Examination of the Occupational Polarization Hypothesis: Analysis on the Japanese Labor Market in 21st Century Based on the *Employment Status Survey* Data

SANO Kazuko

The "job polarization hypothesis"—which posits that there has been a decline in the share of middle-pay jobs relative to jobs with higher or lower pay—has become a prominent theoretical framework, particularly in Europe and the US. The objective of this paper is to examine the extent to which the polarization hypothesis applies to the Japanese labor market since the late 2000s. The analysis draws upon the methodological framework of international comparative studies, with a particular focus on the institutional complementarities observed in advanced economies. The study utilizes individual-level data from the *Employment Status Survey* (Shugyo Kozo Kihon Chosa) to substantiate its findings. In the analysis, jobs at a detailed occupational classification level are ranked into five quintiles based on the average income level. A subsequent analysis will present changes in the composition of each quintile over the 10-year period from 2007 to 2017 by sex and educational background.

The analysis indicates that, when considered as a whole, no polarization has occurred. Conversely, a moderate upgrading of the occupational structure is evident, marked by a decrease in the "middle and lower" quintiles and an expansion of the "upper middle" and "top" quintiles. With respect to background factors, the growth of service occupations in the bottom-end quintile, a factor that drives polarization, is constrained, while the proportion of women with a university degree increases in the top quintile. In contrast to the upgrading observed in advanced European countries during the same period, as indicated by previous studies, the degree of expansion in the upper quintile is comparatively slight.

Additionally, occupations related to the healthcare sector exhibit a tendency to increase their share across a wide range of the occupational structure. Previous studies conducted in Europe and the US have indicated that the advent of computer technology and the influx of immigration have brought changes to occupational structures. In Japan, on the other hand, since the mid-2000s, the expanding demand for care services for the elderly has led to significant changes in the occupational structure.

I. Introduction

A review of long-term changes in the occupational structure reveals that technological change has resulted in a shift in industries characterized by high productivity and a transformation in the types of jobs held by the working population. The transition from an industrial to a post-industrial economy since the 1970s has resulted in a decline in the number of production-line jobs in manufacturing, which had previously constituted a significant segment of employment across the middle of the income distribution. Consequently, this transition has led to the emergence of a significant number of service sector jobs at the below-median income level. In recent years, with the progression of digital transformation in various industries, there has been an increase in the prevalence of highly specialized technical occupations and managerial positions that are not supplanted by computerization (Ministry of Economy, Trade and Industry 2018).

These changes in the occupational structure have been a primary subject in the fields of labor economics, sociology, and comparative welfare state research. Elucidation of the relationship between occupational expansion and decline, on the one hand, and the structure of income stratification, on the other, furnishes valuable policy recommendations in terms of suggesting the extent to which social equality is upheld (Oesch 2013).

Research trends published since the year 2000 demonstrate that the view of advancing "polarization" in occupational structure in the US since the 1980s has become firmly established, with similar discussions unfolding in Europe. The term "polarization" of the occupational structure refers to patterns of changes in which the share of employees in the middle-skill jobs decreases while the shares of employees in the high- and low-skill jobs increase when occupations are ranked from high to low based on income levels and examined for shifts in the share of employees within high-, middle-, and low-level groups (Acemoglu and Autor 2011; OECD 2017). The present study aims to examine the extent to which the job polarization hypothesis, a theory that has gained prominence in the US labor market, applies to the Japanese labor market since the late 2000s, utilizing a descriptive analysis approach.

The polarization of the US employment structure has been empirically analyzed using various theories and indicators, beginning with Wright and Dwyer (2003). Analytical findings supporting this polarization of the employment structure have accumulated in recent years. These findings are based on the "routinization hypothesis," which utilizes the tasks inherent to each occupation as indicators to assess changes in the occupational structure with respect to its substitutability with computer technology.

Concurrently, since the year 2000, international comparative studies have advanced in Europe, aiming to reevaluate the polarization hypothesis—which gained prominence after the routinization hypotheses—by focusing on the characteristics of employment systems in advanced countries. These studies center on the question of why disparities in patterns of changes in the occupational structure were observed across countries despite the experience of similar technological change. Among the representative empirical studies, Oesch (2013) and Oesch and Piccitto (2019) analyzed European advanced economies, including the UK, since the 1990s. In their study, the scholars demonstrated that "upgrading," defined as an upward shift in the occupational structure, has occurred in countries other than the UK. In the subsequent analysis, the underlying factors were examined from three dimensions: technological change, changes in the skill sets of the labor force, and labor market institutions.

This paper elucidates the changes in the Japanese occupational structure since the late 2000s using individual-level data from the *Employment Status Survey*. The analysis draws upon the methodological framework of international comparative studies as articulated by Oesch and other scholars in the field. In addition to overall changes, it also examines how the labor force of women[1]—which brought significant changes to labor supply during this period—has changed in the occupational structure.

II. Theories and empirical research on changes in the occupational structure

2.1 Patterns of changes

Theories concerning changes in the occupational structure have been developed by presenting either one of three distinct patterns of change: downgrading, upgrading, or polarization.

One of the predominant theories that lends support to the occupational downgrading hypothesis is the deskilling theory, which was proposed by Harry Braverman. He predicted that the technological change driven by the Industrial Revolution would lead to the breakdown of jobs into smaller tasks, the elimination of the need for highly skilled craftsmanship, and the expansion of low-skill, low-autonomy occupations (Braverman 1974).

Concurrently, the concept of post-industrial society emerged in the 1970s (Bell 1973), emphasizing the expanding demand for professionals due to the rise of the knowledge society. This development introduced the concept of upgrading theory. The notion that technological change leads to an increase in skill levels, resulting in an upward shift in the occupational structure, is a common tenet of the recent theory of skill-biased technological change (SBTC). The SBTC theory, which has undergone continuous development since the early 1990s, is distinguished by its approach for comprehending occupational transformation through the "race" between skill levels—measured by workers' educational attainment—and technological change. The introduction of new technologies has been demonstrated to augment the demand for highly skilled workers to a greater extent than for low-skilled workers. Furthermore, technological change and increasing educational attainment have developed in a mutually complementary manner (Goldin and Katz 2008). While employment opportunities for the less educated do not expand to the same extent as those for the highly educated, the SBTC theory posits that technological change leads to an overall upgrading of the employment structure.

