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Productivity Trends in Japan — Reviewing Recent Facts and the Prospects for the Post-COVID-19 Era —

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— Reviewing Recent Facts and the Prospects for the Post-COVID-19 Era[*] —

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Abstract

Labor productivity is the source of economic growth. This paper shows that the growth rate of labor productivity in Japan has remained low since the collapse of the bubble economy in the early 1990s. We summarize the background and the issues involved in improving productivity based on previous research and additional analyses provided in this paper. We also analyze developments in labor productivity during the novel coronavirus infection (COVID-19) pandemic and discuss the issues involved in achieving sustainable growth in the post-COVID-19 era.

Based on our literature review, the background to the recent stagnation in labor productivity can be summarized as follows. First, the pace of capital accumulation has generally slowed. Second, there are issues involved with the utilization of capital stock. While investment in research and development (R&D) has been increasing, it has not led to improvements in productivity. Third, Japan has issues with resource reallocation. By analyzing data on individual firms, we find that production resources are not being allocated efficiently as low-productivity firms remain in the market for a long time.

These long-standing issues which Japan has faced became apparent once again under the pandemic. Specifically, the pace of capital accumulation is further reduced, and the efficiency of resource allocation has not improved. Meanwhile, increased utilization of IT capital, such as the expansion of working from home and online consumption, is a progress in improving productivity; however, such progress has been limited in comparison to that of other countries. To improve its labor productivity and attain sustainable economic growth in the future, it will be needed for Japan to further accelerate such progress and steadily resolve the various issues which it faces.

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Keywords: Productivity, Intangible assets, Efficiency of utilization, Reallocation, COVID-19 pandemic.

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Productivity isn't everything, but, in the long run, it is almost everything.

Krugman (1994)

1. Introduction

The Japanese economy's growth rate has been low since its high-growth period ended, averaging only about 1% per annum in the 30-year period since the 1990s (Figure 1). The stagnation in the 1990s was initially regarded by many as temporary due to the bursting of the bubble economy and the ensuing financial crisis in Japan, but growth remained low even as the progress was made in disposing of nonperforming assets in the 2000s and a strong global economy bolstered the longest business expansion in history (the so-called Izanami boom). Then, during the 2010s, from 2012 through 2018, long-term business expansion continued, but economic growth was still unable to break out of its low trend. Upon examining the growth rate during each business cycle, growth has remained low, below 1% per annum since the second half of the 1990s.[1] Since the start of the 2020, economic growth has stagnated even further because of the global spread of the novel coronavirus infection (COVID-19).

Can Japan escape from the low growth that has been plaguing the country for almost 30 years and increase its growth potential again? Given the demographic change of a declining birthrate and aging population in Japan, achieving economic growth requires an increase in the labor force participation rate and higher labor productivity. Regarding the labor force participation rate, it is higher than in the past since more women and the elderly entered the labor force in the 2010s and now exceeds that of the United States (Figure 2). Therefore, higher labor productivity is necessary to boost Japan's potential to grow in the future.

This paper summarizes the labor productivity situation before and during the pandemic in order to provide a perspective on the Japanese economy in the post-COVID era. First, we use several methodologies to measure and fact-check the trends in Japan's labor productivity. We then review the background to the recent stagnation in productivity based on previous studies and our own analysis. We then assess the issues that need to be resolved for Japan to return to a growth path. Meanwhile, the United States and other developed countries have also experienced a shift to lower growth trends since the 2008 global financial crisis. There has been

[1] Figure 1 compares average growth rates during each business cycle as measured between the dates of troughs (one business cycle). The most recent business cycle peaked in October 2018 and bottomed out in May 2020, but because the spread of the COVID-19 pandemic has had such a large impact, we also include the data through the October–December 2019 quarter for reference. In addition, comparing data on economic growth from the dates of the business cycle troughs to the peaks (the expansionary periods only), the result remains the same as growth has remained minimal since the second half of the 1990s, in the low to mid-1% range.

much discussion on secular stagnation, as represented by Summers (2013).[2] In our assessment of the issues which Japan faces in overcoming stagnant productivity, we also reference the discussions overseas.

