.

Note: The 1874-1940 estimates of the census-based series are adjusted for subsidiary employments, while the 1947-2010 data are not. The JIP series is taken from 'industrial' survey data measured in person-hours.

Figure 4. The proportion of people living in ‘densely inhabited districts’ (DIDs) and the share of the non-primary sectors in the total labour force, 1874-2010.



Sources: Online appendix 2 and table A2.

Table 4. Changing sectoral and sub-sectoral shares by gender: Japan, 1906-2010

(%)

Sector/sub-sector	1906	1920	1940	1950	1970	2010
A. Males						
Primary sector	**54.7**	**47.0**	**34.4**	**40.2**	**15.0**	**4.3**
Mining and quarrying	1.6	2.1	2.6	2.4	0.6	0.1
Manufacturing	13.6	16.7	24.4	18.2	27.0	19.2
Construction and public works	5.6	6.0	6.3	7.5	11.9	14.1
Secondary sector	**20.8**	**24.8**	**33.3**	**28.1**	**39.5**	**33.3**
Commerce	12.6	14.9	17.0	10.4	15.4	14.3
Services and professions				10.6	17.1	35.8
Government and armed forces	7.3	7.0	9.3	4.4	4.4	4.4
Transport	4.6	6.3	6.0	6.3	8.7	8.0
Tertiary sector	**24.5**	**28.2**	**32.3**	**31.8**	**45.5**	**62.4**
Total	100	100	100	100	100	100
B. Females						
Primary sector	**65.9**	**62.1**	**56.8**	**61.2**	**26.2**	**3.7**
Mining and quarrying	0.6	1.1	0.6	0.5	0.1	0.0
Manufacturing	14.6	15.5	14.9	11.9	23.6	11.5
Construction and public works	0.1	0.2	0.3	1.0	2.3	3.7
Secondary sector	**15.3**	**16.9**	**15.7**	**13.3**	**26.0**	**15.3**
Commerce	16.5	17.4	21.7	9.4	17.7	19.4
Services and professions				13.3	26.6	56.9
Government and armed forces	1.9	2.8	4.6	1.4	1.6	2.0
Transport	0.5	0.8	1.2	1.3	1.9	2.7
Tertiary sector	**18.8**	**21.0**	**27.5**	**25.4**	**47.8**	**81.1**
Total	100	100	100	100	100	100

Continued

C. Both sexes combined						
Primary sector	**59.0**	**52.6**	**43.0**	**48.3**	**19.4**	**4.0**
Mining and quarrying	1.2	1.7	1.8	1.7	0.4	0.0
Manufacturing	14.0	16.2	20.7	15.7	25.7	15.9
Construction and public works	3.5	3.9	4.0	5.0	8.1	9.7
Secondary sector	**18.7**	**21.8**	**26.5**	**22.4**	**34.2**	**25.6**
Commerce	14.1	15.8	18.8	10.1	16.3	16.5
Services and professions				11.6	20.8	44.8
Government and armed forces	5.2	5.5	7.5	3.3	3.3	3.3
Transport	3.0	4.3	4.2	4.4	6.0	5.7
Tertiary sector	**22.3**	**25.6**	**30.5**	**29.3**	**46.4**	**70.4**
Total	100	100	100	100	100	100
D. Female shares						
Primary sector	**42.8**	**43.7**	**50.7**	**48.9**	**53.0**	**39.3**
Mining and quarrying	18.1	24.3	11.6	11.1	10.7	16.8
Manufacturing	40.0	35.3	27.6	29.2	36.0	31.0
Construction and public works	1.3	2.4	2.8	7.5	11.0	16.6
Secondary sector	**31.4**	**28.6**	**22.8**	**23.0**	**29.7**	**25.5**
Commerce	44.8	40.7	44.4	36.3	42.5	50.3
Services and professions				44.1	50.0	54.4
Government and armed forces	13.9	19.3	23.4	17.0	19.4	25.6
Transport	6.0	6.5	11.0	11.1	12.5	20.2
Tertiary sector	**32.3**	**30.5**	**34.7**	**33.5**	**40.3**	**49.3**
Total	38.3	37.0	38.4	38.6	39.1	42.8

Source: Online appendix table 2.

Notes:

1) Commerce cannot be separated from non-government services and professions in the pre-World War II period.
2) Category ‘construction and public works’ includes PSTI codes ‘2, 2, 76’ (Stone and mineral processing) and ‘2, 0, 0’ (Secondary not further distinguished).
3) Category ‘services and professions’ does not cover services included in ‘government and armed forces’ but includes PSTI code ‘3, 0, 0’ (Tertiary not further distinguished).
4) From 1906 to 1940, non-government professions are not included in the ‘services and professions’, but in the ‘government and armed forces’ category.