More recently, research based on the routinization hypothesis has become increasingly prevalent. The objective of this hypothesis is to examine the substitutability of jobs with computer technology in order to capture occupational change. The utilization of specific task characteristics inherent within various job roles serves as the primary indicator. These studies suggest that the substitutability of occupations due to technological change is dependent on the inherent nature of the tasks within these occupations, thereby leading to shifts in occupational structure. The substitution of computers for routine production-line or clerical jobs is becoming increasingly widespread. Occupations that require sophisticated communication or analysis remain largely unaffected by this transition. Likewise, tasks that require physical adaptability or interpersonal flexibility exhibit a low degree of substitutability (Autor et al. 2003; Acemoglu and Autor 2011). Consequently, the middle tier of the occupational hierarchy, which comprises routine physical or clerical tasks, becomes hollowed out. Subsequently, an expansion of both the upper and lower tiers occurs, leading to the development of polarization.

A comparison of the aforementioned theories reveals that, while these arguments differ in terms of the direction of the changes that technological innovation brings to employment, they hold the common view that the most significant employment expansion occurs in occupations requiring high-level skills. Conversely, there is a paucity of consensus regarding the impact of technological change on jobs in the middle to lower tiers of the occupational hierarchy, and no consistent explanation has been established. To resolve this issue, the findings from international comparative studies examining changes in the occupational structure based on the institutional characteristics of advanced countries offer practical solutions.

2.2 Analytical perspectives of international comparative studies

Since the late 1990s, research in Europe has been conducted with the objective of capturing the characteristics of patterns of changes in the occupational structure. This research focuses specifically on the institutional framework of each country and examines the applicability of the hypothesis of labor market polarization in the US—which is based on the routinization hypothesis—to other advanced countries. This body of research,

drawing upon theories typifying welfare capitalist countries, such as the "Varieties of Capitalism (VoC)" theory or the welfare regime theory, posits the following views.

A triad of factors has been identified as contributing to occupational change. Firstly, technological change has resulted in shifts in labor demand. Secondly, the expansion of education and the influx of immigrants have led to changes in the labor supply. Thirdly, the institutional environment of each country's labor market should be considered. Among these factors, the first—the widespread adoption of computers—corresponds to a transition that has been uniformly observed across advanced countries. The differential impacts observed across countries can be attributed to variations in the second and third factors. Specifically, the occupations most strongly affected by technological change are determined by the characteristics of the labor force, as well as by how the welfare states support workers through labor market institutions—particularly how it integrates low-educated workers into the labor market. Consequently, disparities emerge among countries in the proliferation of low-paid service sector employment or the unemployment rates of low-skilled workers (Esping-Andersen 1999; Oesch 2013).

This assertion has been substantiated by analyses employing extensive European microdata. A representative study, Oesch (2013), drawing on the analytical approach of Wright and Dwyer (2003) that initiated the polarization hypothesis in the US, descriptively examines the overall direction of changes in the occupational structure for the period 1990–2008 in the UK, Germany, Spain, Switzerland, and Denmark, in terms of changes in the share of employment across five occupational categories ranked by income. The analysis reveals a clear upgrading trend across the four countries, with the exception of the UK, where the top tier of the occupational structure expanded most significantly. The analysis elucidates that discrepancies in the direction of change emanated from the institutional framework governing the labor market. Specifically, the continental European economy, predicated on coordinated wage bargaining, contrasted with the UK's less regulated liberal market economy. The analysis further elucidates that the influx of immigrants and their skill sets also contributed to these discrepancies (Oesch 2013).

International comparative studies also examine occupational change by national origin and sex. Analyses encompassing the US (Wright and Dwyer 2003), in addition to five European countries (Oesch 2013), reveal that in each country, women born in that country contribute to the expansion at the top-end of the occupational structure. This outcome is attributable to the enhancement of women's skill sets, which has been prompted by the expansion of educational opportunities and the heightened demand from employers for highly skilled occupations.

The objective of this paper is to provide a descriptive analysis of an overview of the changes in the Japanese occupational structure, based on the findings from these international comparative studies. Prior empirical research on the Japanese occupational structure has been constrained to analyses that rely on the routinization hypothesis. A representative study by Ikenaga and Kambayashi (2010) demonstrated the changes in the Japanese occupational structure since 1960. The study examined long-term changes in the five task categories, which were classified as either routine or non-routine types. Nevertheless, the principal objective of this study was to examine the impact of substitutability with computer technology on the labor market. Consequently, it remains challenging to indicate the direction of changes in the Japanese occupational structure more comprehensively, based on changes in the share of employees by occupation, as seen in the international comparative studies in Europe and the US, which are examined in this section. This paper provides a comprehensive analysis of the changes in the Japanese occupational structure and examines the underlying factors by drawing on patterns observed in other countries.

2.3 Research topics on the Japanese labor market

The primary objective of this paper is to provide an overview of the changes in Japan's occupational structure.

To this end, the study employs individual-level data from the 2007 and 2017 *Employment Status Surveys*. The time period from 2007 to 2017 is selected for analysis due to the availability of data, as will be explained in the subsequent section. This time frame is also chosen to facilitate a comparison with the findings of Oesch and Piccitto (2019), who examined occupational change patterns in four European countries during the nearly identical period of 2008–2015. The following analyses are undertaken.

In addressing the first research topic, the analytical methods of Wright and Dwyer (2003) as well as Oesch (2013) are utilized to classify occupations into five categories based on income level. The direction of changes in the overall occupational structure of Japan is demonstrated based on the changes in the share of each category relative to the total labor force.

As discussed in Section 2.1, the polarization of the occupational structure is closely linked to the expansion of low-tier jobs within the occupational hierarchy. The extent of this expansion varies across countries due to differences in labor market institutions and the characteristics of the labor force. In consideration of this perspective, the following outlines a predicted pattern of possible change for Japan.

First, according to the VoC theory, which classifies advanced countries based on the characteristics of their labor market institutional frameworks, Japan is classified as a coordinated market economy (CME). In comparison to countries that adhere to a liberal market economy (LME), such as the US and UK, Japan has implemented a more robust system of employment protection measures, including minimum wage systems and labor unions[2] (Hall and Soskice 2001; OECD 2017). In addition, Thelen (2014) conducted a comparative analysis of institutional changes in CME countries since the 1980s, a period during which these countries experienced pressure from globalization and liberalization. Thelen's study indicated that Japanese labor market institutions underwent no significant changes during this period.[3] In light of these findings, it is expected that Japan has not experienced the expansion of low-end service jobs observed in LME countries, such as the US and UK. In contrast, consistent with the patterns observed in CME countries in Europe since the late 1990s (Oesch 2013), Japan is expected to exhibit a restrained growth in jobs at the lowest quintile of its occupational structure.