Next, based on these pre-pandemic discussions, we investigate the trend in labor productivity since the outbreak of the COVID-19 pandemic and assess how we can evaluate the aforementioned issues under the pandemic. In doing so, we focus on the question of whether the issues discussed before the pandemic have become more apparent during the pandemic and whether new developments toward resolving these issues are observed.

This paper is organized as follows. In section 2, we review the recent trends in labor productivity in Japan. In section 3, we examine the background to the slowdown in the growth rate of labor productivity. Both sections 2 and 3 refer to the arguments made by Nakamura, Kaihatsu, and Yagi (2019), who discussed the background to Japan's stagnating productivity, as this paper does, while incorporating a survey of related studies accumulated since then and additional analyses provided in this paper. In section 4, we investigate trends in economic growth and labor productivity during the COVID-19 pandemic. Here, we also explore how the pandemic has affected the factors causing the recent stagnation in productivity discussed in section 3. Section 5 is our conclusion.

2. Labor productivity in recent years

2-1. Trends in labor productivity

Labor productivity is an efficiency indicator that shows the volume of production output per unit of labor input. When measuring a country's labor productivity, it is customary to use real GDP, the value-added to the economy as a whole. On the other hand, for labor input, existing studies often use the number of workers ("output per worker") or the total hours worked ("output per hour worked"). The latter considers the hours worked by each worker (i.e., number of workers times hours worked per worker; manhour).

Taking labor productivity as output per worker, with the slowdown in real GDP growth, growth in labor productivity plunged between the 1960s and the 1990s and has stagnated at around 1% per annum since the 1990s (Figure 3). Growth has also remained low when it is measured over business cycles and even fell to an annual adjusted rate of 0% after the October–December 2012 quarter until prior to the pandemic.

[2] See, for example, Nakano and Kato (2017) for an overview of theories about secular stagnation.

Much of the increase in labor force participation (mostly by women and the elderly) in recent years has been in non-regular or part-time employment (Figure 4). Since these workers tend to work fewer hours than full-time workers, hours worked per worker have been declining for the country as a whole (Figure 5). Therefore, it is also instructive to use output per hour worked when looking at Japan's labor productivity in recent years. The growth rate of output per hour worked is slightly higher than that of output per worker, reflecting the decrease in total hours worked (Figure 6). Even so, the growth rate during the 2010s was in the low 1% range, and it further decreased to the mid-0% range on an annualized basis after the October–December 2012 quarter until just before the pandemic.[3]

Thus far, we have calculated labor productivity using real GDP from the national accounts. If we calculate labor productivity based on the *Financial Statements Statistics of Corporations by Industry, Quarterly* (FSSC), in order to confirm the above observations using other statistics, the growth rate of labor productivity in the mid-2010s is higher than it is when using the GDP-based calculation and stayed at about a 2% annual rate during the period from the October–December 2012 quarter to year-end 2017 (Figure 7).[4] During this period, as labor market conditions tightened, firms were investing in software, for example, to improve productivity. Meanwhile, because the growth rate of labor productivity based on the FSSC slowed somewhat significantly in the second half of the 2010s, it was no higher than the low 1% per year range for the 2010s as a whole, about the same outcome as that when we used the national accounts.[5] In the 2020s, growth in productivity based on the FSSC declined further due to the pandemic, but it started to show a trend toward recovery thereafter.

As we have seen, although it should be noted that some differences exist between different measurement methods, over the long term, labor productivity in recent years has remained relatively low despite the various policies and corporate initiatives implemented.[6] This point is similar to the views expressed in several studies, including those by Fukao *et al.* (2021a) and

[3] As in Figure 1, comparing labor productivity from the "trough" to the "peak" of the business cycles does not change the overall picture of this low growth rate.

