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Abstract

This paper examines various factors that have dampened nominal wage growth in Japan, comparing them with those in the U.S. and Europe, and shows that some of these factors have been changing since around the COVID-19 outbreak. Specifically, we point to the tightening of the labor market conditions partly reflecting demographic trends, the plateauing trend of the part-time worker ratio, signs that the job-to-job transition is becoming more active as wages rise, and an increased consideration of inflation for labor-management wage negotiations. Key issues on the outlook for the pace and durability of nominal wage growth in Japan are (A) whether wages will rise more broadly, including among full-time workers with relatively low mobility, (B) whether firms' growth expectations will increase, boosting investment and leading to higher labor productivity, (C) whether labor mobility will be facilitated by skill upgrading, and (D) whether the situation in which wage increases have been suppressed under the low inflation norm will change so that prices and nominal wages will rise together.

JEL Classification: J20, J30
Keywords: Wages, Labor market, Prices

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1. Introduction

As of the fall of 2022,[1] nominal wages in Japan were increasing moderately, reflecting a pickup in overall economic activity following a downturn caused by the COVID-19 pandemic. However, wage growth remained slow compared to consumer prices, which were increasing rapidly due to higher energy prices and other factors. Wage developments are attracting increasing attention in terms of the prospect for sustained growth of Japan's economy beyond 2023. The Bank of Japan also aims at achieving the "price stability target" in a sustainable and stable manner, accompanied by wage increases.[2]

In light of this situation, this paper will summarize key issues on the assessment and outlook for aggregate wage developments in Japan. There are various aspects of the labor market depending on the type of work (full-time, part-time, etc.), worker attributes (gender, age, etc.), and firm attributes (industry, size, etc.). Although it is beyond the scope of this paper to grasp all these aspects in detail, we will selectively look at some aspects of the labor market as necessary, since it is not sufficient to focus only on the average wage for evaluating macroeconomic developments.

This paper will also look at some distinctive features of wage developments in Japan compared to the U.S. and Europe. From 2000 to 2019 (pre-COVID-19 period), both nominal wage growth and consumer price inflation have been lower in Japan than in the U.S. and Europe (Figure 1).[3] Moreover, in the U.S. and Europe, nominal wage growth generally exceeded inflation (real wage increased), while no such relationship was observed in Japan.[4] Using data from 1980 onward, we estimate wage Phillips curves for

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[1] As a general rule, the descriptions in this paper are based on information available as of November 2022. According to the Monthly Labour Survey released in November 2022, nominal wages per employee increased by 1.4 percent year-on-year (based on continuing observations following the sample revisions) in September. The consumer price index (all items less fresh food) increased by 3.6 percent year-on-year in October.

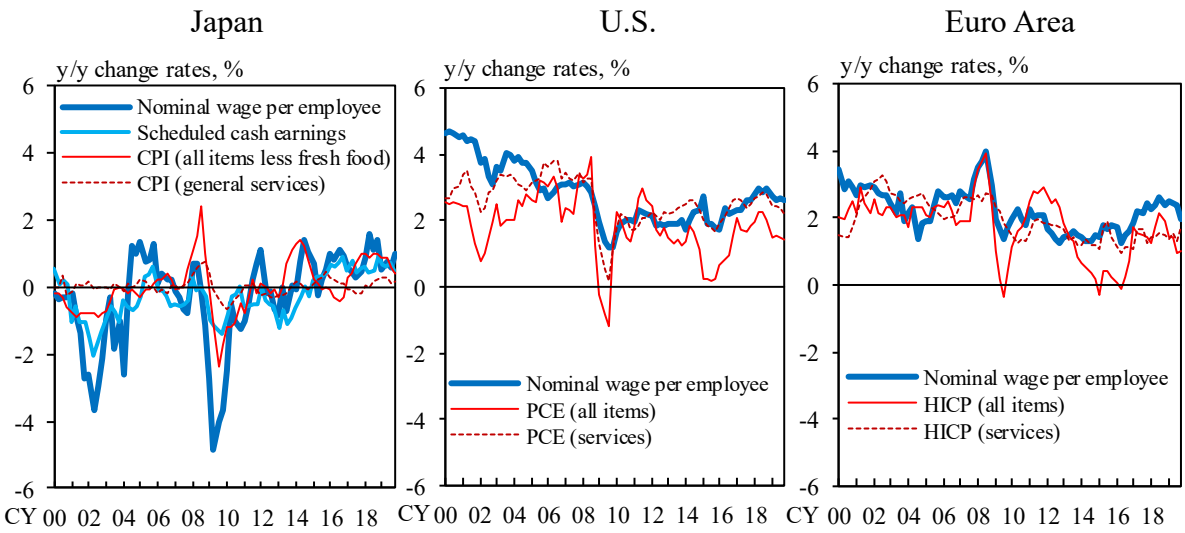
[2] See, for example, Kuroda (2022).

[3] This paper focuses on nominal wages per employee. In the late 2010s, Japan's nominal wages per hour grew at higher rates than the nominal wages per employee, reflecting declines in hours worked per employee, but the two have not differed much in recent years (Supplementary Figure 1). The unit labor cost (nominal employee compensation divided by real GDP) has been volatile in the short term due to the volatility of the denominator, real GDP (Supplementary Figure 2), but it shows a stable relationship with the GDP deflator in the long term, and has recently had only near-zero growth (Supplementary Figure 3).

[4] In addition, Japan's nominal wages are characterized by greater fluctuations than those in the U.S. and Europe. These fluctuations mainly reflect changes in non-scheduled and special cash earnings (e.g., bonuses). Yamamoto (2007) and Kambayashi (2011) point out that while downward rigidity has been observed in Japan with respect to scheduled cash earnings, bonuses have been adjusted in a flexible manner in response to economic fluctuations.

Japan, the U.S., and Europe using variables related to prices, labor productivity, and labor market tightness for each country (Figure 2; see Appendix 1 for details on the estimation method).[5] It can be seen that in Japan, especially in the 2010s, the actual wage growth was continuously lower than the fitted value of the regression, which indicates that Japan's nominal wage growth had been dampened during this period.[6]

Figure 1. Consumer Prices and Wages



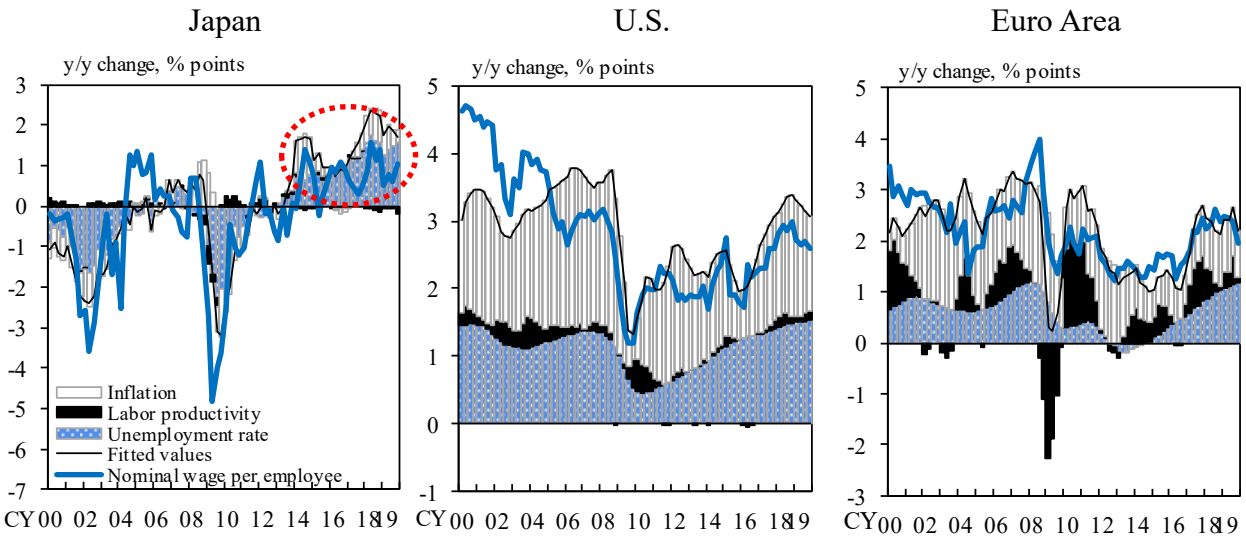
Note: Nominal wage per employee is based on the National Accounts data (nominal compensation of employee divided by the number of employees. For Japan, scheduled cash earnings are based on Monthly Labour Survey (data from 2016/Q1 onward are based on continuing observations following the sample revisions). Japan's Consumer Price Indices are the Bank of Japan staff's estimates and excludes the effects of the consumption tax hikes, and policies concerning the provision of free education.

Sources: Cabinet Office; Ministry of Health, Labour and Welfare; Ministry of Internal Affairs and Communications; BLS; BEA; Eurostat; Haver.

[5] Nominal wage functions with similar explanatory variables are estimated by IMF (2017) for advanced economies, Abdih and Danninger (2018) for the U.S., and Nickel et al. (2019) for euro area countries.

[6] In the 2010s, in many advanced economies, several explanations for sluggish growth of wages were provided, including the upward rigidity in nominal wages possibly reflecting past downward rigidity, and the flattening of the wage Phillips curve making wages less sensitive to labor market slack. Empirical studies using Japanese data include Yamamoto and Kuroda (2016), Hirata, Maruyama, and Mineyama (2020), and Iwasaki, Muto, and Shintani (2021).

Figure 2. Wage Phillips Curve



Note: See Appendix 1 for details. The increase in the unemployment rate is shown as a negative contribution to wage growth. The contributions of the unemployment rates shown in the figure include those of the constant terms.
Sources: Cabinet Office; Ministry of Health, Labour and Welfare; BLS; Eurostat; Haver.

The rest of the paper is outlined as follows. Section 2 summarizes the various factors that have made nominal wage growth in Japan more sluggish than those in the U.S. and Europe since before the COVID-19 pandemic, followed by Section 3 which looks at how these factors have changed after COVID-19. Finally, in Section 4, we discuss key issues on the outlook for Japan's wage growth.

2. **Why had wage growth in Japan been weak?**

In this section, we discuss the following four groups of factors that appear to have dampened Japan's nominal wage growth since before the pandemic, providing analysis on each group of factors and making comparisons with the U.S. and Europe.

(A) Households' labor supply and dual labor market

(B) Firms' labor demand and their wage-setting behavior

(C) Industry-specific factors and labor mobility

(D) Persistent low inflation

These factors are not necessarily independent and are rather linked across groups. For example, the increase in the number of part-time and non-regular employees reflects firms' stance of curbing fixed costs as well as households' elastic labor supply (especially women and the elderly), therefore is related to both the factors (A) and (B) above. The

factors (A), (B), and (C) are theoretically regarded as real factors and appear to be disconnected from a nominal factor like (D), but these real factors, which affect the aggregate labor market tightness, could be connected to nominal wages through the wage Phillips curve.

(A) Households' labor supply and dual labor market

First, we discuss the "dual structure" of the Japanese labor market, which is often pointed out as its key characteristic. This dual structure refers to differences in the labor market structure between workers who follow long-term employment contracts (typically seniority-based wages) and those who are more susceptible to short-term fluctuations in labor market slack and have greater mobility.[7] In order to capture these characteristics, we look mainly at the differences between full-time and part-time workers (or employees) in the Monthly Labour Survey. Since the 1990s, the ratio of part-time workers to the sum of full-time and part-time workers in Japan had continuously increased,[8] a phenomenon not seen in the U.S. or Europe during the same period (Figure 3). Although the wage gap between full-time and part-time workers had narrowed during this period, it remained large compared to the U.S. and Europe (Figure 4). The increase in the ratio of part-time workers, whose wages were relatively lower, had continuously pushed down the average wage across full-time and part-time workers, even when wages for both groups were rising (Figure 5).

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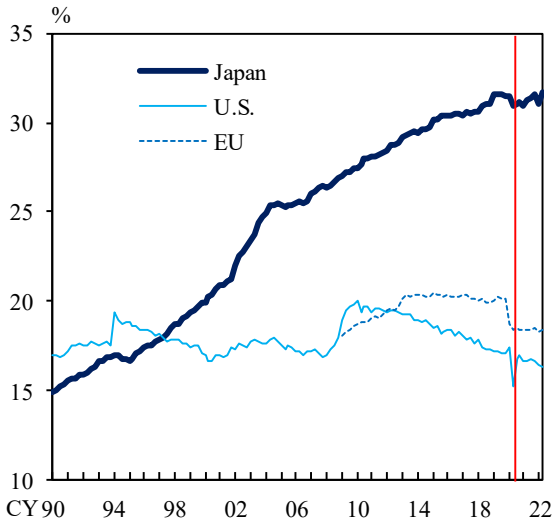
[7] The dual structure of the Japanese labor market has long been recognized, and until around the 1990s, attention was focused on the coexistence of workers, within regular and full-time workers, who follow long-term employment contracts (internal labor market) and those who are susceptible to short-term fluctuations in labor market slack (external labor market). In recent years, with the increase in the number of non-regular and part-time workers, more attention has been paid to the distinction between non-regular/part-time workers and regular/full-time workers. Kurozumi et al. (2023) classifies full-time workers into internal and external labor market workers and analyze their respective nominal wage growth.

[8] The ratio of non-regular employees (part-time, temporary, contract, etc.) in the Labour Force Survey also increased continuously during the same period. While the ratio of regular employees to non-regular employees declined due to the increase in the number of non-regular employees, the number of regular employees themselves (and its share in the population) did not decline. It was the number of self-employed and family workers that continuously declined over this period. The income of self-employed (recorded as "mixed income" separately from "compensation of employees" in the National Accounts) is outside the scope of this paper.

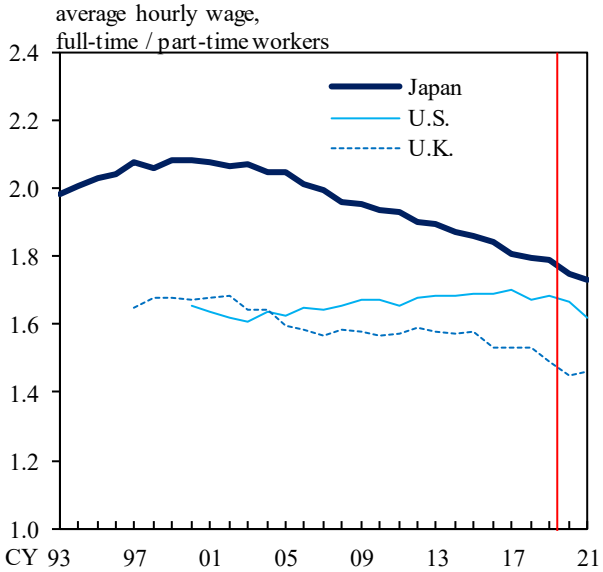
Figure 3. Part-time Worker Ratio



Note: The ratio of part-time workers (employees) to the sum of full-time and part-time workers (employees). For Japan and Europe, part-time workers are defined as workers whose working hours per day are shorter than those of full-time workers. For U.S., part-time workers are defined as workers whose working hours are shorter than 35 hours per week. The red vertical line shows 2020/Q1.