Next, characteristics of the Japanese labor force reveals notable distinctions from those of the US and UK during their periods of increasing polarization. While the labor force in these countries has become increasingly highly educated, similar to other advanced countries, the polarization was largely driven by the influx of immigrants and their skill sets, which matched the demand for low-end service jobs (Oesch and Piccitto 2019; Wright and Dwyer 2003). In contrast, the impact of immigration is minimal in Japan. As the SBTC theory posits, the ongoing trend toward higher educational attainment causes the overall skill distribution of the labor force to shift upward. As a consequence, there has been a decline in low-educated workers entering low-end jobs and an increase in highly educated workers entering higher-paid jobs. Consequently, the occupational structure is expected to undergo an upgrade. Given these considerations, the first hypothesis is hereby postulated as follows.

Hypothesis 1: The overall direction of changes in the occupational structure suggests an upgrade. Specifically, the proportion of the top quintile exhibits the most significant growth, while the proportion of the bottom quintile remains relatively stable.

The second research topic focuses on the identification of the characteristics of the labor force that produced the results of the first analysis. To this end, an analysis of trends in changes by sex and educational background is conducted. In contrast to Europe and the US, where the entry of immigrants into the labor market has resulted in changes to the labor force, the predominant impetus behind the observed changes in Japan since 2007 appears to be the expansion of women's participation in the labor force. As educational attainment levels rise, there is a concomitant increase in women's employment rates. As a result, there has been an increase in the proportion of highly educated women in occupations that demand high-level skills. As a result, it is postulated that women are

expanding their share in the upper tiers of the occupational structure and contributing to upgrading, thus leading to Hypothesis 2.

Hypothesis 2: Within the top quintile, there is a greater increase in the proportion of women compared to men.

III. Analytical method

3.1 Data

The analysis employs the individual-level data from the 2007 and 2017 *Employment Status Surveys* for on-site facilities, which was provided under Article 33 of the Statistics Act in Japan. Analyses that encapsulate an overview of the occupational transformation, predicated on the number of employees per occupation, yield more precise results when employing national data with finer occupational classifications (Oesch 2013). According to Oesch (2013), the UK possesses the most detailed occupational classification among the analyzed countries, with 171 categories (minor occupational classifications). The two-point data employed in this analysis encompasses 231 occupational unit groups (minor occupational classifications), excluding unclassifiable cases, which renders it suitable for the objectives of this paper. In contrast, data collected at 10-year intervals may prove inadequate for capturing trends over time. However, occupational data prior to 2002 are available only at an aggregated middle-group level, making it necessary to collapse the 2007 and 2017 classifications to this coarser level in order to extend the time period. This paper therefore prioritizes analytical precision by using data with finer occupational classifications.

3.2 Methods for capturing changes in the occupational structure

The analysis is methodically structured into three sequential stages. Firstly, this analysis targets respondents aged 18–69 who were employed, excluding those enrolled in school, and who worked 20 hours or more per week, as captured in the microdata of the *Employment Status Survey* for on-site facilities (Table 1).

With respect to the definition of analytical sample, previous studies employed a variety of criteria. For instance, Wright and Dwyer (2003) included only full-time workers, while Oesch (2013) focused on individuals who worked 20 hours or more per week. The distribution of weekly working hours among the respondents in the *Employment Status Survey* (Table 2) reveals an increase in the proportion of workers with less than 30 hours per week over the decade, from 4.4% to 7.4% for men and from 27.1% to 30.4% for women. Excluding these workers from the analysis may result in an underestimation of the impact of part-time workers on changes in the

Table 1. Analytical sample

	2007	2017
Men	33,207,046	31,426,117
(%)	(59.9)	(58.3)
Women	22,237,133	22,509,551
(%)	(40.1)	(41.7)
Total	55,444,179	53,935,668
(%)	(100.0)	(100.0)

Note: Estimates are weighted using aggregation factors.

Table 2. Respondents in the *Employment Status Survey*

	2007		2017	
	Men	Women	Men	Women
Under 20 hours	1.9	10.9	4.4	14.4
20–29 hours	2.5	16.2	3.1	16.0
30–34 hours	2.6	8.0	2.7	7.8
35–42 hours	25.1	31.1	27.4	32.9
43–48 hours	26.9	18.4	28.5	17.0
49–59 hours	22.5	9.7	20.2	7.9
60 hours and over	18.5	5.7	13.8	4.0
Total	100.0	100.0	100.0	100.0

occupational structure. Conversely, the inclusion of all workers in the analysis may result in an overestimation of the growth in short-hour employment. The present study adopts a middle ground between the 30-hour threshold defining full-time versus part-time work and including all workers, selecting weekly work hours of 20 hours or more as the analysis cutoff, consistent with Oesch (2013). In order to ascertain the validity of this selection, an examination was conducted to determine how the occupational rankings and five occupational categories derived from this analysis vary based on the cutoff for weekly hours. The findings of the study demonstrate that no discrepancies emerge in the analysis outcomes.[4]

Secondly, occupations are ranked based on job quality, determined by income earned from each occupation, serving as an indicator, as of 2007. Job quality is primarily indicated by factors including income, skill (education) requirements, and job satisfaction. In the context of the aforementioned factors, empirical evidence has demonstrated that income is the most comprehensive indicator of job quality and skill levels (Goos and Manning 2007; Oesch and Piccitto 2019). A preponderance of earlier studies that focused on Europe and the US frequently rank occupations based on the median or average hourly earnings of workers within each occupation. In this analysis, occupations are also ranked based on the average hourly earnings of the individuals analyzed included in each occupational unit group. This approach is employed to determine whether there is an increase in "good jobs" or "bad jobs" (Oesch 2013).

Japan's wage structure is characterized by significant disparities in compensation for comparable occupations. The disparities in this regard are influenced by factors such as age, sex, employment type, and firm size. This prompts the question of whether average hourly earnings by occupational unit group—calculated without controlling for these variables—can strictly rank occupations. The methodology of representative studies on occupational change is employed in the present study, conceptualizing income as a broadly representative indicator of "job quality" (Acemoglu and Autor 2011; Goos and Manning 2007; Oesch and Piccitto 2019; Wright and Dwyer 2003). The study employs an analytical framework that examines occupational changes in relation to income, with the aim of identifying specific characteristics associated with sex and skills (educational) levels within the resulting changes in the occupational structure. To confirm the validity of ranking occupations based on average values for occupational unit groups, a comparison of occupational ranks derived from regression models was conducted: one with hourly earnings as the dependent variable and occupational unit groups as the independent variable, and another incorporating additional control variables for age, sex, employment type, and firm size. This finding suggests that there is minimal probability of obtaining differing analytical results.[5]

Furthermore, this analysis operates under the assumption that the relative ranking of each occupation's income level remains constant over the specified time periods. Consequently, the hourly earnings in the initial survey year of 2007 are employed as an indicator representing occupational rank. The rank correlation coefficient for occupational rank based on income level between the two time points is high at 0.975. When constructing the ranking based on the 2007 data, the analytical sample is restricted to individuals who had been employed at the same workplace one year prior.