[4] The base excludes financial services, insurance, and pure holding companies. Output (value-added) is calculated as the sum of operating profit, personnel costs, and depreciation divided by the GDP deflator. The volume of labor input is calculated using the total number of executives, full-time employees, and temporary employees. The number of temporary employees in the FSSC is calculated by dividing the total number of hours worked by temporary employees by the average hours worked per full-time employee. Therefore, real labor productivity calculated here can be considered conceptually similar to productivity per hour worked.

[5] Since the figures excluding financial services, insurance, and pure holding companies have been published since the April–June 2009 quarter, we calculated annualized averages of quarter-on-quarter growth rates from the January–March 2010 quarter through the October–December 2019 quarter.

[6] Morikawa (2018) argues that it is highly possible that the actual growth rate of productivity reflects the impact of growth policies in the past and that if those policies had not been adopted, the recent growth rate in productivity would have been even lower.

Murata (2019).

Meanwhile, existing studies also argue that, while the level of labor productivity in Japan for these years is lower than in other developed countries, its growth rate is comparable. A comparison of labor productivity (per hour worked, in real terms) in the G7 countries in the 2000s and 2010s shows that, while labor productivity grew rapidly in the United States and other countries in the 2000s, its growth remained relatively low in Japan (Figure 8). During the 2010s, in contrast, the growth rate in Japan was comparatively high. However, this does not imply that Japan's productivity increased significantly, but rather, as Summers (2013) points out, it is reasonable to regard this as a slowdown in the productivity growth amid stagnant growth in advanced economies, which resulted in a growth rate similar to that in Japan. In other words, in recent years, labor productivity has been stagnant in many countries including Japan (Figure 9).

2-2. Decomposition of labor productivity using growth accounting framework

Using the framework of growth accounting, we explain the factors in changing growth rates of labor productivity as follows (see also Nakamura, Kaihatsu, and Yagi (2019)). First, we employ the Cobb–Douglas production function that takes into account capital and labor as factors of production:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}, \tag{1}$$

where Y_t is output (real GDP), K_t is the amount of capital input, L_t is the amount of labor input, and A_t represents the efficiency of capital and labor utilization and is referred to as total factor productivity (TFP). α and $1-\alpha$ denote the contributions of capital and labor to production and measure the relative shares of capital and labor, respectively. Converting both sides of Equation (1) into a logarithm gives us the following equation:

$$y_t = a_t + \alpha k_t + (1-\alpha) l_t,$$

where, y_t, a_t, k_t, and l_t are logarithms of Y_t, A_t, K_t, and L_t, respectively, and the difference from the prior period is the rate of growth, denoted by Δ. Then, we can express the growth rate, Δy_t, of output Y_t as follows.

$$\Delta y_t = \Delta a_t + \alpha \Delta k_t + (1-\alpha) \Delta l_t. \tag{2}$$

Now, labor productivity G_t, which we define as output per unit of labor input, can be expressed as

$$G_t = Y_t / L_t.$$

Taking the logarithm of G_t as g_t and converting the equation into a logarithm to obtain the difference, we have the following:

$$\Delta g_t = \Delta y_t - \Delta l_t. \tag{3}$$

Rearranging Equations (2) and (3), we can express the growth rate of labor productivity as follows.

$$\Delta g_t = \alpha(\Delta k_t - \Delta l_t) + \Delta a_t. \tag{4}$$

Here, the $(\Delta k_t - \Delta l_t)$ in the first term on the right-hand side of Equation (4) is the growth rate of the amount of capital input per unit of labor input ($=K_t/L_t$), i.e., the growth rate of the capital equipment ratio. The second term on the right-hand side, Δa_t, represents the growth rate of TFP.

When we use the above growth accounting framework, we can break down the growth rate of labor productivity into the growth rates of the capital equipment ratio and TFP. The capital equipment ratio shows how much capital stock, such as buildings, machinery, and software, is being allocated per unit of labor input. Additionally, as TFP goes up, the production level increases without any change in the level of capital or labor; hence we can interpret TFP as the level of production technology. The rate of change in TFP indicates the pace of technological progress.