Sources: Ministry of Health, Labour and Welfare; BLS; Eurostat; Haver; OECD.

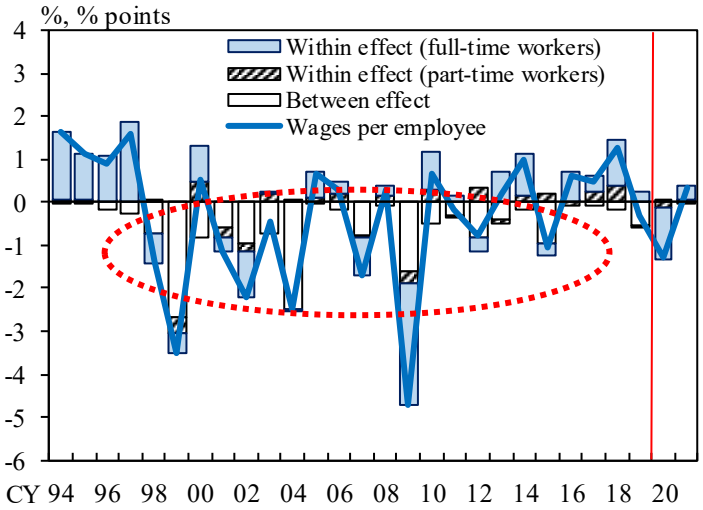
Figure 4. Wage Gap between Full-time and Part-time Workers



Note: See the note for Figure 3 for the definition of part-time workers. The red vertical line shows 2020.

Sources: Ministry of Health, Labour and Welfare; BLS; ONS.

Figure 5. Decomposition of Nominal Wages per Employee

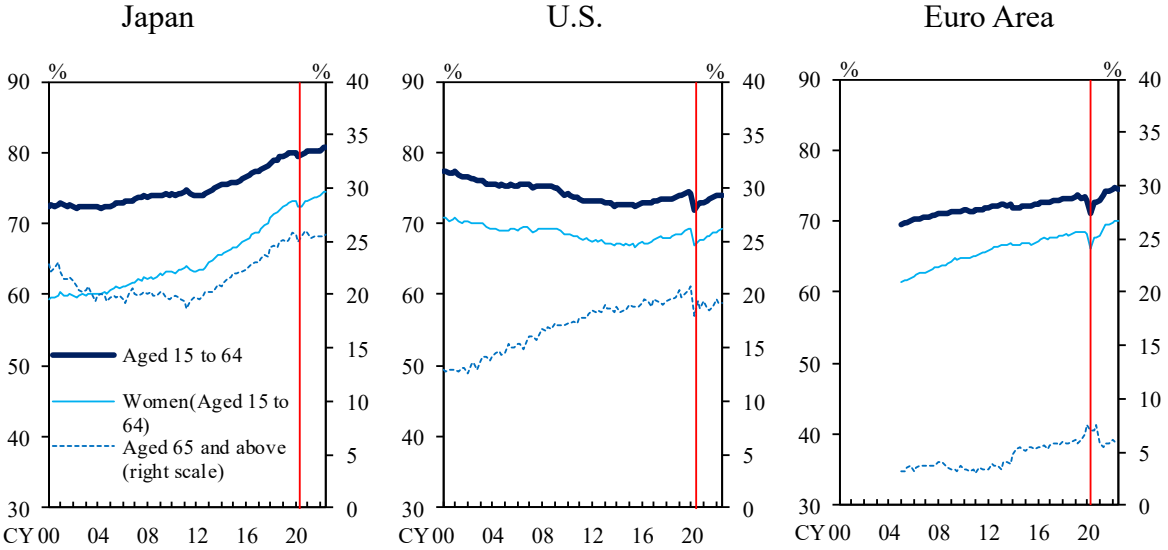


Note. Data for Japan. Within effect is the contribution of part-time (or full-time) workers' wages. Between effect is the contribution of changes in the part-time (or full-time) worker ratio and residuals. The red vertical line shows 2020.

Source: Ministry of Health, Labour and Welfare.

The increase in the number of part-time workers was supported by the elastic labor supply of mainly women and the elderly. A remarkable increase in Japan's labor force participation rate was seen in the 2010s, especially among women and the elderly (Figure 6). The participation rates of the elderly increased also in the U.S. and Europe, but the participation rates of women in the U.S and Europe did not show any notable increase during the same period, and in the U.S., the female participation rate rather declined in the first half of the 2010s.[9]

Figure 6. Labor Force Participation Rates



Note: The red vertical lines show 2020/Q1.

Sources: OECD; Haver.

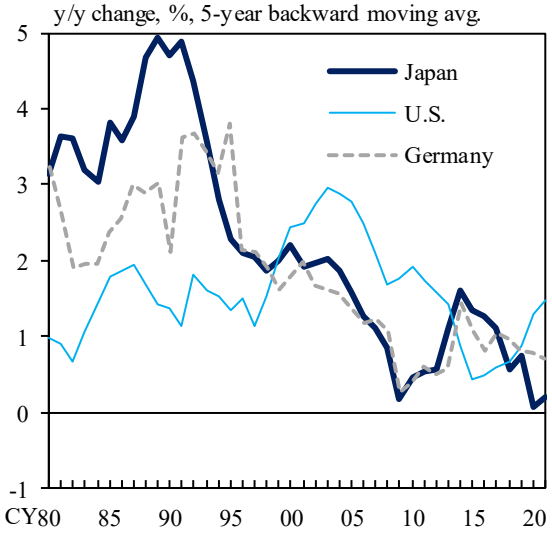
(B) Firms' labor demand and their wage-setting behavior

Next, we examine the firm-side factors that suppressed wages and labor costs. Theoretically, firms' demand for labor is set at a level where the marginal product of labor is equal to its wage. Japan's (average) labor productivity had grown at a higher rate than in the U.S. and Europe in the 1980s, but its growth slowed from around 1990, and although there was a temporary recovery thereafter, the growth rate has hovered near zero in recent years (Figure 7). In addition, uncertainty indices calculated using the volatility of labor productivity for individual Japanese firms have been on a gradual upward trend

[9] However, since many Japanese women are part-time workers, the employment rate of female full-time workers (the ratio of full-time workers to the population) remains low compared to the U.S. and Europe (Supplementary Figure 4).

since around 2000, and firms faced with such heightened uncertainty had restrained fixed labor costs, especially for full-time workers (Figure 8). As noted above, combined with the elastic labor supply of households (especially women and the elderly), this appeared to have led to the rise in the part-time worker ratio.

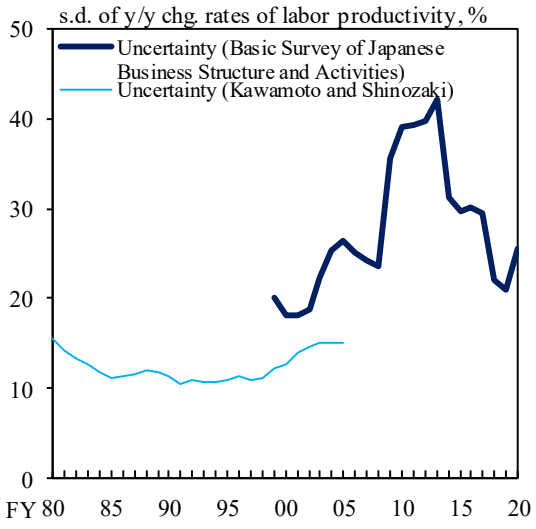
Figure 7. Labor Productivity per Hour



Note: Data collected by Conference Board from IMF, OECB, national statistic offices, etc.

Source: Conference Board.

Figure 8. Uncertainty Faced by Firms



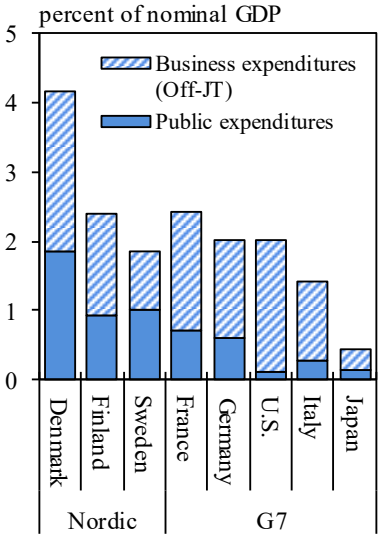
Note: Uncertainty faced by Japanese individual firms, which is calculated as the standard deviation of year-on-year changes in labor productivity per employee over the past five years, following Kawamoto and Shinozaki (2009). An index calculated using different data (Basic Survey of Japanese Business Structure and Activities) from Kawamoto and Shinozaki (2009) is also shown.

Sources: Ministry of Economy, Trade and Industry; Kawamoto and Shinozaki (2009).

Japanese firms have been restraining not only fixed labor costs but also human capital investment, which possibly led to a vicious cycle with further slump in labor productivity. A cross-country comparison of human capital investment shows that, in the second half of the 2010s, Japan was far behind other countries not only in public spending on human capital but also in corporate off-the-job training (Off-JT) spending (Figure 9). The percentage of Japanese workers taking Off-JT had remained stagnant since its sharp decline around the time of the global financial crisis, with a significantly lower

participation rate of non-regular employees (Figure 10).[10] Japanese firms tend to focus more on on-the-job training (OJT), which is comparable to other countries in terms of the percentage of workers who experienced OJT (Figure 11). However, it has been pointed out that the effectiveness of OJT has declined since the beginning of the 2010s (Kimura, Kurachi, and Sugo (2022)).

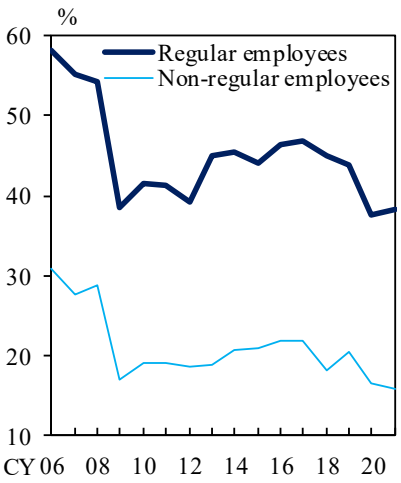
Figure 9. Human Capital Investment



Note: The data for business expenditures are as of 2017, except for Japan (2015) and the U.S. (2016). The data for public expenditures are as of 2019.

Sources: RIETI; INTAN-Invest; OECD.

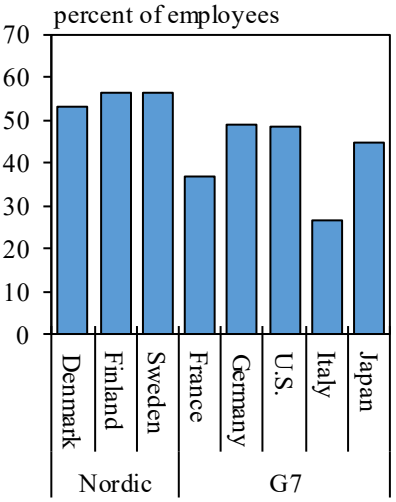
Figure 10. Participation in Off-the-Job Training



Note: Data for Japan.

Source: Ministry of Health, Labour and Welfare.

Figure 11. Participation in On-the-Job Training



Note: Data as of 2012.

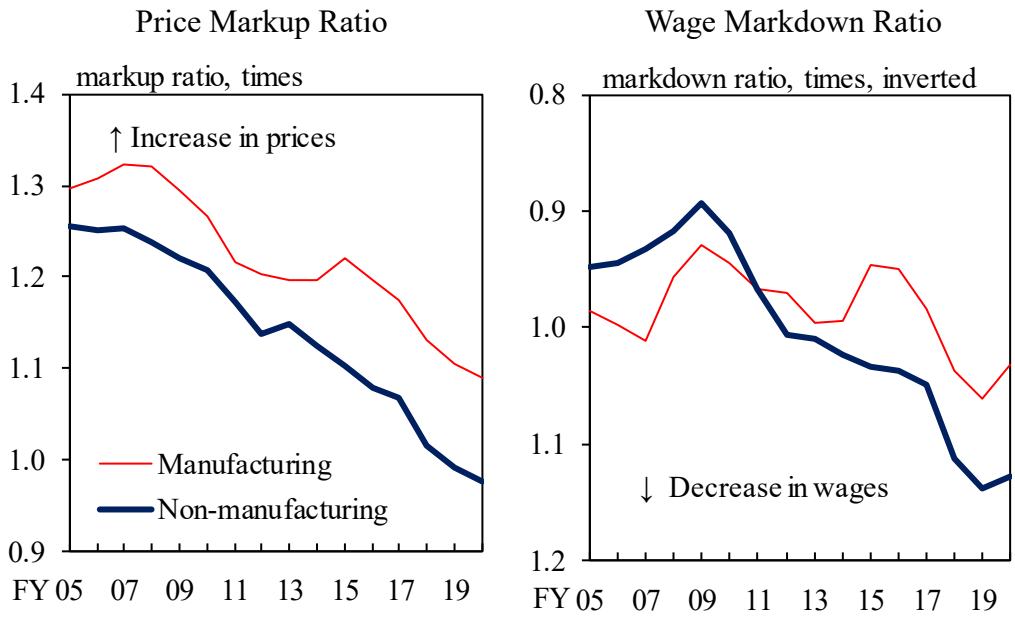
Source: OECD.

As for other firm-side factors that determined wages, changes in the competitive environment in labor and product markets have also possibly had a significant impact on firms' wage- and price-setting behavior. According to a recent study of the U.S. manufacturing industry (Yeh, Macaluso and Hershbein (2022)), the price markup (the ratio of sales prices exceeding marginal costs) has been increasing in the U.S. due to the strong monopolistic power of firms, and the wage markdown (the ratio of wages below the marginal revenue products of labor) has also been increasing, putting downward pressure on wages. Aoki, Hogen and Takatomi (2023) estimate the price markup and wage markdown using a similar method with Japanese data on individual firms in a wide range

[10] Some empirical studies using Japanese data find that Off-JT has led to higher wages, especially for full-time and female workers (e.g., Kawaguchi (2006) and Hara (2014)).

of industries (including non-manufacturing). Their results suggest that Japanese firms have secured profits by containing wage growth through wage markdowns in the labor market, while facing reduced price markups, indicating increased competitiveness in product markets (Figure 12).[11]

Figure 12. Price Markup Ratio and Wage Markdown Ratio



Note: See Aoki, Hogen and Takatomi (2023) for details.

Sources: Ministry of Economy, Trade and Industry; Ministry of Health, Labour and Welfare; Cabinet Office; Development Bank of Japan; CRD Association.