Thirdly, occupations are ranked into five quintiles according to their income level, ranging from the highest-paying to the lowest-paying occupations. As of 2007, each quintile is classified to contain approximately 20% of the target individuals, categorized sequentially from the top quintile to the lowest quintile as Q5, Q4, Q3, Q2, and Q1. By examining how this approximate 20% composition ratio changes for the year 2017, it is possible to capture changes in the occupational structure. With regard to the occupations assigned to these five categories, Table 3 presents the distribution of occupational unit groups included in each quintile, aggregated at the major group level. Table 4 presents a list of representative occupations categorized by each quintile.

The classification of occupations into multiple categories and the subsequent analysis of changes in their relative shares has become a well-established method for capturing occupational change (Acemoglu and Autor 2011). It should be noted, however, that the number of categories employed is contingent upon the specific

objective of the study. The adoption of five categories in this study is predicated on the rationale of facilitating a comparative analysis with the findings reported by Oesch and Piccitto (2019). In their study, the authors examined occupational change by employing the same five categories for four European countries over the period from 2008 to 2015. This timeframe closely aligns with that of this study, thereby enabling a meaningful comparison between the two studies. The analysis in this study examines the impact of changes in the shares of the five quintiles from 2007 to 2017 by comparing them with the magnitude of changes in other countries.

Table 3. Aggregation of occupational unit groups in the five quintiles by major group level

	Administrative and managerial workers	Professional and technical workers	Clerical workers	Sales workers	Service workers	Security workers	Agricultural, forestry and fishery workers	Production-line jobs in manufacturing
Q1		1		2	19		3	3
Q2		11	4	2	15	2	7	19
Q3		5	5	2	2		1	25
Q4	1	17	6	5	3		1	22
Q5	4	29	1	3		4		7

Table 4. Top five occupations with the largest shares in each quintile

Q1	Shop assistants; Cooks; Crop farming workers; Food manufacturing workers; Food and drink service and personal assistance workers, etc.
Q2	Motor vehicle drivers; Care workers (medical or welfare facilities, etc.); Delivery workers; Carpenters; Automobile maintenance and repair workers, etc.
Q3	Comprehensive clerical workers; Accountancy clerks; Electro-mechanical apparatus assembly workers; Other product manufacturing and processing workers (metal products); Other construction and civil engineering workers, etc.
Q4	Other sales workers; General affairs and human affairs workers; Nurses (including assistant nurses); Sales clerical workers; General-purpose, manufacturing and business-use mechanical apparatus assembly workers, etc.
Q5	Other general clerical workers; Company officers; System consultants and designers; Machinery, communication and system sales workers; Elementary school teachers, etc.

IV. Results

4.1 Overview of the changes

Figure 1 presents an overview of the changes in the Japanese occupational structure since the late 2000s, which serves as the primary analytical focus of the present study. The horizontal axis of the graph delineates five income quintiles, based on income rankings from 2007, with Q1 through Q5 denoting the first to the fifth quintile, respectively. The vertical axis indicates the extent to which the proportion of workers employed in occupations within each quintile relative to the total target population has changed over the decade. For instance, among all workers analyzed in 2007, 19.55% are employed in occupations classified in Q3. This share exhibits a 2.56 percentage point decrease, reaching 16.99% in 2017. This decrease in percentage points is represented in the scale depicted in Figure 1 (shown to two decimal places). Given that the sum of the shares for each year is equivalent to 100%, it can be concluded that the aggregated changes in the shares of the five quintile groups over
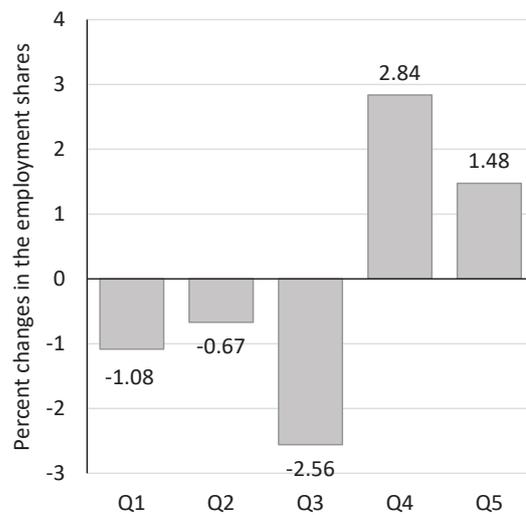
Figure 1. Changes in the occupational structure of Japan (2007–2017)

the 10-year period is equal to zero. Consequently, the height of the bar graph serves as an indicator of the relative degree of increase or decrease for each quintile group relative to total employment. By examining the extent to which the points that decreased in Q1 to Q3 show increases in Q4 and Q5, changes in the occupational structure can be captured.

Job polarization is defined by a decline in the proportion of middle-pay jobs, concurrent with an increase in the proportions of higher-pay and lower-pay jobs. Figure 1, however, does not demonstrate a trend toward polarization. The middle-to-lower quintiles (Q3, Q2, Q1) demonstrate a contraction, while the upper quintiles (Q4 and Q5) demonstrate an expansion, suggesting an upgrading trend. A notable point is that the rate of expansion in Q4 exceeds that of Q5. In this regard, the observed pattern deviates from the clear upgrading predicted by Hypothesis 1, in which the top-tier is expected to undergo the most substantial expansion. Consequently, Hypothesis 1 appears to be partially substantiated.

During the 10-year period from 2007 to 2017, Q4 exhibits an increase of 2.84 percentage points, while Q5 demonstrates a rise of 1.48 percentage points. This prompts the question of the extent to which this change is truly significant. With reference to the findings of Oesch and Piccitto (2019), who conducted an examination of occupational changes in four European countries from 2008 to 2015, Q5 experiences the most significant expansion in Germany, Sweden, and the UK. The graph shows approximate changes of 5.0 percentage points for Germany, 6.0 percentage points for Sweden, and 7.5 percentage points for the UK. Consequently, the changes in the Japanese occupational structure from 2007 to 2017 are characterized by a relatively minor upgrade, with the integration of Q4 and Q5.

Specifically, it is evident that the bottom-end occupations of Q1 exhibit a decline of 1.08 percentage points. The aforementioned decreases in Germany and Sweden's Q1 are approximately −4.0 percentage points and −6.0 percentage points, respectively, showing a change comparable to the increase in Q5 (Oesch and Piccitto 2019). In comparison to the pronounced trade-off pattern between the decline in the bottom quintile and the expansion in the top quintile, the decrease in Q1 indicated by the results of Japan represents a negligible change.