If we decompose the growth rate of labor productivity in Japan into the capital equipment ratio and TFP, the growth rates of both factors are slowing, thus putting downward pressure on labor productivity (Figure 10). Arguably, improving the capital equipment ratio and TFP is imperative for increasing labor productivity to achieve sustainable economic growth.

In order to increase the capital equipment ratio, firms need to invest in capital equipment actively. To increase TFP, improvements in the efficiency of capital use and technological innovation are likely important. In addition, if the allocation of production resources, such as capital and labor, is skewed toward low-growth firms, the necessary production resources do not flow to the firms and industries that are proactively taking steps toward enhancing capital intensity and technological innovation. If the capital allocation is optimized (reallocated) and the factors of production are distributed to firms that can be expected to grow, the growth rates of both the capital equipment ratio and TFP are likely to increase.

3. Background to the recent slowdown in labor productivity growth rate

In this section, we follow up on the previous section and consider the issues underlying Japan's low growth rate of labor productivity from the standpoints of (i) capital accumulation, (ii) the efficiency of capital utilization and technological progress, and (iii) resource reallocation.[7] Then, we examine (iv) the role the labor market can play in overcoming these challenges.

3-1. Capital accumulation

First, regarding capital accumulation, the stock of tangible fixed assets has clearly stagnated in Japan, remaining flat since the mid-2000s (Figure 11; see Kim *et al.* (2019)). As pointed out by Gutiérrez and Philippon (2017), many developed countries are experiencing some degree of stagnation in the accumulation of tangible fixed assets. As economic growth rates slow, firms' growth expectations are also going down, possibly leading to restraint in capital investment. In addition, Nakajima *et al.* (2016) argue that inefficiencies in capital allocation in developed countries, especially the United States and Europe, reflecting weaker financial intermediation functions, are inhibiting the accumulation of tangible fixed assets. In Japan, the slowdown in the pace of accumulation of tangible fixed assets is causing the vintage of the capital stock to rise. This development has the potential of inducing a decline in output volume, namely a decline in productivity, through the degradation of capital over time, as pointed out by Tsuru *et al.* (2019).[8]

During this period, intangible assets have continued to accumulate, especially in research and development (R&D) and software (Figure 12). However, as discussed below, it bears noting that in Japan, it is possible that such investment is not being adequately utilized.

3-2. Efficiency of utilization and technological progress

We next review the efficiency of utilization of accumulated capital. Roth and Thum (2011) and Colacelli and Hong (2019) argue that increasing labor productivity requires both the accumulation and the effective utilization of intangible assets. As the name implies, intangible assets are assets that do not exist in physical form, such as software, R&D, human assets (e.g., workers' skills and abilities), and intellectual properties (e.g., patents and copyrights). In

[7] See Appendix 1 for the reasons for focusing on trends in labor productivity.

[8] According to the Bank of Japan (2020), the rising vintage of capital in Japan reflects the long-term stagnation in construction investment since the bursting of the bubble economy in the early 1990s rather than stagnation in machinery investment.

addition, a know-how built up in the course of work can also be considered an intangible asset. These intangible assets are regarded as a source of innovation and improvements in labor productivity since they are expected to complement investment in tangible fixed assets such as machinery as well as labor input.

(Analyzing the impact of intangible assets on labor productivity)

This paper uses data from 24 member countries of the OECD, including Japan, to investigate how intangible assets affect labor productivity. Specifically, we perform panel estimation using the following equation. In the estimation, country-fixed effects are added to control for country-specific factors. Time dummies are also added to control for time-series variations that are shared among countries.

$$Labor\ productivity\ growth\ rate_{i,t} = \sum_{k=0}^{n} \alpha_k Investment\ in\ intangible\ assets_{i,t-k}. \quad (5)$$

Here, investment in intangible assets is the ratio of investment in software and R&D to total investment.[9] Regarding investment in intangible assets, the amount of investment in a given period is not necessarily linked to innovation during the same period. Equation (5) assumes that investment during the current and past few years has a cumulative effect on productivity. The length of lags (denoted by n) is set as 1, 4, or 7 following previous research.[10] We also calculate the sum of the lag terms (the total value of intangible asset elasticity, i.e., $\sum \alpha$) and examine the Wald test to check whether the sum is statistically different from zero. The estimation period is from 1995 to 2017.