Such wage- and price-setting behaviors of firms has also had some impact on the labor share. The labor share in the U.S. has been on a downward trend since around 2000, reflecting an increase in price markups and wage markdowns against the backdrop of firms' strong monopolistic power. In contrast, Japan's labor share has been generally stable over the long term, with some fluctuations associated with business cycles (Figure 13).[12] In recent years, due in part to the increased social security contributions of firms (Figure 14), the labor share measured in the National Accounts has been rising, which possibly has led to the suppression of wages.[13]

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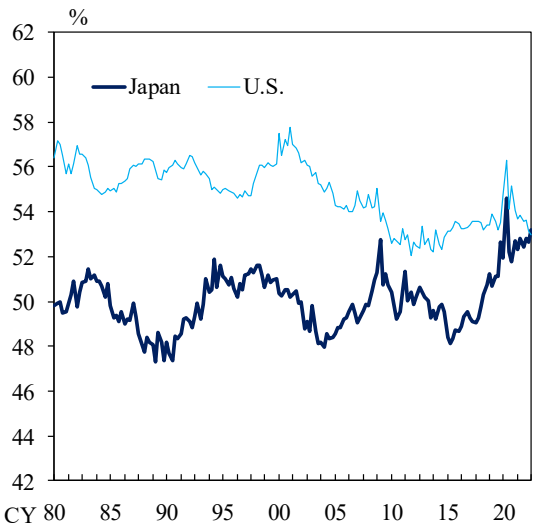
[11] This may be related to the decline in the union membership rate and the increase in the ratio of part-time workers who do not belong to unions. For details, see Aoki, Hogen and Takatomi (2023).

[12] The level and movement of the labor share can vary greatly depending on the data used, calculation method, etc. The labor share has been declining in some large firms, which raised criticism that an increase in their earnings has not been sufficiently distributed to their workers.

[13] The recent increase in the labor share has been pushing up real wages even as labor productivity has stopped rising (Supplementary Figure 5).

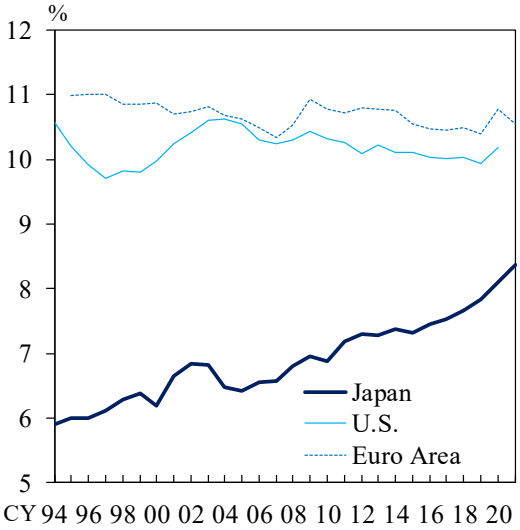
Figure 13. Labor Share



Note: Labor share is calculated as the ratio of nominal compensation of employees to nominal GDP.

Sources: Cabinet Office; BEA.

Figure 14. Employers' Social Contribution



Note: Percentage of nominal GDP.

Sources: Cabinet Office; OECD.

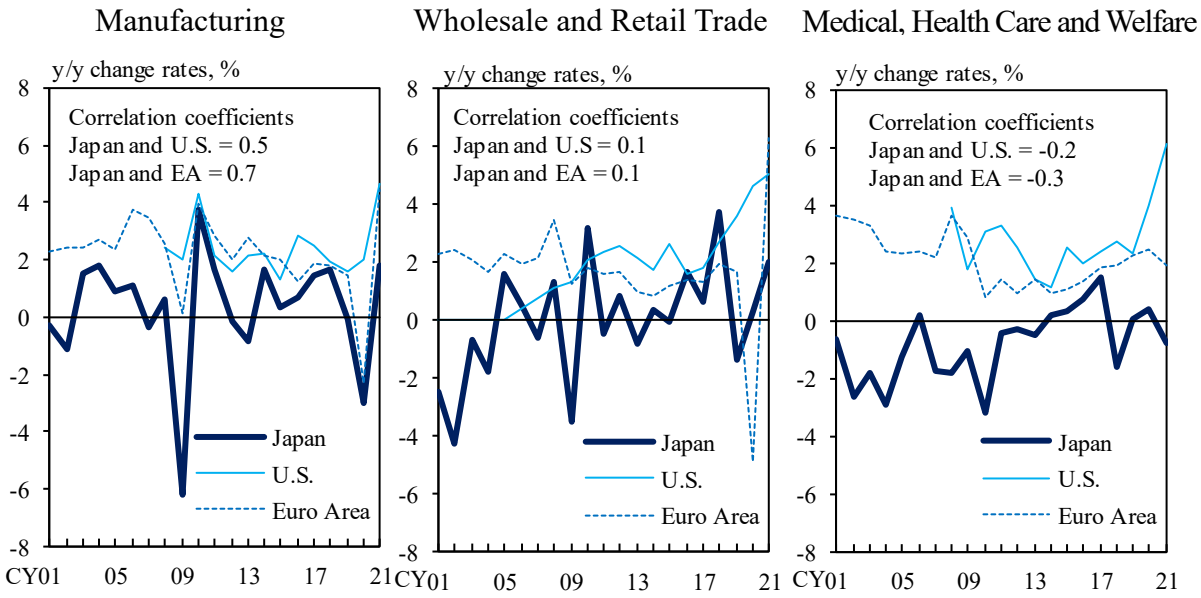
(C) Industry-specific factors and labor mobility

We also consider the possibility that factors specific to certain industries and low labor mobility among industries and firms have contained the average wage growth across industries.

By comparing wages in Japan, the U.S., and Europe for each industry, it can be seen that wages in the manufacturing industry in these countries are linked through trade and global supply chains, while the linkage is low in the non-manufacturing industries (Figure 15). In particular, wage growth in Japan's medical, health care and welfare industries has been significantly contained compared to the U.S. and Europe, partly because their service prices have been suppressed under the health care insurance and the long-term care insurance systems.[14]

[14] Kondo (2019) points out that the increase in long-term care insurance premiums in 2012 did not necessarily lead to an increase in the monthly earnings (excluding bonuses) of workers in the long-term care industry in Japan.

Figure 15. Wages by Industry

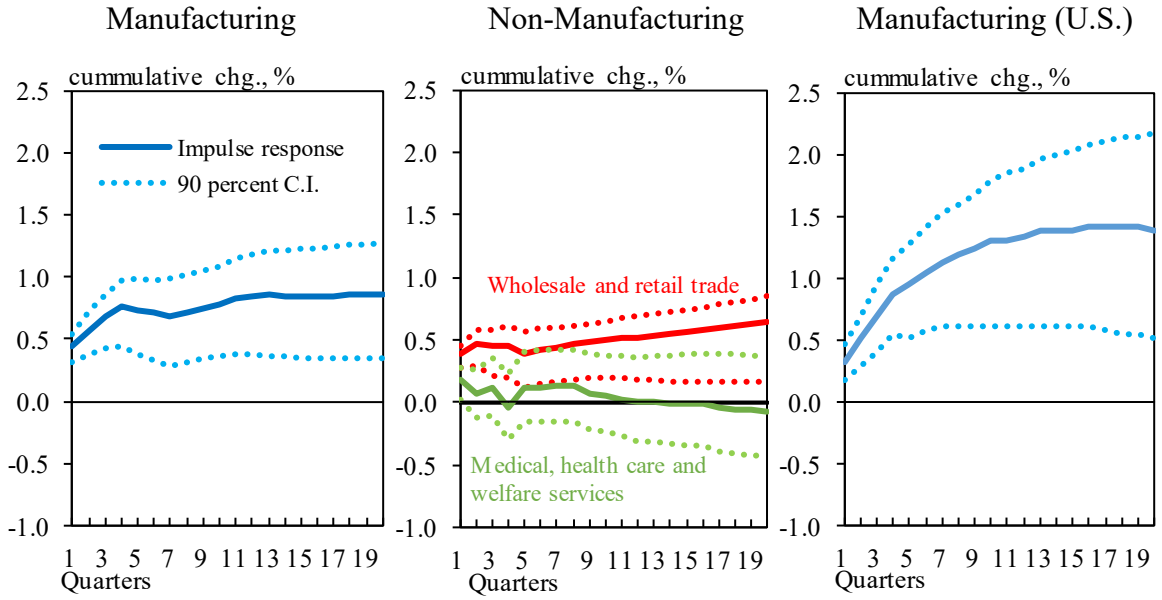


Note: Wages per employee. The data for Japan are total cash earnings obtained from Monthly Labour Survey (the data from 2016 onward are based on continuing observations following the sample revisions). For Europe, "wholesale and retail trade" includes accommodation and food services, and "medical, health care and welfare" includes public administration, education, etc. The correlation coefficients are calculated based on annual data.

Sources: Ministry of Health, Labour and Welfare; BLS; ECB; Haver.

That said, the average wage across industries will eventually increase if a mechanism functions whereby a wage increase in the manufacturing industry, which has high international linkages and a relatively high wage level, spills over into wages in other industries. To analyze this point, we estimate error-correction models that take into account the long-term relationships between the wage in each of the three industries in Figure 15 and the average wage across all industries in Japan (see Appendix 2 for details). The results suggest that manufacturing shows a larger spillover effect on the average wage compared to wholesale and retail trade, and medical, health care and welfare (Figure 16). Compared to the U.S., however, the spillover effect of Japan's manufacturing wage is smaller, suggesting that the spillover mechanism described above may not be sufficiently effective in Japan.

Figure 16. Wage Spillover across Industries



Note: Cumulative impulse responses (C.I.) of average wages across all industries to a 1 percentage point increase shock to wage in each industry. See Appendix 2 for details.

Sources: Ministry of Health, Labour and Welfare; BLS.

Weak wage spillovers across industries may also be related to low labor mobility. In fact, a labor mobility index calculated based on job-to-job transitions and gross employment-unemployment flows confirms that mobility is lower in Japan than in other advanced economies (Figure 17).[15] However, it is not necessarily clear whether greater labor mobility across industries and firms will lead to a higher average wage. In Japan, seniority-based wages and long-term employment practices often lead to wage losses of middle-aged and elderly workers upon their job changes (Figure 18).[16] Moreover, not only in Japan, but also in many other advanced economies, as demand and industry structures transition over time, there have been a tendency that employment decreases in industries where productivity is rising while it increases in industries where productivity is declining or stagnant (Figure 19).[17] Such labor flows have rather led to the reduction

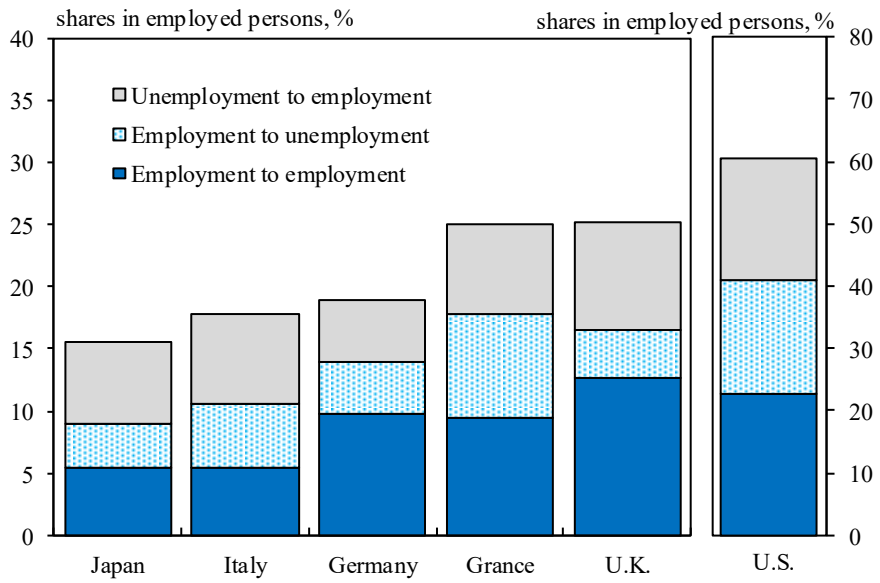
[15] The labor mobility index is calculated as the total number of employees who (1) have changed jobs, (2) have lost their jobs, and (3) have found a job from unemployment status in the past year as a percentage of the total employees, following the definition by Causa, Luu, and Abendschein (2021).

[16] It has been widely acknowledged that practices such as seniority-based wages and long-term employment are more prominent in Japan than in other countries.

[17] Ngai and Pissarides (2007) utilizes an economic growth model of multiple industries with different productivity (TFP) growth to show that labor flows from industries with high productivity growth to those with low productivity growth can occur under a certain assumption about the consumers' utility function (a low elasticity of substitution across goods and services produced by industries). Kondo and Naganuma (2015) conduct an empirical analysis using Japanese data on the possibility that inter-industry job change reduces wages, focusing on differences in required tasks in each industry.

of the average wage across industries. In the next section, we present recent data and discuss the possibility that job switching among different firms in the same industry rather than between different industries leads to higher wages, especially for younger workers.

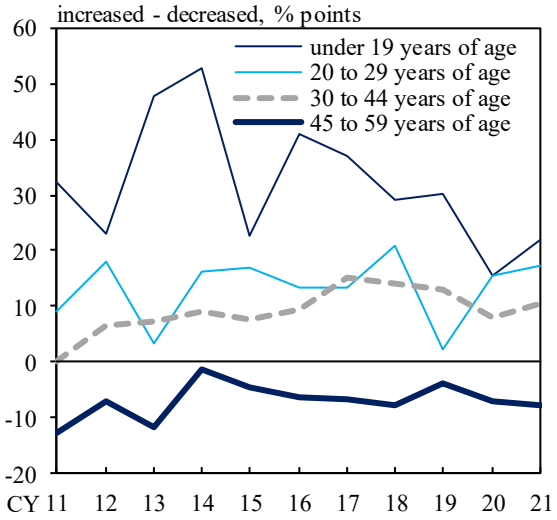
Figure 17. Labor Mobility



Note: Data as of 2019. Employment to employment is the ratio of employees who have changed jobs within a year and are currently working. The data for the U.S. is estimated by Causa, Luu, and Abendschein (2021).

Sources: Ministry of Internal Affairs and Communications; OECD; Causa, Luu and Abendschein (2021)

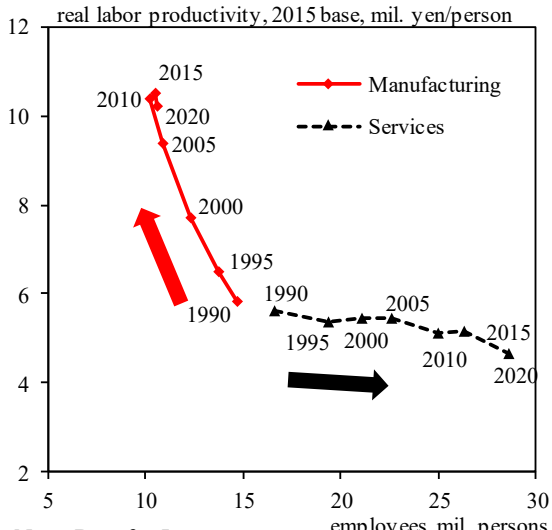
Figure 18. Job-to-Job Transition and Wage Increase



Note: The share of job changers whose wages increased minus the share of job changers whose wages decreased in Japan.