The subsequent section undertakes a thorough examination of the occupational changes that have contributed to these distinctive Japanese patterns of change.

4.2 Occupations showing increases or decreases

Table 5 presents the top 15 occupations with larger increases and decreases, based on changes in their respective shares. The occupations demonstrating the highest increases are predominantly concentrated in Q4 or Q5. Among these occupations showing the largest increases, care workers (e.g., those employed at medical and welfare facilities) in Q2 hold the first rank. According to Esping-Andersen (1999), who examined the post-industrial employment structures from the viewpoint of the welfare regime theory, while aging populations and expanding demand for healthcare are commonly observed in advanced countries, the question of which part and to what extent of the occupational hierarchy low-skilled care service occupations (excluding professionals such as medical doctors and nurses) are expanding depends on each country's institutional framework. In the Nordic countries, care service occupations have expanded significantly as an integral component of the welfare state, which has ensured the provision of stable employment protections in the public sector. In the US, where regulations are less stringent, similar occupations are expanding as low-cost private services. In contrast, in Germany, Southern European countries, and Japan—where families are the primary providers of welfare—the growth of care service occupations has been constrained.[6]

An examination of Japan's results since 2007, as presented in Table 5, reveals that care workers have the highest rate of growth. Among the occupations in the care service sector, excluding professionals, which have also experienced significant growth, only care workers are included, and they are positioned in Q2. The Long-Term Care Insurance Act, enacted in 2000, has been a significant factor in increasing the demand for care workers in medical and welfare facilities, thereby shifting the care of the elderly from the home environment to other settings. With respect to the Long-Term Care Insurance system, the profession of providing care is positioned in Q2 in the occupational hierarchy based on job quality, rather than occupying the bottom-end of the occupational hierarchy.

The occupation with the second-most significant increase is "Other general clerical workers," which is included in Q5. The occupational unit groups delineated by the *Employment Status Survey* encompass eight types of clerical jobs.[7] This particular clerical job is the only one classified under Q5. Among the top 15 occupations by growth, three clerical jobs are included—two from Q4 and one from Q5—all scoring high in non-routine tasks (Komatsu and Mugiyama 2021).[8] The increasing trend of clerical jobs involving more non-routine tasks at the upper tiers of the occupational structure is consistent with the routinization hypothesis.

Concurrently, there has been an increase in the number of professionals. The tendency for IT-related highly specialized occupations, such as "Software creators" in Q4 and "Other data processing and communication engineers" in Q5, to exhibit a marked prevalence within the upper tiers of the occupational structure is consistent with the SBTC theory and the routinization hypothesis. At the same time, medical and welfare-related professions, encompassing "Nurses," "Other social welfare professionals," and "Physiotherapists and occupational therapists," demonstrate expansion in Q4.

Among the occupations in the top 15 for growth in Q1 are "Building cleaning workers," "Other carrying, cleaning, packaging and related workers," and "Service workers not classified elsewhere." In the US, the proliferation of these low-cost service occupations since the 1980s has been propelled by an influx of immigrants who have become integral contributors to the labor force (Wright and Dwyer 2003). While similar occupations have exhibited growth in Q1 in Japan, the extent of this expansion is not as pronounced as the job polarization hypothesis would suggest when compared to occupations that increased in Q4 and Q5. The Japanese institutional framework of a coordinated market economy, which is based on employment protections and wage bargaining, coupled with the upgrading of the skill distribution of the labor force due to increasing educational attainment, has restrained the expansion of Q1.

Additionally, among the top 15 occupations exhibiting the higher growth, the proportion of workers in non-regular employment has increased in 12 occupations.[9] This finding suggests that non-standard working

Table 5. Occupations showing larger increases or decreases in the employment shares

Rank-ordering by increase

	Occupation	Quartile rank	Share in 2007 (%)	Share in 2017 (%)	Percentage-point change
1	Care workers (medical or welfare facilities, etc.)	Q2	1.44	2.38	0.94
2	Other general clerical workers	Q5	6.89	7.83	0.95
3	Sales clerical workers	Q4	1.08	1.85	0.77
4	Software creators	Q4	0.27	0.83	0.56
5	Automobile assembly workers	Q5	0.19	0.69	0.50
6	Nurses (including assistant nurses)	Q4	1.93	2.42	0.49
7	Other social welfare professionals	Q4	0.45	0.92	0.46
8	Production-related clerical workers	Q4	0.74	1.18	0.43
9	Other carrying, cleaning, packaging and related workers	Q1	1.07	1.46	0.39
10	Other data processing and communication engineers	Q5	0.03	0.39	0.36
11	Building cleaning workers	Q1	0.64	0.98	0.34
12	Childcare workers	Q2	0.78	1.11	0.33
13	General affairs and human affairs workers	Q4	2.36	2.65	0.29
14	Service workers not classified elsewhere	Q1	0.38	0.66	0.28
15	Physiotherapists, occupational therapists	Q4	0.15	0.35	0.21

Rank-ordering by decrease

	Occupation	Quartile rank	Share in 2007 (%)	Share in 2017 (%)	Percentage-point change
1	Comprehensive clerical workers	Q3	4.48	3.48	-1.00
2	Shop assistants	Q1	6.07	5.28	-0.79
3	Other sales workers	Q4	3.59	3.08	-0.51
4	Crop farming workers	Q1	2.21	1.75	-0.46
5	Electro-mechanical apparatus assembly workers	Q3	1.34	0.93	-0.41
6	Other cleaning workers	Q2	0.53	0.16	-0.37
7	Spinning, weaving, apparel and fiber product manufacturing workers	Q1	0.85	0.50	-0.35
8	General-purpose, manufacturing and business-use mechanical apparatus assembly workers	Q4	1.03	0.71	-0.33
9	Retailers, retail manager	Q2	0.82	0.49	-0.32
10	Company officers	Q5	1.77	1.49	-0.28
11	Civil engineering workers	Q3	1.09	0.82	-0.27
12	Other product manufacturing and processing workers (metal products)	Q3	1.16	0.89	-0.27
13	Carpenters	Q2	0.87	0.61	-0.27
14	System consultants and designers	Q5	1.50	1.24	-0.26
15	Administrative and managerial workers of corporations and organizations	Q5	0.66	0.41	-0.24

arrangements are becoming increasingly prevalent not only in lower-level occupations but also in those at other levels.

An analysis of declining occupations reveals that "Comprehensive clerical workers" in Q3 ranks first. This occupation is marked by a high proportion of women, with 74.0% in 2007 and 75.9% in 2017. Declines in production-line jobs in manufacturing are also observed in the 5th (Q3), 7th (Q1), 8th (Q4), and 12th (Q3) ranks.