The estimation results show that in every specification, the total elasticity of intangible assets ($\sum \alpha$) is statistically significant and positive, indicating that investment in intangible assets increases the growth rate of labor productivity (Table 1, Specifications A1–A3). If we divide the estimation period into two groups, elasticity in recent years (Specifications C1–C3) is lower than before (Specifications B1–B3). Regarding this point, Bloom *et al.* (2020b) argue that the amount of investment in intangible assets that is required to attain a certain rate of growth in

[9] As mentioned previously, the concept of investment in intangible assets includes human assets, know-how, and the like. It should be noted that our estimations use only investment in the areas of software and R&D, which form only a part of intangible asset investment.

[10] For instance, Oh and Takahashi (2020) used 0.15 and 0.30 as depreciation rates for intangible assets. Consequently, the value of the intangible asset investment almost vanishes in about 7 years for the former and about 4 years for the latter.

productivity has been increasing rapidly in recent years, which indicates declining efficiency. Brynjolfsson *et al.* (2017) argue that, although technological innovation is progressing, particularly in the area of artificial intelligence (AI), organizations, institutions, and regulations should be reformed accordingly in order to apply this progress to business, and that the lack of such reforms in major countries has led to stagnation in the efficiency of utilization of intangible assets globally.

In addition, according to our estimation results, the estimated value of the country dummy for Japan is highly negative, suggesting that the efficiency of investment in intangible assets is lower in Japan than it is in other major countries (Figure 13). Looking at the level of investment in intangible assets in Japan, investment in R&D and software appears at least as high as, or even higher than, that in the United States or Germany, while the level of investment related to human capital (firms' investment in human capital and organizational reform) is remarkably lower (Figure 14). Consequently, the ability to translate IT and results in R&D into profits may be lacking (Murata (2019), Hayakawa (2019), Miyagawa and Ishikawa (2020, 2021)). In this regard, the correlation between investment in R&D as well as software and investment related to human capital is close to 1 in the United States, indicating a strong tendency for both types of investment to occur simultaneously (Table 2). On the other hand, in Japan, the correlation between the two is negative, which indicates that whichever type of investment is made, the other type of investment is reduced, suggesting that complementarity between the two is not sufficient.

In the light of the results of the above estimates and the discussion by Brynjolfsson *et al.* (2017), it is clear that insufficient investment, institutional and regulatory reforms to take advantage of technological innovation through IT and AI and the inability to effectively utilize accumulated capital globally are causing the growth rate of TFP and labor productivity to stagnate. Based on the estimation results, including the values of country dummies, and other analyses in this session, this is likely particularly problematic in Japan.[11]

(Issues on measurement)

Regarding technological progress, some studies argue that, both in Japan and overseas, issues on measurement have led to an underestimation of productivity. Brynjolfsson and McAfee (2011, 2014) and Aghion *et al.* (2019) argue that there is a possibility that (i) existing statistics, such as GDP, do not capture the output of firms responsible for new services, such as online

[11] There is also a "technology stagnation" theory, which argues that the recent decline in TFP growth rate is due to the lack of new innovative technology in recent years that would significantly affect the entire economy (Gordon (2012, 2016)). However, this theory is perhaps overly pessimistic as new technologies, such as the Internet, smartphones, and AI, have been steadily emerging over the past few decades.

consumption and sharing economy, and that (ii) existing statistics do not accurately measure the decline in prices of IT-related goods and services. The former takes the view that, although productivity tends to be generally higher for new services than for existing services, macro productivity is underestimated because these services are not being captured. The latter takes the view that price reductions resulting from technological progress are being underestimated, leading to an underestimation of overall economic growth and productivity in real terms. The academic community is divided on these measurement issues, with Byrne *et al.* (2018) and Syverson (2017) arguing that these measurement issues cannot be quantitatively analyzed. (See Miyagawa (2018) for details.)