Source: Ministry of Health, Labour and Welfare.

Figure 19. Employment and Labor Productivity by Industry



Note: Data for Japan.

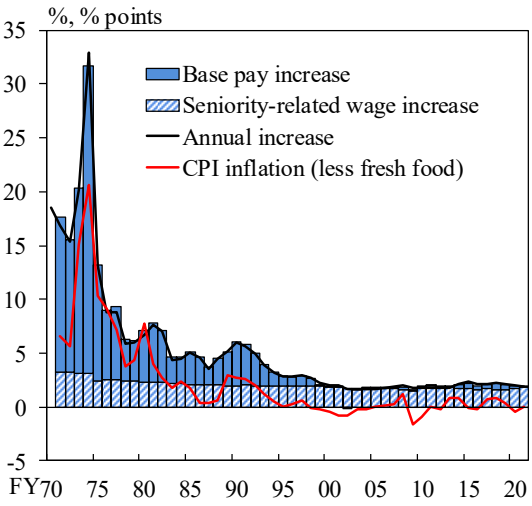
Source: Cabinet Office.

(D) Persistent low inflation

To conclude this section, we briefly touch on a purely nominal factor that have dampened nominal wage growth in Japan: the impact of persistent low inflation that had become a social "norm."

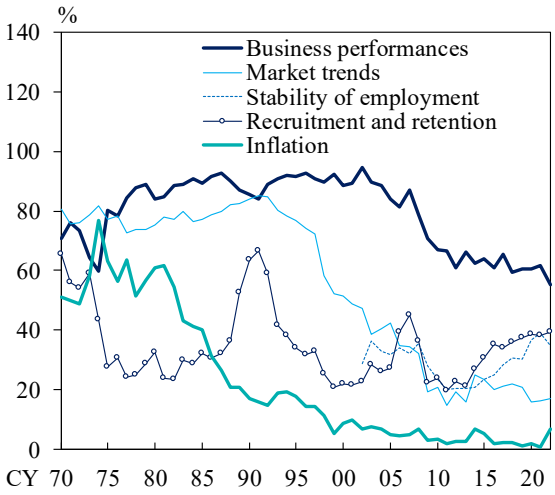
In Japan, the percentage of firms that place importance on inflation when revising wages began to decline rapidly in the 1980s, when inflation fell below the range of seniority-related wage increases, which was around 2 percent (Figures 20 and 21). As low inflation or moderate deflation persisted since then, base pay increases had not been observed from around 2000. Although base pay increases have resumed since 2014, partly due to strengthened coordination between the government, employees, and employers, base pay increases have remained modest as inflation remains low and within the range of seniority-related wage increases. Consumer price inflation in 2022 is likely to exceed the range of seniority-related wage increases for the first time since the early 1990s. Given this, its potential impacts are discussed in the next section.

Figure 20. Wage Revisions



Sources: Cabinet Office; Ministry of Internal Affairs and Communications; Ministry of Health, Labour and Welfare; Central Labour Relations Commission.

Figure 21. Reasons for Wage Revisions



Note: Multiple choices answered by firms.
Source: Ministry of Health, Labour and Welfare.

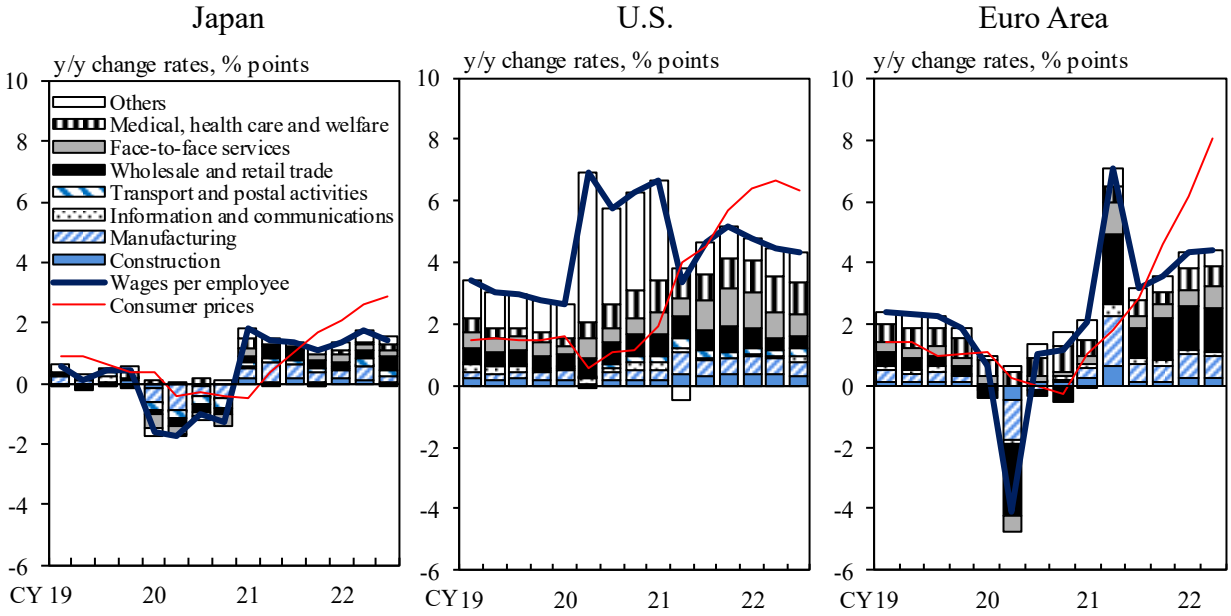
3. Wage developments since the outbreak of COVID-19

In this section, we examine how each of the four groups of factors (A) through (D) discussed in the previous section have been changing since around the COVID-19 outbreak. It should be noted that the changes discussed in this section are not necessarily

limited to the effects of the COVID-19 per se.[18]

We will first briefly review wage and labor market developments in Japan, the U.S., and Europe since the outbreak of COVID-19. Japan's nominal wage growth has been low relative to the U.S. and Europe as in the pre-COVID-19 period, but compared to the past, the growth rate has been higher, especially in industries such as wholesale and retail trade and face-to-face services (Figure 22). In relation to prices, nominal wage growth has not kept pace with inflation (real wages have fallen) even in the U.S. and Europe as well as in Japan. Immediately after the outbreak of COVID-19 in 2020, nominal wages per employee fell sharply in Japan and Europe as their employment was maintained. By contrast, in the U.S., nominal wages per employee grew rather strongly as employment was reduced mainly in lower-wage industries.

Figure 22. Wage Development since the COVID-19 Pandemic



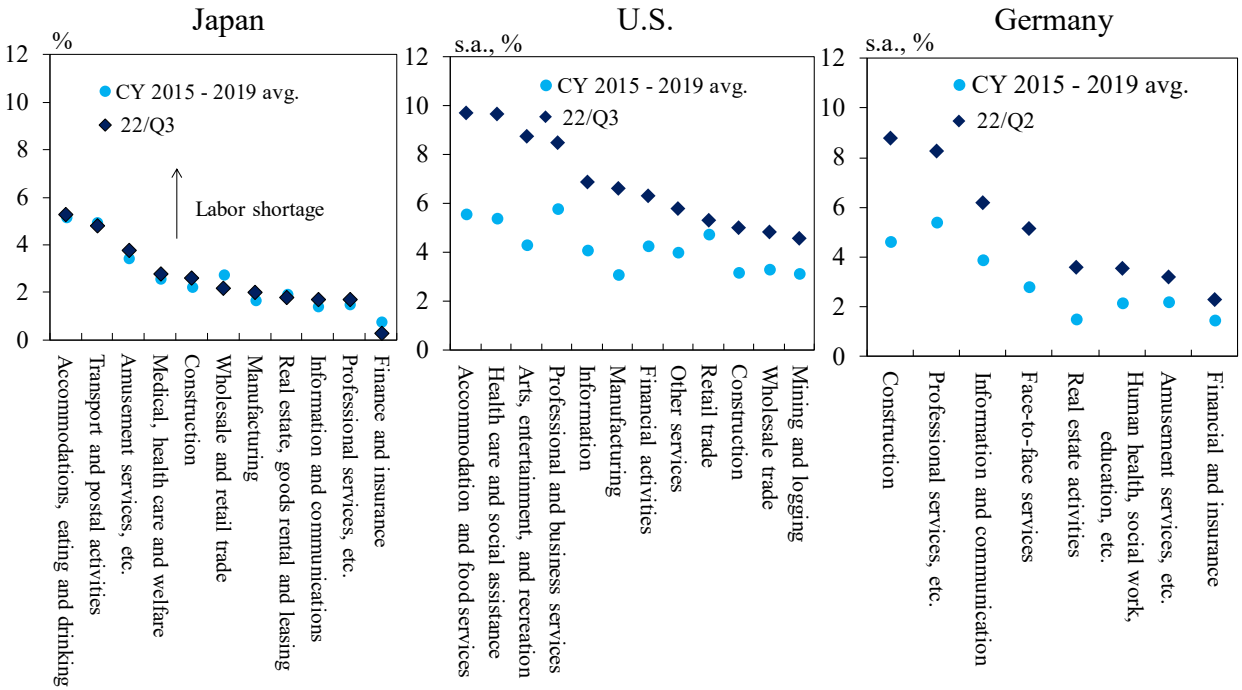
Note: For Japan, total cash earnings (including bonuses) per employee from Monthly Labour Survey are shown (Q1: March-May, Q2: June-August, Q3: September-November, Q4: December-February). The data from 2016/Q1 onward are based on continuing observations following the sample revisions. Consumer Prices for Japan is CPI (all items less fresh food) and adjusted for the effects of the consumption tax hike, etc. (the Bank of Japan staff's estimates). For Europe, "wholesale and retail trade" includes transport and postal activities, and "medical, health care and welfare" includes public administration, education, etc.

Sources: Ministry of Health, Labour and Welfare; Ministry of Internal Affairs and Communications; BLS; Eurostat.

[18] Hoshi and Kashyap (2020) note that the dual structure of the Japanese labor market began to change in the late 2010s, before the COVID-19 outbreak.

The differences in recent wage developments between countries and industries can be attributed largely to the differences in the degree of tightness of labor market conditions. In the U.S., the number of workers who left the labor market increased significantly after the pandemic (the so-called "Great Resignation"), and in Europe, a decrease in immigration has led to the prolonged decline in labor supply. These have been reflected in the rise in vacancy rates of wide range of industries to the levels higher than the pre-COVID-19 levels (Figure 23) and the surge in nominal wage growth not seen in recent years in these countries.[19] By contrast, in Japan, labor supply has been relatively stable and the recovery in labor demand has been slower than in the U.S. and Europe, resulting in the vacancy rates similar to the pre-COVID-19 levels.

Figure 23. Vacancy Rates by Industry before and after the Pandemic



Note: Data for Japan are the numbers of job vacancies divided by the numbers of employees. Data for U.S. are the numbers of job openings divided by the numbers of employees. Data for Germany are the numbers of job vacancies divided by the numbers of occupied jobs. The face-to-face services for Germany are wholesale and retail trade, transport, and accommodation and food service activities.

Sources: Ministry of Health, Labour and Welfare; BLS; Eurostat.

[19] See, e.g., Hobijn (2022) for a discussion of the mass retirement after the pandemic in the United States and Bodnár and O'Brien (2022) for a discussion of the impact of immigration on the labor market after the pandemic in Europe.

(A) Households' labor supply and dual labor market

As indicated in the previous section, Japan's labor force participation rate rose markedly in the 2010s, especially among women and the elderly, but declined slightly immediately after the outbreak of COVID-19. Thereafter, unlike in the U.S. and Europe, the labor force participation rate has recovered quickly in Japan, but the pace of increase has been slow compared to the 2010s (Figure 24). Furthermore, the room for additional labor supply in Japan is expected to decline in the medium-term. The population aged 15 and over is expected to decline[20], and the baby-boom generation is becoming over 75 years old, making it increasingly difficult for them to remain in the labor force (Figure 25). As for women, the "M-shaped curve" seen in the conventional labor force participation rates by age group has been dissipating, as the female participation rate for the 35-44 age group has been increasing along with the increase in other close-age groups (Figure 26).[21] Given these demographic trends, from a labor supply perspective, it is highly likely that the Japanese labor market has been entering a phase where wages tend to rise, although it is uncertain whether it will reach the "Lewis turning point" where the elasticity of additional labor supply to wages declines nonlinearly (the slope of the labor supply curve steepens). In the meantime, labor demand will also likely push up wages reflecting the improvement in economic activity, although it will depend on the pace of economic recovery and other factors.[22]

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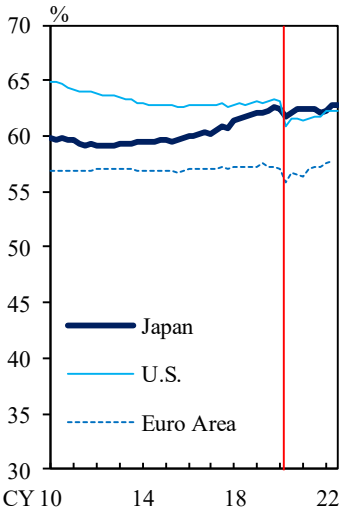
[20] The pace of decline in the population aged 15 and over has recently accelerated, partly because the increase in foreign workers stopped after the pandemic. If foreign workers increase again in the future, the pace of decline in the population aged 15 and over is expected to slow down, but the decline itself is expected to continue due to factors related to the domestic demographic trend.

[21] However, since many women aged 35-44 are part-time workers, their level of labor participation in terms of working hours remains low. In the future, there will be room for further increase in the supply of working hours, if more women work as full-time workers rather than part-time workers especially after childbirth.

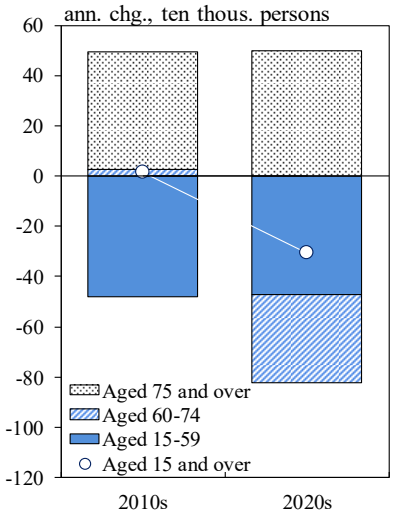
[22] See Bank of Japan (2023) Box 2 for the recent situation and outlook for labor supply and demand.