Table 5. Changing shares of manufacturing industries by gender: Japan, 1906-2010

(%)

Industrial group	1906	1920	1940	1950	1970	2010
A. Males						
Food, drink and tobacco	1.9	2.2	1.5	2.4	1.9	1.8
Textiles, clothing and footwear	3.3	3.9	3.4	2.2	2.4	0.6
Wood and furnishing	2.9	3.0	2.8	2.8	2.1	0.6
Metal and metal working	1.9	2.5	3.1	2.4	5.4	2.8
Machines and tools	0.9	2.0	9.3	3.5	8.0	8.6
Rest of manufacturing	2.7	3.0	4.4	4.9	7.2	4.8
Manufacturing total	13.6	16.7	24.4	18.2	27.0	19.2
B. Females						
Food, drink and tobacco	1.4	1.5	1.0	1.9	2.4	2.7
Textiles, clothing and footwear	9.3	10.8	8.8	5.8	7.4	1.2
Wood and furnishing	2.3	1.3	0.9	0.6	1.3	0.3
Metal and metal working	0.3	0.2	0.4	0.4	1.9	0.9
Machines and tools	0.1	0.2	1.8	0.6	4.9	3.5
Rest of manufacturing	1.4	1.4	2.0	2.6	5.7	3.0
Manufacturing total	14.6	15.5	14.9	11.9	23.6	11.5
C. Both sexes combined						
Food, drink and tobacco	1.7	2.0	1.3	2.2	2.1	2.2
Textiles, clothing and footwear	5.6	6.5	5.4	3.6	4.4	0.8
Wood and furnishing	2.6	2.4	2.1	1.9	1.8	0.5
Metal and metal working	1.3	1.6	2.1	1.7	4.0	2.0
Machines and tools	0.6	1.4	6.4	2.4	6.8	6.4
Rest of manufacturing	2.2	2.4	3.5	4.0	6.6	4.0
Manufacturing total	14.0	16.2	20.7	15.7	25.7	15.9
D. Female share						
Food, drink and tobacco	30.7	29.2	30.4	33.1	45.6	52.8
Textiles, clothing and footwear	63.7	62.1	61.9	62.1	66.1	58.9
Wood and furnishing	32.8	19.6	16.2	11.2	28.1	24.3
Metal and metal working	8.0	4.8	8.3	10.1	18.4	20.4
Machines and tools	3.6	6.6	10.7	10.2	28.2	23.3
Rest of manufacturing	24.2	21.2	22.0	24.9	33.6	31.6
Manufacturing total	40.0	35.3	27.6	29.2	36.0	31.0

Source: Online appendix table 2.

Notes:

1) In each cell the share is calculated with respect to the total labour force, not to the manufacturing labour force.
2) For the reason given in table 4, note 2, those who were engaged in Stone and mineral processing (2, 2, 76) are not included in this table.

Table 6. Comparison of LTES and revised sectoral labour productivity differentials, 1885-1970

	I. LTES (Principal only)		II. Our estimates (Principal only)		III. Subsidiary taken into account			
					Multiplier = 0.5		Multiplier = 0.25	
	Secondary	Tertiary	Secondary	Tertiary	Secondary	Tertiary	Secondary	Tertiary
1874			2.11	2.51	1.13	2.00	1.49	2.24
1885-89	2.40	4.19	2.21	3.79	1.62	3.22	1.88	3.49
1894-99	2.31	3.28	2.17	3.61	1.74	3.16	1.94	3.37
1901-07	2.80	3.39	2.33	3.67	1.91	3.28	2.11	3.47
1908-14	2.94	3.03	2.56	3.48	2.16	3.17	2.35	3.32
1915-22	3.13	2.75	3.06	3.28	2.71	3.06	2.88	3.17
1927-33	4.03	3.72	3.88	4.86	3.63	4.66	3.75	4.76
1936-40	4.24	2.69	4.56	3.76	4.32	3.62	4.44	3.69
1947-55	3.33	2.54						
1955-60	3.46	2.69						
1960-65	3.48	3.03						

Sources: For LTES estimates, Ohkawa *et al*., *Patterns*, table 2.12, p. 41; for our series with multiplier = 0.5, Fukao et al., *Iwanami kōza Nihon keizai no rekishi*, vol.3, Appendix table 2, pp. 266-67. For other two series, see text.

Note: As the LTES's definitions of the secondary and tertiary sector do not completely agree with the PSTI system, strict comparison between the two may not be possible.