The routinization hypothesis posits that occupations comprising predominantly routine tasks, such as clerical jobs and manufacturing process jobs, exhibit a tendency to decline in the middle quintile of the occupational structure. This tendency is evident in the findings of the present study, which are consistent with the decline observed in clerical jobs, where women are highly represented, as well as in various production-line jobs in the manufacturing sector.

4.3 Changes by sex

Figure 2 presents a detailed analysis of the changes in the occupational structure, as depicted in Figure 1, subdivided into changes experienced by sex. As demonstrated in Figure 2, the observed expansion of Q5 (1.48 percentage point increase) in Figure 1 is attributed to changes among women (1.16 percentage point increase), thereby supporting Hypothesis 2. The occupation contributing to the expansion of Q5 for women is "Other general clerical workers." The proportion of women employed in this occupation relative to the total individuals analyzed increased by 0.73 percentage points.

As demonstrated in Figure 3, the data presented in Figure 2 is further subdivided to reveal changes in each quintile for both men and women. The analysis is categorized by educational background, distinguishing between those with a university degree and those in other categories.

In Q5, the proportion of women with a university degree increased by 0.96 percentage points, indicating a more pronounced upward trend compared to the change for women without a university degree. As indicated by the evidence presented in Hypothesis 2, the tendency of highly educated women to enter occupations that require a high degree of skill has increased over the examined decade.

Meanwhile, an unanticipated change not predicted by the hypothesis is that for both sexes, those with a university degree expanded their share in Q4. For women, the largest increased share is for "Nurses," followed by "Other social welfare professionals." Among men, the occupations demonstrating the highest growth in share are "Sales clerical workers" and "Software creators." The SBTC hypothesis exhibited a clear upgrade, indicating that those with a university degree in the US experienced an increase at the highest end of the income distribution. In contrast, in Japan, from 2007 to 2017, those with a university degree also contributed to the expansion in Q4.

In sum, although the proportion of men in Q5 and Q4 remained higher than that of women in 2017,[10] the descriptive analysis in this section suggests a period in which women increased their presence in the labor market and began to catch up with men in terms of job quality.
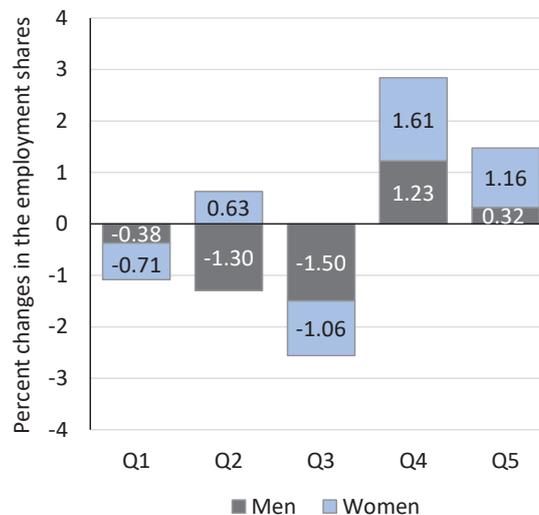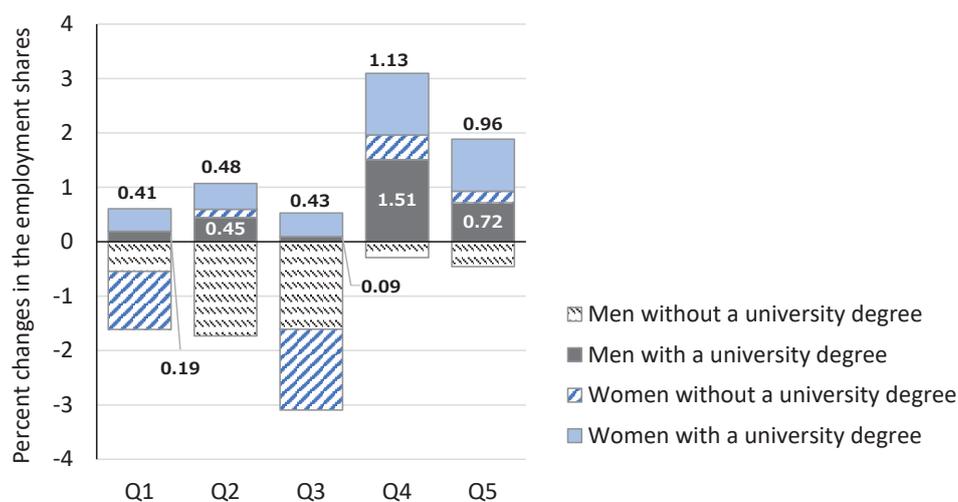

Figure 2. Changes in the occupational structure of Japan by sex

Note: The values for men and women with a university degree are shown.

Figure 3. Changes in the occupational structure of Japan by sex and educational background

V. Discussion

A comprehensive analysis of Japan's data from 2007 to 2017 reveals a decline in Q3, Q2, and Q1. In contrast, Q4 and Q5 exhibit growth. While the degree of change is comparatively modest when viewed in conjunction with that of Europe and the US during the same period, an upgrade is occurring. This upgrade is marked by a decline in the middle and lower quintiles of the occupational structure, accompanied by an increase in the upper quintiles. The subsequent section will review and discuss the background to these key findings.

An absence of expansion trend is evident in the bottom-end occupations of Q1, which is regarded as indicative of whether the pattern of change is polarization or upgrading. The first factor is that, as Hypothesis 1 suggests, Japan's institutional framework, based on a coordinated market economy, hinders the expansion of low-cost service occupations, in contrast to the US and UK, which are based on liberal market economies. The second factor, which was not anticipated in the hypothesis, is that occupations related to care in Japan are not concentrated in Q1 but are expanding in Q2 as care workers (e.g., those employed at medical and welfare facilities). It is also noteworthy that the growth in employment within the lowest occupational quintile has been constrained without a concomitant rise in the unemployment rate. In the context of confirming occupational upgrading, the relationship with unemployment is a salient point that requires verification. For instance, if the expansion of low-end service jobs is being restrained at the cost of early retirement among the elderly or youth unemployment, as was observed in Germany during the 1980s, then it would become an upgrade accompanied by exclusion (Esping-Andersen 1999; Oesch 2013). In this regard, Japan's unemployment rate remained at a low level throughout the analysis period.[11] This finding is consistent with the upgrading observed in Denmark and Switzerland since the late 1990s (Oesch 2013).