Figure 24. Labor Force Participation Rates



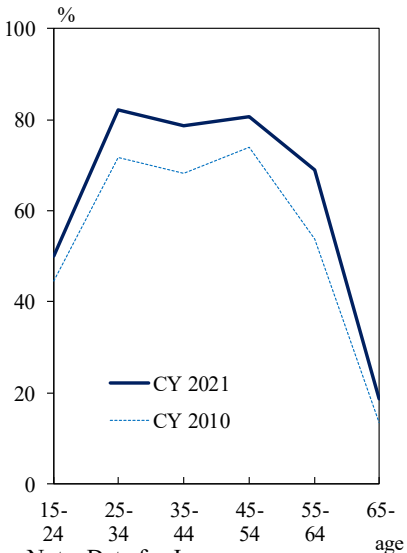
Note: The red vertical line shows 2020/Q1.
Sources: OECD; Haver.

Figure 25. Changes in Population Aged 15+



Note: Data for Japan. The data for 2020s is based on projection up to 2024.
Sources: Ministry of Internal Affairs and Communications; National Institute of Population and Social Security Research.

Figure 26. Female Labor Force Participation Rates

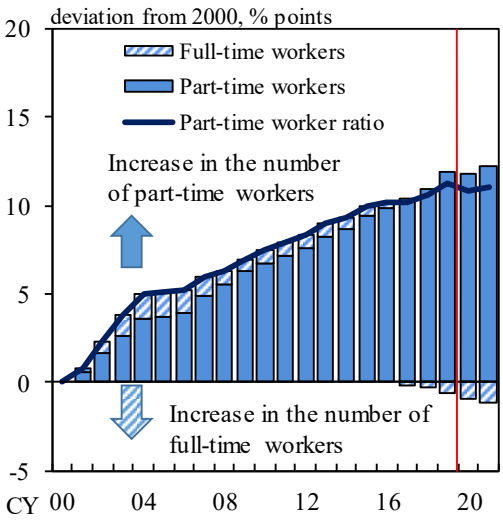


Note: Data for Japan.
Source: Ministry of Internal Affairs and Communications.

The upward trend of the part-time worker ratio since the 1990s, as indicated in the previous section, has also changed since around the pandemic. In particular, while the number of part-time workers temporarily declined after the outbreak of COVID-19, the number of full-time workers continued to increase steadily, resulting in the plateauing trend of part-time worker ratio (Figure 27). During this period, the "wage premium" (see Appendix 3 for details) also narrowed in a wide range of industries, indicating that the wage gap between full-time and part-time workers continued to narrow (Figure 28).[23] Although the dual structure itself has not changed, the average wage across full-time and part-time workers is no longer continuously being pushed downward by the rising ratio of part-time workers. The current and future wage trends for each group (full-time and part-time) of workers are discussed in the next section.

[23] While the wage gap between full-time and part-time workers has narrowed, it has also been pointed out that the gap in other aspects than wages, such as flexibility in working styles (e.g. working from home) may have widened since the pandemic.

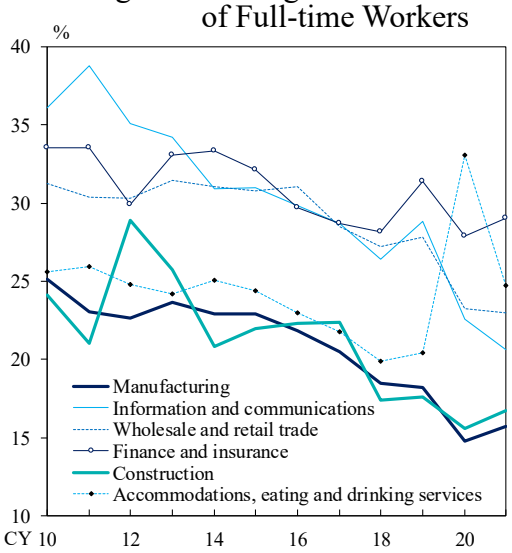
Figure 27. Part-time Worker Ratio



Note: Data for Japan. The cross-term is evenly distributed. The red vertical line shows 2020.

Source: Ministry of Health, Labour and Welfare.

Figure 28. "Wage Premium" of Full-time Workers



Note: Data for Japan. See Appendix 3 for details.

Source: Ministry of Health, Labour and Welfare.

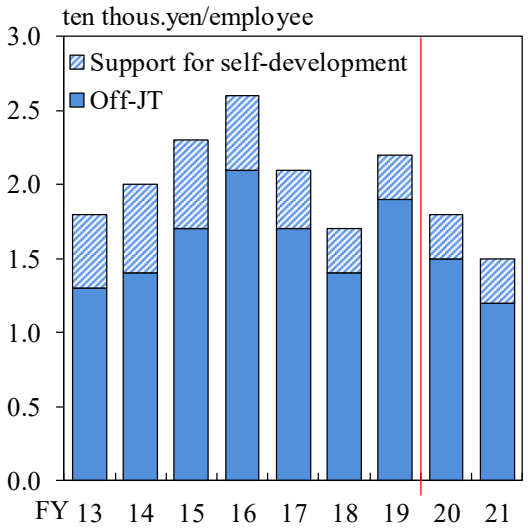
(B) Firms' investment and labor productivity

The firm-side factors mentioned in the previous section have not changed noticeably after the pandemic. In some respects, Japan has lagged further behind the U.S. and Europe with regard to factors related to labor productivity.[24]

Human capital investment (Off-JT and support for self-development) by Japanese firms has remained sluggish after the outbreak of COVID-19 (Figure 29). Software investment has decelerated significantly, in contrast to the U.S., where digitization has accelerated after the pandemic (Figures 30). As for the content of fixed capital formation, Japan's capital stock has not only seen a slowdown in overall growth but also a stoppage of accumulation of intellectual property after the pandemic (Figure 31). Although Japanese firms' appetite for investment has recently increased in relation to digital and green transformation, it is hard to deny that they have lagged behind the U.S. and European firms.

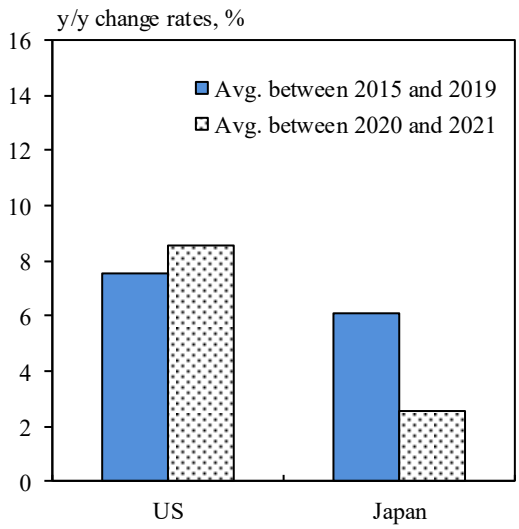
[24] A more detailed discussion of labor productivity in Japan before and after the pandemic is provided in Yagi, Furukawa, and Nakajima (2022).

Figure 29. Human Capital Investment



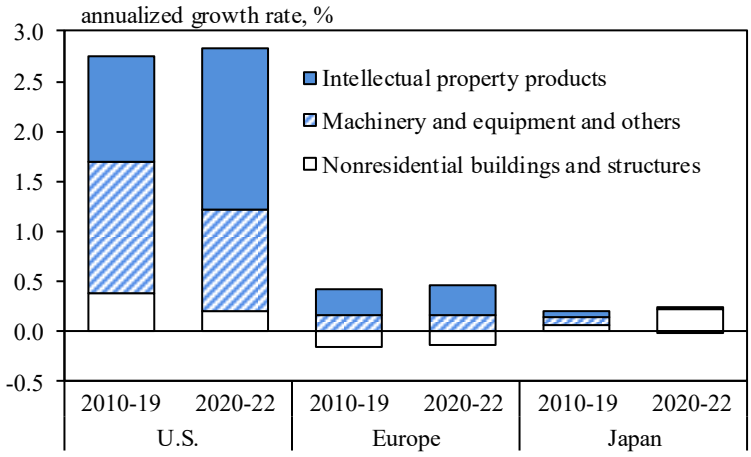
Note: The red vertical line shows FY2020.
Sources: Ministry of Health, Labour and Welfare.

Figure 30. Investment in Software



Sources: Cabinet Office; BEA; Haver.

Figure 31. Real Gross Capital Formation by Type

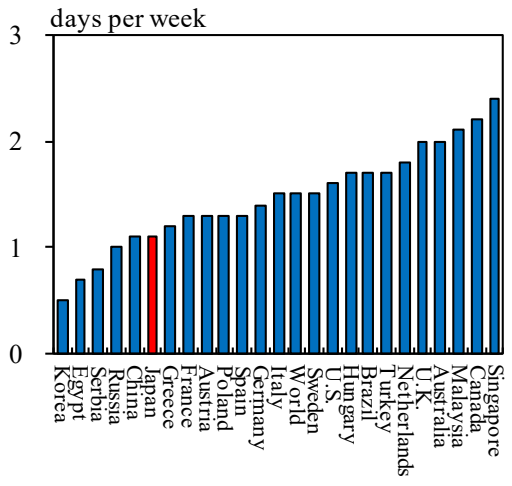


Note: Europe includes Germany, France and Italy.
Sources: Cabinet Office; San Francisco Fed; Eurostat.

The prevalence of working from home (or remote working) was one of the major changes in working styles during the pandemic. However, according to a survey conducted by Aksoy et al. (2022), Japan lagged somewhat behind other developed countries in its prevalence as of February 2022 (Figure 32). While some surveys in the U.S. and other countries suggest that working from home has led to an increase in labor productivity (e.g., Barrero, Bloom and Davis (2021)), a survey of workers in Japan also finds that the number of respondents who replied that working from home led to an

increase in productivity has been gradually increasing (Figure 33).[25]

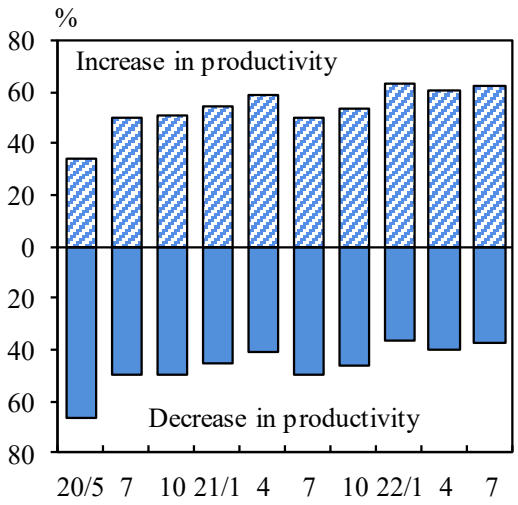
Figure 32. Working from Home



Note: Based on the survey by Aksoy et al. (2022), which was conducted from July 2021 to Feburary 2022 and covered about 30,000 workers in the world. Fixed effects related to gender and education are controlled for.

Source: Aksoy et al. (2022)

Figure 33. Working from Home and Productivity



Note: Based on responses to a survey on performance of working from home conducted by Japan Productivity Center.

Source: Japan Productivity Center.

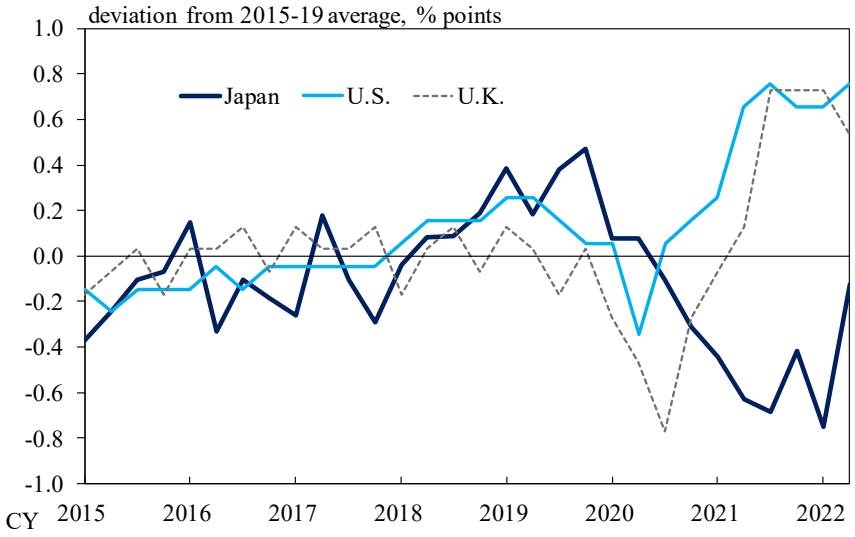
(C) Labor mobility across firms

The previous section discussed labor mobility and wage spillover across industries. This section discusses the possibility that labor mobility mainly across firms (i.e. job-to-job transitions) will increase, accompanied with an increase in wages.

After the outbreak of COVID-19, the job-to-job transition ratio (the ratio of those who changed jobs in the past year to all employees) in Japan continued to decline, especially among part-time workers, but showed signs of recovery in early 2022 (Figure 34). In the U.S. and the U.K., similar job-to-job transition indicators rebounded strongly after they fell in 2020. It warrants attention whether the job-to-job transition ratio in Japan will also rise above the pre-COVID-19 levels.

[25] Based on a survey of Japanese firms and workers, Morikawa (2022) finds that working from home (WFH) reduced overall productivity, but that changes in productivity varied greatly both by firm and worker characteristics. He also finds that the firms which introduced WFH before the pandemic were relatively more productive in WFH than those that introduced it after the pandemic.

Figure 34. Job-to-Job Transition Ratios



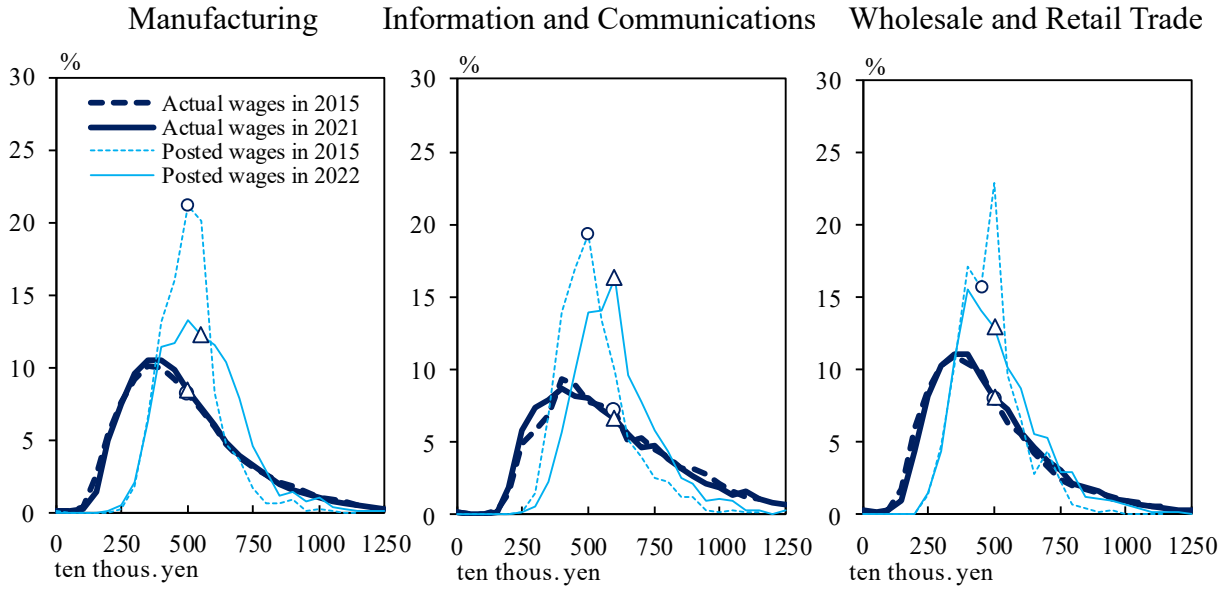
Note: Data for Japan is the ratio of the number of employees who have changed jobs within a year to the number of all employees, which is based on Labour Force Survey (Detailed Tabulation). Data for the U.K. is the job-to-job transition ratio of employees aged 16-69 . The data for the U.S. is the voluntary separation ratio.

Sources: Ministry of Internal Affairs and Communications; BLS; ONS; Haver.

Next, we discuss an analysis by Furukawa, Hogen, and Kido (2023), which analyze job advertisement data for regular employees. They show that while the distribution of actual wage levels (Basic Survey on Wage Structure) has not changed much since before the pandemic, the distribution of posted wages observed in the job advertisement data has shifted to the right (higher wage) direction (Figure 35). Looking more closely by industry, as for manufacturing and wholesale and retail trade industries, the distribution of wages near the lower end remains unchanged, while the right half of the distribution has shifted to the right. In contrast, in the information and communications industry, the entire wage distribution, including the lower end, has shifted to the right. Such an increase in posted wages could lead to more active job switching and put upward pressure on existing regular workers' wages.[26]

[26] Furukawa, Hogen, and Kido (2023) shows in their empirical analysis that the growing demand for highly skilled workers has led to the increase in posted wages, and that the increase in posted wages may spill over with a lag to wages of existing regular employees.

Figure 35. Wage Distribution of Regular Employees



Note: Posted wages are based on the data from a major private recruiting agency's website. Actual wages are full-time or regular employees' wages obtained from Basic Survey on Wage Structure. Markers indicate average values.

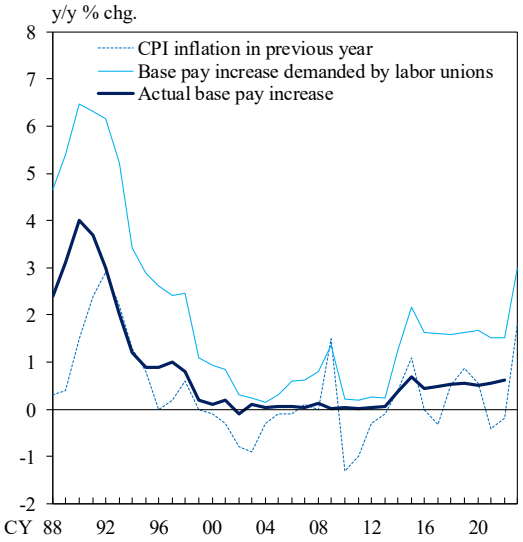
Sources: Ministry of Health, Labour and Welfare; HRog Co., Ltd.

(D) Wage negotiations under rising prices

As indicated in the previous section, base pay increases have been frozen or limited to a modest level along with persistent low inflation. There has been an increasing attention to the annual wage revision negotiations (*shunto*) for 2023, given the recent surge in CPI inflation rate which is annually the largest in about 30 years.

According to the "Negotiation Plan (*toso hoshin*)" decided by Japan Trade Union Confederation (*Rengo*), their demand for base pay increase in 2023 has been set at 3 percent (excluding seniority-based wage increase of approximately 2 percent), which is on par with the mid-1990s, reflecting the CPI inflation in 2022 (Figure 36). In response, some large firms have pointed out the need to raise wages in a structural way taking into account developments in inflation. Moreover, the Japan Chamber of Commerce and Industry's Local Business Outlook survey (as of December 2022), which mainly targets small and medium-sized enterprises in a relatively severe business environment, also showed a marked increase in responses citing "rise in prices" as a reason for raising wages (Figure 37). Although uncertainty remains regarding the outlook for the business environment and the relationship between base pay increases and temporary inflation allowances, some change from the low-inflationary period is expected.

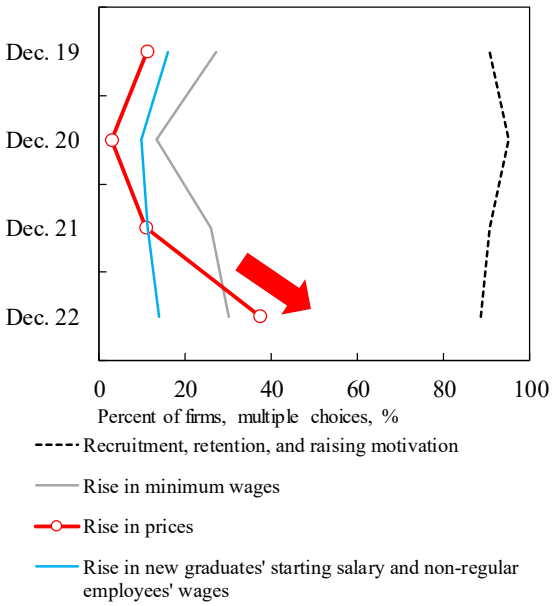
Figure 36. Wage Negotiations



Note: CPI inflation is all items less fresh food and excludes the effects of the consumption tax hikes, etc. (the Bank of Japan staff's estimates). Data for 2022 is the average of January-September. Base pay increase demanded by labor unions is based on the Central Labour Relations Commissions up to 2014, and is based on Rengo after that (data for 2023 is from Rengo's policy for the spring 2023 wage negotiations). The data before 2022 is calculated by subtracting seniority-related wage increases from the total increase in wages demanded.

Sources: Ministry of Internal Affairs and Communications; Japanese Trade Union Confederation (Rengo); Central Labour Relations Commission.

Figure 37. Reasons for Wage Increase



Note: Based on survey data which covers members of the Japan Chamber of Commerce and Industry that have increased or plan to increase wages. Data for scheduled earning of regular employees.

Source: The Japan Chamber of Commerce and Industry.

4. Issues for the post-COVID-19 wage growth

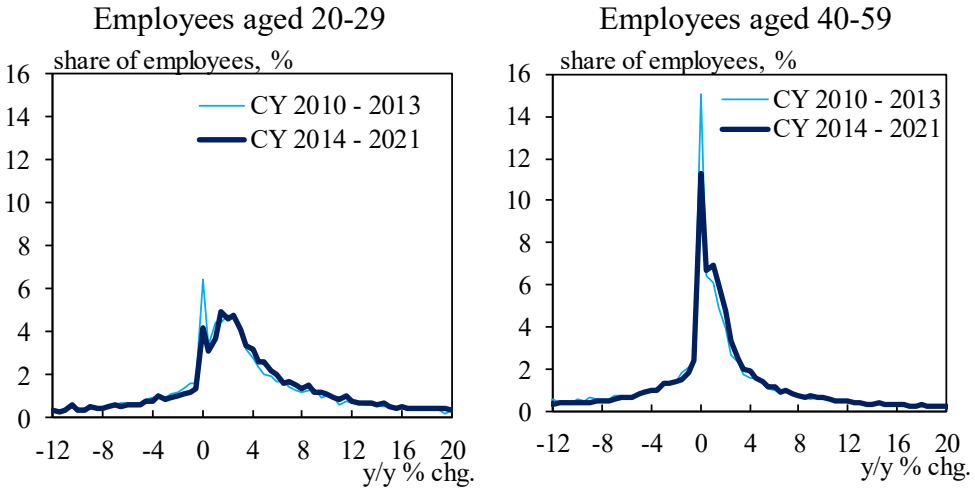
In the previous section, we showed that some of the factors that had contained Japan's wage growth have been changing since around the COVID-19 outbreak. Specifically, these include the tightening of the labor market conditions partly reflecting demographic trends, the plateauing part-time worker ratio, signs that the job-to-job transition is becoming more active as wages rise, and an increased consideration of inflation for labor-management wage negotiations. Finally, we present some key issues on the outlook for the pace and durability of wage growth in Japan, ranging from near-term to longer-term issues.

(A) Outlook for wages under the dual labor market

Reflecting the tightening of labor market conditions noted in the previous section, wages of part-time workers, who are generally more mobile than full-time workers, have clearly increased, especially in the face-to-face services as their activities have been resuming recently. This change has been spilling over into wages of some full-time workers who have relatively high mobility among them. Specifically, there are signs of changes in wages in certain industries such as face-to-face services, small and medium-sized enterprises, and young employees, partly reflecting labor market tightness.[27]

In this section, we review the changes that appear to have gradually occurred in wages (scheduled cash earnings) of young full-time workers since before the pandemic. While the wage growth distribution for middle-aged and elderly employees (aged 40-59) has a high peak at the 0 percent wage growth rate, the wage growth rates for younger employees (aged 20-29) are widely distributed in positive territory up to about 3 percent (Figure 38).[28] Since the early 2010s, the overall distribution has not changed much for the middle-aged and elderly groups, while the peak of 0 percent has become lower. By contrast, the distribution for the younger age groups has clearly changed, with the peak

Figure 38. Distributions of Changes in Earnings of Full-time Workers



Note: See footnote 28 for details. The changes in scheduled cash earnings are shown and outliers (over +60 percent or less than -35 percent) are excluded. For CY2010-2013, CY2012 is excluded given data limitation.

Source: Ministry of Health, Labour and Welfare.

[27] See Bank of Japan (2023) Box 3 for details.

[28] For calculating wage growth rates of individual workers, we follow Kambayashi (2011) in identifying workers who have worked at the same establishment for two consecutive years from the questionnaire information of the Basic Survey on Wage Structure.

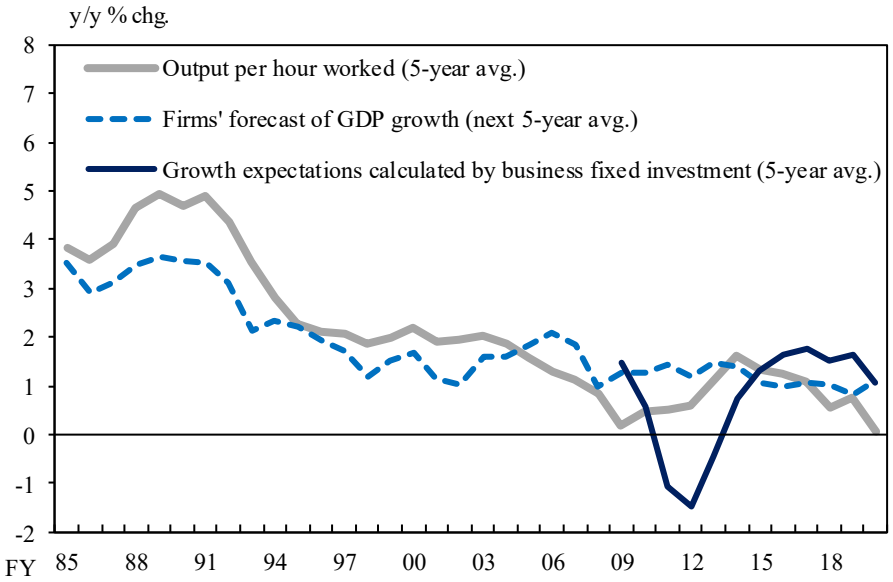
shifting from 0 percent to positive territory.[29]

The change shown above suggest that the rigidity of wages for some full-time workers appears to have eased. For the outlook for the average wage growth across all workers in the economy, a key issue is whether wages will rise more broadly, including for workers with relatively low labor mobility.

(B) Firms' growth expectations

Next, we discuss firms' growth expectations as a somewhat long-term factor that could stimulate investment and thereby raise labor productivity among Japanese firms. According to a business survey, the outlook for Japan's real economic growth rate over the next five years has been generally in line with the average growth of labor productivity over the past five years (Figure 39). Moreover, Japanese firms' growth expectations calculated using data on business fixed investment (see Appendix 4 for details) has recently appeared to be steady compared to the actual labor productivity growth.

Figure 39. Firms' Growth Expectations and Labor Productivity



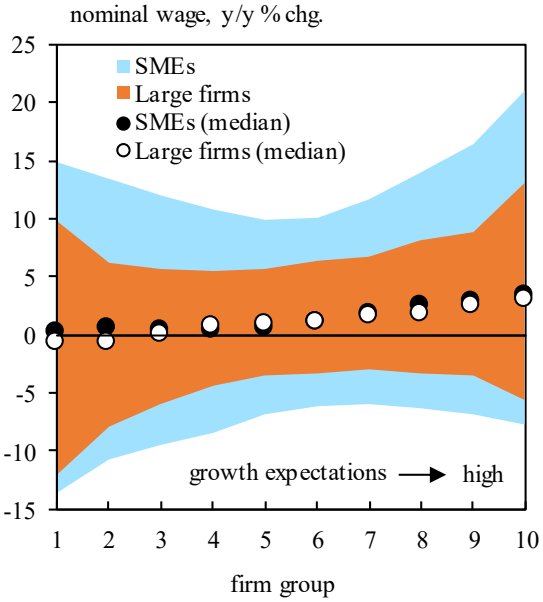
Note: See Appendix 4 for calculations of firms' growth expectations. Firms' forecast of GDP growth (in real terms, next 5-year average) is obtained from Annual Survey of Corporate Behavior.

Sources: CRD Association; Development Bank of Japan; Cabinet Office.

[29] A more detailed analysis of the distribution of nominal wage growth rates for full-time workers and their sensitivity to factors including labor market tightness is provided in Kurozumi et al. (2023).

The distribution of individual firms' growth expectations calculated above shows a moderate positive relation between growth expectations and nominal wage growth, that is, firms with higher growth expectations tend to have higher nominal wage growth for both large firms and small and medium-sized enterprises (SMEs) (Figure 40).[30] Although the underlying mechanism is not necessarily clear, one possible explanation is that increasing capital investment based on high growth expectations led to an increase in labor productivity through capital deepening (a rise in the capital-to-labor ratio).[31] To examine the dynamic relationship among these variables, we estimate a panel vector autoregression (VAR) model in which growth expectations, labor productivity growth, and nominal wage growth for each firm are included as endogenous variables (see Appendix 4 for details). The responses of nominal wages to a shock raising growth expectations are positive and persistent, especially for large firms (Figure 41).