In the top-end occupations of Q5, there is an expansion of IT-related professional occupations and high-level clerical occupations, which is consistent with the SBTC theory and the routinization hypothesis. Specifically, in Q5, as predicted by Hypothesis 2, the increase in contribution from women has a greater impact than the increase from men. The increasing prevalence of educational attainment among women, coupled with their growing participation in the labor force, has resulted in a notable rise in the proportion of women engaged in occupations that demand high-level skills.

Contrary to the predictions made in Hypothesis 1, among the five categories, it is Q4, rather than Q5, which exhibits the most significant expansion. This expansion is largely attributed to the impact of institutional changes accompanying an aging Japanese society. The implementation of the revised Long-Term Care Insurance Act in 2000 prompted the systematic establishment of elderly care services, consequently leading to a substantial growth in various professional and service occupations within Q4, including care workers in Q2. This expansion has resulted in the creation of numerous employment opportunities, particularly for women.

Since the turn of this century, in the US and UK, the job polarization hypothesis has become dominant based on the routinization hypothesis, which focuses on the substitutability of tasks with computer technology. The present study also corroborates findings consistent with the routinization hypothesis, based on the characteristics of jobs that increase and decrease. While technological change is a contributing factor, it is not the sole influence on changes in occupational structures across nations. In Europe, the influx of immigrants and their skill sets have led to differences in the direction of occupational structure change (Oesch 2013). As previously mentioned, in Japan, the transition of elderly care to publicly subsidized services has resulted in a significant change since the late 2000s. Consequently, in accordance with this change, there has been a considerable augmentation of related jobs within the occupational hierarchy. The demand for elderly care is expected to increase further in the future. In order to ensure the future enhancement of employment opportunities, the implementation of policies that promote the expansion of occupations related to healthcare and insurance services within the upper tiers of the occupational hierarchy is necessary. Concurrently, as the SBTC theory elucidates, the race between education and technological change is ongoing. Consequently, it has become crucial to bolster public support for education and vocational training to enhance the overall skill levels of the labor force.

Finally, a future research challenge for this study is outlined. In occupations where there has been an increase in the share, a considerable proportion of the labor force is engaged in non-regular forms of employment. If non-standard working arrangements are expanding not only in low-end service occupations but across a broad range of occupations, then the impact of technological change on the labor market may extend beyond the polarization or upgrading of occupational structures discussed by the SBTC theory and the routinization hypothesis, with the potential to affect how people work as well. A thorough analysis is imperative to elucidate the intricacies of the occupational changes as depicted by this study, including the aforementioned issue.

Notes

1. The *Employment Status Survey* reveals an increase in the employment rate of women (aged 18–69, excluding students) from 62.3% in 2007 to 68.9% in 2017.
2. The Varieties of Capitalism (VoC) theory is a theoretical framework that categorizes the institutional complementarities of capitalism based on the coordination patterns between firms and stakeholders. These two forms of capitalism are delineated as the coordinated market economy (CME) and the liberal market economy (LME). In German-speaking countries, which represent CME countries, extensive vocational training systems or nationwide minimum wage and trade union systems are well-designed. In comparison with the less regulated LME countries of the Anglo-Saxon world, they demonstrate a higher degree of equality in the distribution of skills as well as in the remuneration received for those skills. Japan is classified as a CME (Hall and Soskice 2001).
3. The OECD indicators of the strictness of employment protection legislation during the present study period reveal that employment

protections for regular workers remained at 1.37 points, while for non-regular workers it stood at 0.88 points from 2007 to 2013 and has maintained 1.00 points from the year 2014 onwards (OECD 2023b).

4. Sano (2023) employed the same dataset as the present study to conduct an analysis of three distinct working hour patterns: no limitations, 20 hours or more, and 30 hours or more. The study then compares occupational ranks created based on average hourly earnings for specific occupational unit groups. According to Sano, the rank correlation among the three patterns is high, with a minimum of 0.98. Given that the employment share of the 13 occupations where ranks changed by 20 or more is minimal, the impact on the results of the analysis is negligible. The changes in the five categories are as follows: among those with no limitations on working hours, Q1 decreases by 2.24 percentage points, Q2 decreases by 0.20 percentage points, and Q3 decreases by 2.27 percentage points; meanwhile, Q4 increases by 2.77 percentage points, and Q5 increases by 1.94 percentage points. For a duration of 30 hours or more, a decline of 0.66 percentage points is observed in Q1, 0.72 percentage points in Q2, and 2.83 percentage points in Q3. Conversely, an increase of 2.70 percentage points is noted in Q4 and 1.51 percentage points in Q5. In all cases, the trend is similar to that demonstrated in Figure 1.

5. To examine differences in the results of the analysis based on the presence or absence of control variables other than the occupational unit groups, multiple regression analysis was conducted using five models with hourly earnings as the dependent variable (see Table 6). A comparison of occupational ranks based on regression coefficient magnitude reveals a high correlation coefficient of 0.967 or higher. The five-category classification, which is derived from the occupational rank based on Model (5), is utilized in the analysis. The following changes are observed in the five categories: a 1.38 percentage point decrease in Q1, a 0.70 percentage point decrease in Q2, and a 2.10 percentage point decrease in Q3; in contrast, a 2.46 percentage point increase in Q4, and a 1.73 percentage point increase in Q5. A comparison of the decrease points for Q1 and Q2 with the increase points for Q4 and Q5, as shown in Figure 1, indicates a slight increase. Nevertheless, the trend of change remains comparable. The average hourly earnings utilized in the present study correspond to the same value as the earnings estimate obtained from the OLS (ordinary least squares) regression of Model (1).

Table 6. Rank correlation in occupational ranking based on the five regression models with hourly earnings as the dependent variable, along with the adjusted R-squared values for each model

	(1)	(2)	(3)	(4)	(5)	Adjusted R^2
(1): Occupation only		0.997	0.995	0.968	0.993	(1) 0.280
(2): (1) + Age + Age squared	0.997		0.998	0.967	0.994	(2) 0.329
(3): (2) + Sex	0.995	0.998		0.969	0.997	(3) 0.349
(4): (3) + non-regular employment dummy variable	0.968	0.967	0.969		0.970	(4) 0.416
(5): (4) + Firm size (eight categories)	0.993	0.994	0.997	0.970		(5) 0.468

6. Empirical analyses of European countries after the year 2000 have confirmed a similar trend (see Goos and Manning 2007; Oesch 2013; Oesch and Piccitto 2019).

7. The clerical occupations encompassed by the occupational unit groups are as follows: "General affairs and human affairs workers;" "Reception and guidance clerical workers," "Telephone receptionists," "Comprehensive clerical workers," "Accountancy clerks," "Production-related clerical workers," "Sales clerical workers," and "Other general clerical workers."

8. According to Komatsu and Mugiyama (2021), who developed task indicators that distinguish between routine and non-routine characteristics based on the Japanese O-NET and presented scores for seven clerical jobs at the occupational unit group level included in the *Population Census*, the scores for non-routine tasks in the top three growing clerical jobs as shown in this paper are all positive. Among the seven clerical jobs, "Other general clerical workers" demonstrate the highest score for the "non-routine analytical" tasks, while "Sales clerical workers" exhibit the highest score for the "non-routine interactive" tasks. The non-routine task score for "Comprehensive clerical workers," who exhibit the most significant decline in this paper, is negative.

9. Among the 12 occupations examined, excluding "Sales clerical workers," "Software creators," and "Production-related clerical workers," the percentage of non-regular workers increased at the two time points. The most substantial increase is evident in "Other carrying, cleaning, packaging and related workers," which increased from 61.6% in 2007 to 76.6% in 2017, marking an increase of 14.9 percentage points. This is followed by a rise in the percentage of "Childcare workers," which increased from 32.0% in 2007 to 37.0% in 2017, marking a 5.0 percentage point rise.

10. At the time of 2017, the percentage of men in Q5 was 74.0%, while the percentage of men in Q4 was 58.6%.

11. The unemployment rate in Japan stood at 3.8% in 2007 and 2.8% in 2017. The long-term unemployment rate, defined as the share of the working-age population that has been unemployed for 12 months or more, was 1.2% in 2007 and 1.0% in 2017. Consequently, both rates maintained their position at low levels (OECD 2023a).

References

Acemoglu, Daron and David H. Autor. 2011. "Skills, Tasks and Technologies: Implications for Employment and Earnings." In *Handbook of Labor Economics*, 4(B), edited by Orley Ashenfelter and David Card. Elsevier, 1043–1171.

Autor, David H., Frank Levy, and Richard J. Murnane. 2003. "The Skill Content of Recent Technological Change: An Empirical Exploration." *Quarterly Journal of Economics* 118(4): 1279–1333.

Bell, Daniel. 1973. *The Coming of Post-Industrial Society: A Venture in Social Forecasting*. Basic Books.

Braverman, Harry. 1974. *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century*. Monthly Review Press.

Esping-Andersen, Gøsta. 1999. *Social Foundation of Postindustrial Economies*. Oxford University Press.

Estevez-Abe, Margarita, Torben Iversen, and David Soskice. 2001. "Social Protection and the Formation of Skills: A Reinterpretation of the Welfare State." In *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*, edited by Peter A. Hall, and David Soskice. Oxford University Press, 145–183.

Goldin, Claudia, and Lawrence F. Katz. 2008. *The Race between Education and Technology*. The Belknap Press of Harvard University Press.

Goos, Maarten, and Alan Manning. 2007. "Lousy and Lovely Jobs: The Rising Polarization of Work in Britain." *The Review of Economics and Statistics* 89(1): 118–133.

Hall, Peter A., and David Soskice. 2001. "Introduction." In *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*, edited by Peter A. Hall, and David Soskice. Oxford University Press, 1–68.

Ikenaga, Toshie, and Ryo Kambayashi. 2010. "Rodo shijo no nikyokuka no chokiteki suii: Hiteikei gyomu no zodai to rodo shijo ni okeru hyoka [Long-term Trends in the Polarization of the Japanese Labor Market: The Increase of Non-routine Task Input and Its Valuation in the Labor Market]." *PIE/CIS Discussion Paper*, No. 464. Center for Intergenerational Studies, Institute of Economic Research, Hitotsubashi University. https://ideas.repec.org/p/hit/piecis/464.html (accessed on February 26, 2022).

Komatsu, Kyoko, and Ryota Mugiyama. 2021. "Nihonban O-Net no suchi joho wo shiyo shita oyokenkyu no kanosei: Tasuku no torendo bunseki wo ichirei toshite [Trends in Task Distribution in Japan: Evidence from the Occupational Information Network of Japan and the Population Census Data]." JILPT Discussion Paper 21-11. Japan Institute for Labour Policy and Training.

METI (Ministry of Economy, Trade and Industry). 2018. *2050-nen madeno keizaishakai no kozohenka to seisakukadai ni tsuite* [Structural changes in the economy and society, and its policy issues up to 2050], a handout for the First Meeting of the 2050 Economic and Social Structure Committee, the Industrial Structure Council, held on September 21, 2018. https://www.meti.go.jp/shingikai/sankoshin/2050_keizai/pdf/001_04_00.pdf (accessed on Oct. 19, 2023).

OECD (Organization for Economic Co-operation and Development). 2017. *OECD Employment Outlook 2017*. OECD Publishing.

———. 2023a. *OECD Labour Force Statistics*, Unemployment by duration. https://stats.oecd.org/Index.aspx?DataSetCode=DUR_I# (accessed on May 28, 2023).

———. 2023b. *OECD.Stat, Strictness of Employment Protection*. https://stats.oecd.org/Index.aspx?DataSetCode=EPL_OV (accessed on May 26, 2023).

Oesch, Daniel. 2013. *Occupational Change in Europe: How Technology and Education Transform the Job Structure*. Oxford University Press.

Oesch, Daniel, and Giorgio Piccitto. 2019. "The Polarization Myth: Occupational Upgrading in Germany, Spain, Sweden, and the UK, 1992–2015." *Work and Occupations* 46(4): 441–469.

Sano, Kazuko. 2023. "'Shugyo Kozo Kihon Chosa' wo mochiita shokugyo kozo no henka ni kansuru bunseki: Kenkyu shuho no kento [Analysis of Occupational Changes Using the *Employment Status Survey*: Review of Analytical Strategy]." *Hyoron Shakaikagaku (Social Science Review)* No. 147: 101–113.

———. 2024. "Shokugyo kozo no 'nikyokuka kasetsu' no kento: 'Shugyo Kozo Kihon Chosa' no bunseki kara mita 21-seiki no nihon no rodo shijo [Examination of the Occupational Polarization Hypothesis: Analysis on the Japanese Labor Market in 21st Century Based on the *Employment Status Survey* Data]." *Japanese Sociological Review (Shakaigaku Hyoron)* 75(2): 116–132.

Thelen, Kathleen. 2014. *Varieties of Liberalization and the New Politics of Social Solidarity*. Cambridge University Press.

Wright, Erik Olin and Rachel E. Dwyer. 2003. "The Patterns of Job Expansions in the USA: A Comparison of the 1960s and 1990s." *Socio-Economic Review* 1(3): 289–325.

SANO Kazuko

Part-time Lecturer, Department of Applied Sociology, Kindai University.