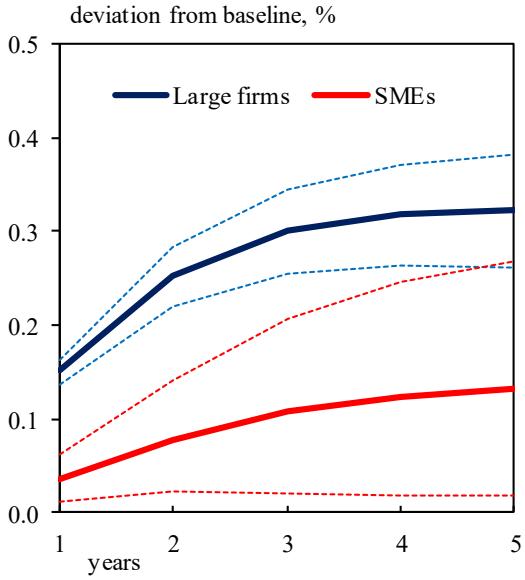
Figure 40. Growth Expectations and Wage Growth



Note: Data as of 2019.The colored areas show 25-75 percentile intervals. Firms groups are classified based on their growth expectations. See Appendix 4 for details.

Sources: CRD Association; Development Bank of Japan; Cabinet Office.

Figure 41. Response of Wage to Growth Expectation Shocks



Note: A cumulative response of wages to a +1 percentage point growth expectation shock. See Appendix 4 for details.

Sources: CRD Association; Development Bank of Japan; Cabinet Office.

[30] For SMEs, wage growth rates are broadly bounded at zero for groups in the lower half of the growth expectation distribution, therefore have no positive correlation with growth expectations.

[31] In general, when capital investment increases and the capital-to-labor ratio rises, wages are likely to rise through higher labor productivity. However, wages may not rise if labor demand is suppressed (even with an increase in the capital-to-labor ratio) by labor-saving investment. On the other hand, a decrease in labor supply due to the demographic and other factors may lead to increases in wages, both through increases in the capital-to-labor ratio and tighter labor market conditions.

(C) Facilitation of labor mobility through skill development

As discussed earlier, it is not necessarily clear whether greater labor mobility across industries and firms will increase the average wage. But anyway, it will be increasingly important to appropriately allocate limited labor resources, as Japan's economy is projected to face a decline in the labor supply.

From this perspective, it is important to facilitate labor mobility through skill development both within and outside firms. Some firms are providing "re-skilling" with their employees in order to reassign them to a more productive job within a company. Meanwhile, as part of its efforts to encourage "Investment in People" and other measures, the Japanese government is taking steps to provide support for skill development and assistance in moving up the job ladder.[32] If these efforts by firms and the government are successful, it should increase wages by boosting labor productivity. In addition, it warrants attention whether the trend toward facilitating labor mobility within and across firms, which is currently observed among some large firms, will spread beyond differences in region, industry, and firm size.

(D) Interrelationship between prices and wages

Finally, it is also important to note whether the situation in which wage increases were contained under the norm of low inflation will change, so that prices and nominal wages will rise together. As mentioned in the previous section, a stronger spillover from prices to wages is expected, as the recent surge in consumer prices has been increasingly considered in the ongoing labor-management wage negotiations. Furthermore, to a certain extent, some spillover from wages to prices may also contribute to price stability in the future, given the risk of persistent low inflation norm in Japan.

In the 1970s, in many countries including Japan, the U.S., and Europe, soaring inflation fueled wage negotiations, and the rise in nominal wages in turn led to further inflationary pressure (so-called the "second round effect"), causing a wage-price spiral. Compared to that time, credibility in monetary policy aimed at price stability has improved, and the labor market environment has changed significantly as evidenced by the decline in the union membership rates in many countries.[33] Nonetheless, in the U.S. and Europe, where

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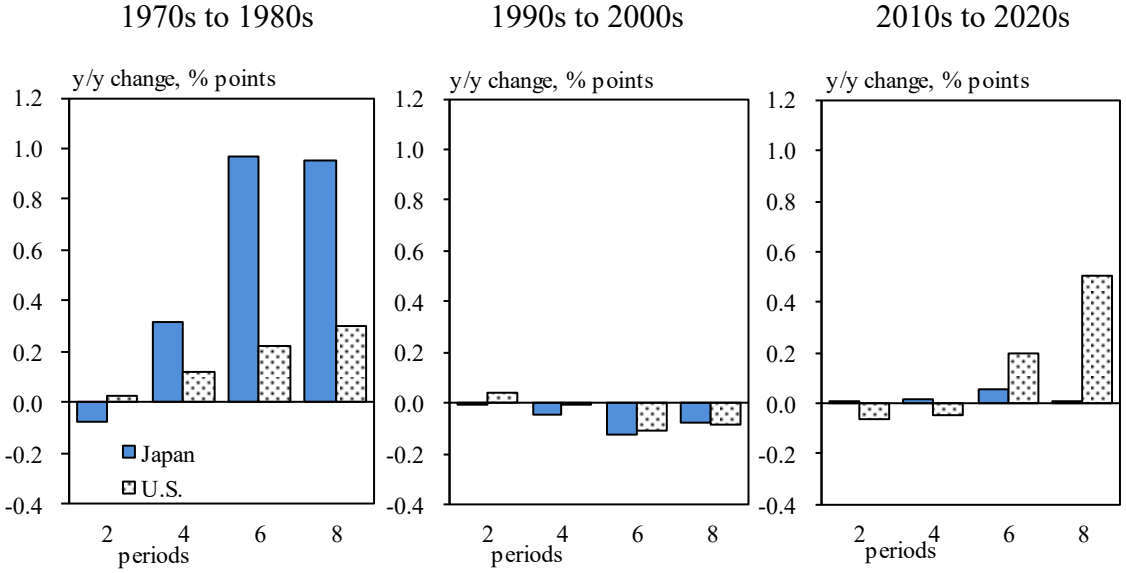
[32] For details, see the materials released from the "Council of New Form of Capitalism Realization" at Cabinet Secretariat of Japan. These measures include raising the minimum wage and strengthening firms' disclosure of information on human capital.

[33] However, recently in the U.S. and Europe, labor unions have been becoming more active (e.g.,

prices and nominal wages have already risen substantially, the risk of such spirals has been pointed out widely.[34]

To analyze the interrelationship between prices and nominal wages since the 1970s, we estimate VAR models using data on consumer prices and nominal wages for Japan and the U.S., respectively. The second-round effects are calculated as the price responses to a shock to prices themselves that is only generated through wages (see Appendix 5 for details). We find that the second round effect in Japan in the 1970s-80s was quite large compared to the U.S. at that time (Figure 42). But since the 1990s, the second round effect in Japan has almost dissipated. In the U.S., on the other hand, the second round effect, which dissipated in the 1990s and 2000s, have increased in recent years to the same level as in the 1970s and 1980s.

Figure 42. Second Round Effects from Wages to Prices



Note: See Appendix 5 for details.

Sources: Ministry of Health, Labour and Welfare; Ministry of Internal Affairs and Communications.

Based on the above results, it can be assessed that the risk of a wage-price spiral is likely to be limited in Japan today as long as the estimated interrelationship between prices and nominal wages is maintained. However, there are many aspects of the interrelationship between prices and nominal wages that need to be closely monitored

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frequent strikes) and some practices of the price-to-wage indexation that used to be common in the 1970s (e.g., Cost Of Living Adjustment provisions in the U.S.) are being restored.

[34] IMF (2022) analyzes the interrelationship between prices and nominal wages using a long time series data for advanced countries, including the 1970s. The analysis shows that the formation of inflation expectations has played a central role in this interrelationship.

from various angles, as it is unclear which factors (including changes in the norm of low inflation) and how they can change this interrelationship.

5. Conclusion

This paper has examined various factors that have dampened nominal wage growth in Japan, comparing them with those in the U.S. and Europe, and showed that some of these factors have been changing since around the COVID-19 outbreak. Key issues on the outlook for the pace and durability of nominal wage growth in Japan are (A) whether wages will rise broadly, including among full-time workers with relatively low mobility, (B) whether firms' expectations for growth will increase, boosting investment and leading to higher labor productivity, (C) whether labor mobility will be facilitated through skill upgrading, and (D) whether the situation in which wage increases have been suppressed under the low inflation norm will change so that prices and nominal wages will rise together.

The pandemic has been still affecting Japan's economy in a variety of ways, and inflation has continued to accelerate. There are many uncertainties as to whether some of the changes pointed out in this paper will be temporary or more long-lasting. Given these observations, it will be necessary to monitor closely various aspects of future wage growth and labor market conditions, with a focus on the issues discussed in this paper.

Appendix 1: Wage Phillips curve

This appendix provides details on the wage Phillips curve presented in Section 1. The wage Phillips curve, which includes explanatory variables related to prices, labor productivity, and labor market slack is widely used in empirical research such as IMF (2017), Abdih and Danninger (2018), Nickel et al. (2019), and Eser et al. (2020). In this paper, we follow previous studies and estimate the following equation for Japan, the U.S., and the Euro area, respectively,[35]

$$\pi_t^w = c + \rho\pi_{t-1}^w + \beta_1 UR_t + \beta_2 UR_{t-1} + \gamma \cdot prod_t + \alpha \cdot infl_t + \varepsilon_t$$

where π_t^w is the quarter-on-quarter growth rate of nominal wages per employee (compensation per employee), UR_t is the unemployment rate, $prod_t$ is the quarter-on-quarter growth rate of labor productivity (real GDP per employee), and $infl_t$ is the year-on-year CPI inflation. We also examine other similar variables, including nominal wages and labor productivity per hour, the CPI inflation of forward moving average (a proxy for inflation expectation), and find that the results do not change qualitatively.

To calculate the contribution of the variables to the change in wages (year-on-year) reported in Figure 2, we recursively substitute the contribution of variables to π_{t-1}^w, following Yellen (2015),

$$\begin{aligned}
\pi_t^w &= \hat{c} + \hat{\rho}\pi_{t-1}^w + \hat{\beta}_1 UR_t + \hat{\beta}_2 UR_{t-1} + \hat{\gamma} \cdot prod_t + \hat{\alpha} \cdot infl_t + \hat{\varepsilon}_t \\
&= \hat{c} + \hat{\rho}(\hat{c} + \hat{\rho}\pi_{t-2}^w + \hat{\beta}_1 UR_{t-1} + \hat{\beta}_2 UR_{t-2} + \hat{\gamma} \cdot prod_{t-1} + \\
&\quad \hat{\alpha} \cdot infl_{t-1} + \hat{\varepsilon}_{t-1}) + \hat{\beta}_1 UR_t + \hat{\beta}_2 UR_{t-1} + \hat{\gamma} \cdot prod_t + \hat{\alpha} \cdot infl_t + \hat{\varepsilon}_t \\
&= \hat{c} + \hat{\rho}\hat{c} + \hat{\rho}^2\pi_{t-2}^w + \cdots
\end{aligned}$$

where $\widehat{\ }$ denotes OLS fitted values. For all regions, absolute values of $\hat{\rho}$ are less than 1, indicating that the contribution of each variable gradually decays. Thus, the change in nominal wages per employee (π_t^w) can be decomposed into the unemployment rate (UR_{t-i}), labor productivity ($prod_{t-i}$), and CPI inflation ($infl_{t-i}$). As for CPI inflation, we estimate the models with CPI all items and CPI core inflation, respectively, and take average of the two models.[36]

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[35] Sample period is 1980/Q1 to 2022/Q1 for Japan and the U.S., and 1998/Q2 to 2022/Q1 for the Euro area.

[36] Core consumer price indices are all items less fresh food for Japan, and all items less fresh food and energy for the U.S. and the Euro area.

Appendix 2: Wage spillovers across industries

This appendix explains the analysis of wage spillovers across industries presented in Section 2. Following a simple theoretical model presented by Lindquist and Vilhelmsson (2006), we consider a situation where firms in industry $i \in \{1,2\}$ maximize their profit every period under perfect competition. The production function is Cobb-Douglas, with industry-specific productivity following an AR(1) process.

The equilibrium wage $W_{i,t}^*$ in industry i is determined by the first-order condition (A2-1) of firm profit maximization. In the long run, equilibrium wages in both industries are equal as in (A2-2), but in the short run, industry-specific productivity shocks cause a divergence in wages across industries because labor mobility across industries are not perfect (see Lindquist and Vilhelmsson (2006) for details and definitions of variables).

$$\frac{\partial \Pi_{i,t}}{\partial l_{i,t}} : P_{i,t}\theta_i a_{i,t}\left(l_{i,t}\right)^{\theta_i - 1} - W_{i,t}^* = 0 \qquad \text{(A2-1)}$$

$$W_{1,t}^* = W_{2,t}^* \qquad \text{(A2-2)}$$

Based on the above relationship, we estimate the following bivariate vector error correction model (VECM).

$$\Delta \mathbf{W}_t = \boldsymbol{\pi} \mathbf{W}_{t-1} + \boldsymbol{\pi}_1 \Delta \mathbf{W}_{t-1} + \cdots + \boldsymbol{\pi}_p \Delta \mathbf{W}_{t-p} + \varepsilon_t \qquad \text{(A2-3)}$$

where $\mathbf{W}_t = \left[W_{1,t}, W_{2,t}\right]'$, ε_t is the vector of industry-specific shocks, and $\boldsymbol{\pi}$ is the coefficient matrix calculated by (A2-2) and the error correction coefficients.[37]

For Japan, we estimate a bivariate VECMs consisting of wages in each of the three industries (manufacturing; medical, health care and welfare; and wholesale and retail trade) and the average wage across all industries, with four-period lags.[38] These wages are log levels of contractual cash earnings per employee (and their differentials). For the U.S., we similarly estimate a bivariate VECM that includes manufacturing and all-industry average wages.[39] Structural shocks are identified using Cholesky decomposition, in the order of wages in each industry followed by the average wage. Figure 16 shows the cumulative impulse response of all-industry average wages to a 1 percent wage increase shock in each industry. Confidence intervals are calculated using bootstrap (2000 times).

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[37] For the estimation, a constant term is added to the (A2-2) relationship.
[38] The sample period for Japan is 1991/Q2 to 2022/Q1 for manufacturing and 2001/Q2 to 2022/Q1 for other industries.
[39] The sample period for the U.S. is 1981/Q2 to 2022/Q2. A similar analysis for the U.S. is conducted by Boissay et al. (2022).

Appendix 3: Wage premium

Wages of full-time workers may include a premium associated with higher skill or responsibility compared with part-time workers. In Section 2, we define the "wage premium" as the difference in hourly wages between full-time and part-time workers with the same attributes such as job duration and gender. This appendix explains the details on the estimation of the wage premium.

First, based on the information from the "Basic Survey on Wage Structure" of the Ministry of Health, Labour and Welfare, we calculate the hourly wage of worker k who works at private establishment j in industry i.[40]

$$\text{Wage}_{i,j,k} = \text{Scheduled cash earnings}_{i,j,k} \div \text{Scheduled Hours Worked}_{i,j,k}$$

Next, we estimate the following wage function for each industry that uses a dummy variable representing the type of employment (a full-time worker dummy) and a year dummy in addition to the attributes of individual workers as explanatory variables.[41] The survey data of the Basic Survey on Wage Structure used for the estimation are annual data from 2009 to 2021. As they are not panel data, the estimation is performed by pooled OLS.[42]

$$\begin{aligned}\log \text{Wage}_{i,j,k} = {} & \beta_{i,0} + \beta_{i,1} \times \text{Exeperience}_{i,j,k} + \beta_{i,2} \times \text{Exeperience}^2_{i,j,k} \\ & + \beta_{i,3} \times \text{Gender}_{i,j,k} + \beta_{i,4} \times \text{Prefecture}_{i,j} + \beta_{i,5} \times \text{Firm Size}_{i,j} \\ & + \beta_{i,6} \times \text{Full} - \text{time}_{i,j,k} + \sum_{t=2009}^{2020} \beta_{i,7,t} \times \text{Year}_t \\ & + \sum_{t=2009}^{2020} \beta_{i,8,t} \times \text{Full} - \text{time}_{i,j,k} \times \text{Year}_t + \varepsilon_{i,j,k}\end{aligned}$$

From the above estimation results, we define the sum of the regression coefficients of the full-time worker dummy and the cross terms between the full-time worker dummy and the year dummy ($\widehat{\beta_{i,6}} + \widehat{\beta_{i,8,t}}$) as the "wage premium" for industry i in year t.

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[40] The Basic Survey on Wage Structure covers nominal wages and working hours in June of each year.

[41] In addition to these variables, a dummy variable for the prefecture in which the business is located and a dummy variable for the firm size are included. For the firm size dummy, firms with 1,000 or more full-time workers are defined as "large firms," those with 100 to 1,000 employees are defined as "medium-sized firms," and those with 5 to 100 employees are defined as "small and medium-sized firms.

[42] This paper covers data from 2009 onward, where consistent industry classifications are available.

Appendix 4: Firms' growth expectations and nominal wages

In Section 4, we analyze the relationship between firms' growth expectations and nominal wages. This appendix provides an overview of the method used to measure firms' growth expectations and the panel vector autoregression (VAR) model used in Section 4.

There is no standard method for measuring individual firms' growth expectations. We apply the method developed by the Cabinet Office (2001), which measures the growth expectation at the aggregate level, to calculate growth expectations of individual firms. The Cabinet Office (2001) calculates the aggregate expected growth rate as follows, based on the assumption of a relationship between the growth rate of capital stock and the expected growth rate of real GDP.

Denoting the growth rate of the capital coefficient (real capital stock $[K]$ / real GDP $[Y]$) as γ_t, we have:

$$\frac{K_t - K_{t-1}}{K_{t-1}} - \frac{Y_t - Y_{t-1}}{Y_{t-1}} = \gamma_t.$$

Assuming that the capital coefficient varies along the trend growth rate ($\overline{\gamma}_t$) and that the (unobservable) expected growth rate of real GDP in the next period at time $t-1$ is g_t, the capital stock (K_t^*) at time t when the capital coefficient grows by the trend growth rate is given by:

$$\frac{K_t^* - K_{t-1}}{K_{t-1}} = g_t + \overline{\gamma}_t.$$

If a firm invests in capital to maintain the trend growth rate of the capital coefficient ($K_t = K_t^*$), the expected growth rate is expressed as:

$$g_t = \frac{K_t - K_{t-1}}{K_{t-1}} - \overline{\gamma}_t.$$

Based on this relationship, the expected growth rate can be calculated using the growth rate of capital stock and the trend growth rate of capital coefficient. In this paper, we apply this method to calculate growth expectations $g_{i,t}$ for each individual firm from corporate financial data.[43]

The corporate financial data used in this paper are the Development Bank of Japan's "Corporate Financial Data bank" for listed firms and the CRD Association's "Credit Risk Database" for small and medium-sized enterprises (SMEs). Capital stock is defined as

[43] The growth expectations of individual firms conceptually correspond to the expected growth rates of the value added created by individual firms.

tangible fixed assets (excluding land), and the definition of value added is based on an income approach.[44] Capital stock and value added are deflated using the private non-residential investment deflators and the industry-specific GDP deflators from the National Accounts, respectively. The trend growth rate of the capital coefficient is the backward three-year moving average of the growth rate of the capital coefficient.

To obtain the responses of individual firms' nominal wages to shocks to growth expectations, we estimate a panel VAR with growth expectations, labor productivity growth, and nominal wage growth (per employee) as endogenous variables.[45] The industry-specific and firm-specific factors are controlled by the average wage growth for the industry to which each firm belongs and the firm fixed effects, respectively.

The estimation employs the Generalized Method of Moments proposed by Arellano and Bond (1991) to address the endogeneity issue.[46] The sample period is FY 2009-2020, and the number of firms included in the estimation is approximately 70,000, for which data can be obtained throughout the period. The lag order is assumed to be one period.

Figure 41 shows the cumulative impulse response of wage growth to a shock of 1 percentage point increase in firms' growth expectations. Structural shocks are identified with the Cholesky decomposition with the following order of variables: firms' growth expectations, labor productivity growth, and nominal wage growth per employee. The results confirm that higher firms' growth expectations have a significant positive impact on wages.[47]

It should be noted that the expected growth rate calculated from the capital stock can vary greatly depending on what value is used for the trend growth rate of the capital coefficient. In addition, as pointed out by Thomas (2002), individual firm's investment is subject to large fluctuations because firms tend to make a lumpy investment. Given these, expected growth rates calculated in this paper may have large measurement errors.

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[44] Specifically, the amount of value added is defined as: operating income + labor costs + executives' compensation (excluding bonuses) + rent + taxes and dues + interest and discount expenses + depreciation and amortization.

[45] Nominal wage per employee is defined as: (labor costs + executives' compensation (excluding bonuses)) / the number of employees. Labor productivity is defined as: real value added / the number of employees.

[46] We use 2- to 3-period lags of endogenous variables as instrumental variables.

[47] The cumulative impulse response in Figure 41 represents the rate of increase in the wage level from the baseline. Thus, it suggests that higher firm growth expectations lead to higher wage levels.

Appendix 5: Second round effects from wages to prices

This appendix explains the method for estimating the second round effects presented in Section 4. First, we estimate the following bivariate vector autoregression (VAR) model consisting of the wage growth rate and the CPI inflation rate for Japan and the U.S.,

$$Y_t = \sum_{j=1}^{p} A_j Y_{t-j} + \varepsilon_t \qquad \text{(A5-1)}$$

where Y_t is a vector of endogenous variables consisting of the CPI inflation rate and the wage growth rate. ε_t is a vector of reduced-form shocks.

The second round effects on consumer prices through wage changes in response to a shock that raises consumer prices are calculated following Bachmann and Sims (2012):

(1) Identify structural shocks in Equation (A5-1) using the Cholesky decomposition (first variable: consumer price inflation; second variable: wage growth). Calculate the impulse response of consumer prices to a shock to consumer price inflation.

(2) Calculate the impulse response of consumer prices to a shock to consumer price inflation when wages are fixed. This can be done by generating shocks to wages (identified by Cholesky decomposition as in (1) above) that offset the response of wages to a shock to consumer price inflation.

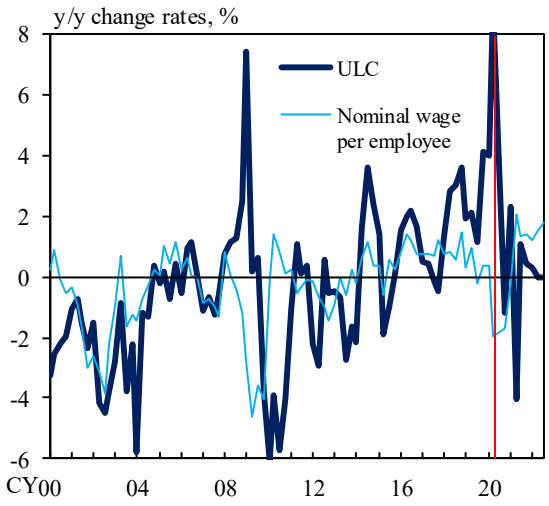
(3) Subtract (2) (the impulse response of consumer prices when wages are fixed) from (1) above (the impulse response of consumer prices when wages are variable) to calculate the second round effects.

The calculations are performed for Japanese and U.S. data. For Japan, CPI (all items) and contractual cash earnings per employee are used; for the U.S., the personal consumption expenditure deflator and hourly wages are used. The VAR is estimated with four-quarter lags, and the sample period is divided into the following three periods: 1970/Q1 to 1989/Q4, 1990/Q1 to 2009/Q4, and 2010/Q1 to 2022/Q2. Figure 42 shows the calculated second round effects converted to year-on-year terms.

Supplementary Figure 1.
Nominal Wages per Hour

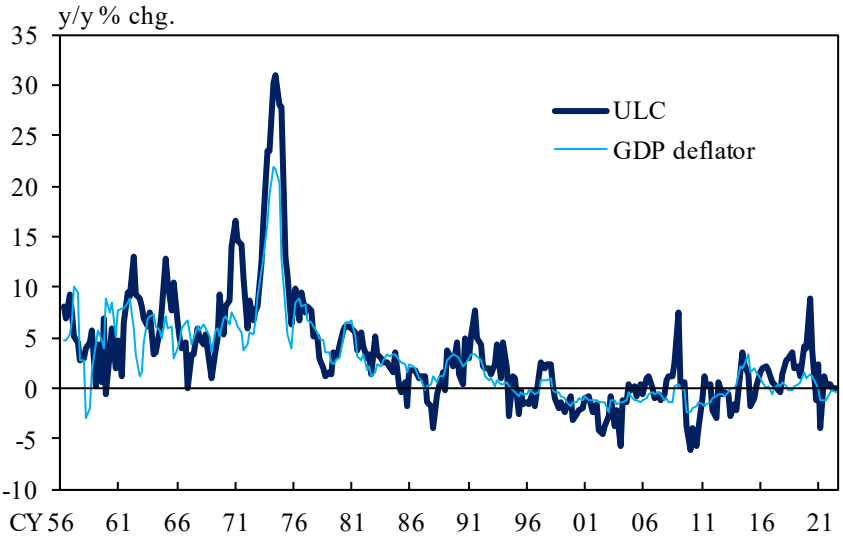
Note: Data from 2016/Q1 onward are based on continuing observations following the sample revisions.
Source: Ministry of Health, Labour and Welfare.

Supplementary Figure 2.
Unit Labor Costs



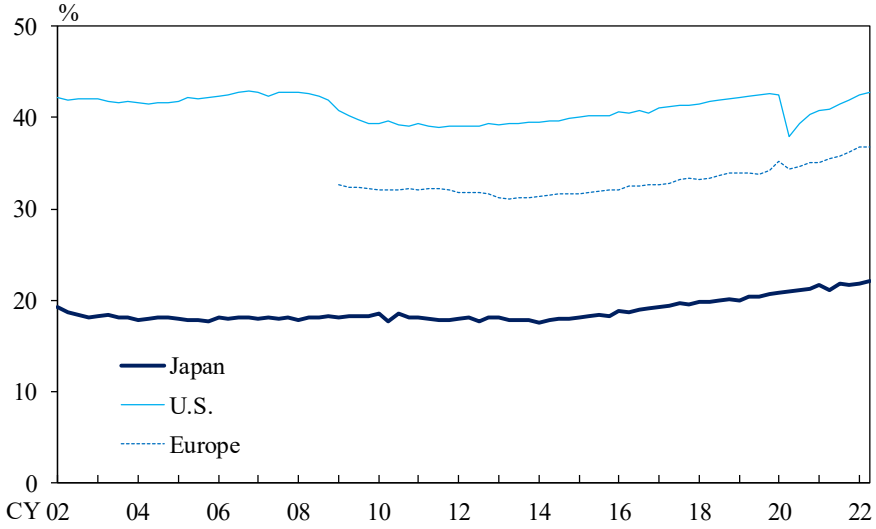
Note: Unit labor costs (ULC) are calculated as nominal compensation of employees, divided by real GDP. Data from 2016/Q1 onward are based on continuing observations following the sample revisions.
Sources: Cabinet Office; Ministry of Health, Labour and Welfare

Supplementary Figure 3. Unit Labor Costs and GDP Deflator



Note: Unit labor costs (ULC) are calculated as nominal compensation of employees, divided by real GDP.
Source: Cabinet Office.

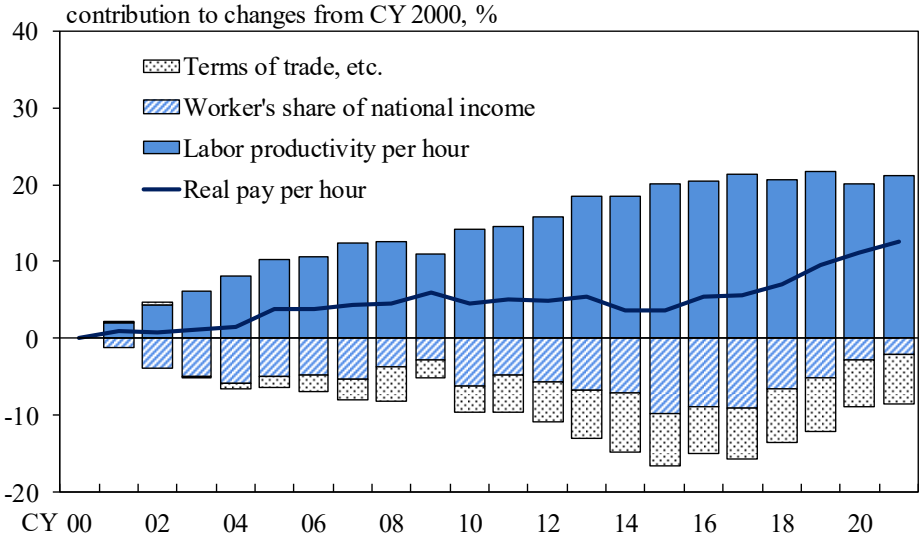
Supplementary Figure 4. Female Employment-to-Population Ratios (Full-time Workers)



Note: The ratios of female full-time workers to female population (15+ for Japan, 16+ for the U.S. and 15-74 for Europe.

Sources: Ministry of Internal Affairs and Communications; BLS; Eurostat.

Supplementary Figure 5. Decomposition of Changes in Real Wages



Note: Real wages per hour are decomposed as follows. In the following, imputed rent and FISIM are excluded from deflator of consumption of households.

$$\underbrace{\frac{\frac{\text{Nominal compensation of employees}}{\text{Deflator of household consumption}}}{\text{Employees} \times \text{Total hours worked}}}_{\text{Real wages per hour}} = \underbrace{\frac{\frac{\text{Nominal compensation of employees}}{\text{Employees} \times \text{Total hours worked}}}{\frac{\text{Nominal GDP}}{\text{Employed persons} \times \text{Total hours worked}}}}_{\text{Labor share}} \times \underbrace{\frac{\frac{\text{Nominal GDP}}{\text{GDP deflator}}}{\text{Employed persons} \times \text{Total hours worked}}}_{\text{Labor productivity per hour}} \times \underbrace{\frac{\text{GDP deflator}}{\text{Deflator of household consumption}}}_{\text{Terms of trade, etc.}}$$

Sources: Ministry of Health, Labour and Welfare; Ministry of Internal Affairs and Communications; Cabinet Office.

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