3-3. Reallocation

Improving the efficiency of resource allocation among industries and firms is also an important issue for improving productivity (Baily *et al.* (1992), Foster *et al.* (2001)). As concrete examples of appropriate reallocation, Kameda (2009) mentions cases in which factors of production, such as capital and labor, are transferred from firms with low productivity to those with high productivity, or where firms with high productivity enter the market. Additionally, Caballero *et al.* (2008) and Morikawa (2018) discuss the importance of reallocating resources through the entry and exit of firms.

(Analysis of reallocation)

Inter-industry analysis

We now analyze the effects of resource reallocation in Japan. First, to examine reallocation among industries, we break down the real growth rate of labor productivity into "within effects" and "between effects (resource reallocation effects)," following Nordhaus (2001).

$$g(A_t) = \sum_i \sigma_{it-1} g(A_{it}) + \sum_i (\sigma_{it} - \sigma_{it-1}) g(A_{it}) + \sum_i (\sigma_{it} - w_{it}) g(S_{it}), \quad (6)$$

where $g(\cdot)$ denotes the rate of change (difference in the logarithm), A_t represents Japan's labor productivity, and A_{it}, σ_{it}, S_{it}, and w_{it} denote labor productivity, the share of nominal value-added, the amount of labor input, and the share of labor input, respectively, for each industry i. The first term represents the within effect, and the sum of the second and third terms is the between effect. The within effect is the product of the growth rate of labor productivity and the share of value-added in the previous period of each industry, and it reflects productivity fluctuations in individual industries. The between effect is everything other than the within effect and reflects movements in labor and market shares among industries.

The calculation shows that the within effect accounts for a large part of Japan's real growth rate of labor productivity (Figure 15). The contribution of the between effect has been limited, suggesting that the reallocation of production resources among industries is stagnating.

Inter-firm analysis

Next, regarding the reallocation of resources among firms, taking the method used by Melitz and Polanec (2015), that is, Dynamic Olley-Pakes Decomposition, we break down the real growth rate of real labor productivity into the within effect, the between effect, the entry effect, and the exit effect.

$$\frac{\Delta A_t}{A_{t-1}} = \frac{A_{C,t} - A_{C,t-1}}{A_{t-1}} + S_{E,t}\frac{A_{E,t} - A_{C,t}}{A_{t-1}} + S_{X,t-1}\frac{A_{C,t-1} - A_{X,t-1}}{A_{t-1}} \tag{7}$$

$$= \frac{\Delta \bar{A}_{C,t}}{A_{t-1}} + \frac{n_t \Delta \mathrm{cov}_{C,t}}{A_{t-1}} + S_{E,t}\frac{A_{E,t} - A_{C,t}}{A_{t-1}} + S_{X,t-1}\frac{A_{C,t-1} - A_{X,t-1}}{A_{t-1}}, \tag{8}$$

where the subscripts denote the following variables: C for existing firms, E for entering firms, and X for exiting firms. $A_{C,t-1}$ and $A_{C,t}$ represent the weighted average of labor productivity of existing firms between time $t-1$ and time t; $A_{E,t}$ is the weighted average of labor productivity for firms entering the market between time $t-1$ and time t, at time t; and $A_{X,t-1}$ is the weighted average of labor productivity for firms exiting the market between time $t-1$ and time t, at time $t-1$. $S_{E,t}$ is the share of labor input of entering firms at time t, and $S_{X,t-1}$ is the share of labor input of exiting firms at time $t-1$.

The first term on the right-hand side of Equation (7) (change in the labor productivity of existing firms) can, as shown in the first and second terms in Equation (8), be broken down into the change in the simple average of labor productivity for each firm at time t and time $t-1$ ($\Delta \bar{A}_{C,t}$), and the product of the change in covariance between the share of labor input and the level of labor productivity ($\Delta \mathrm{cov}_{C,t}$) and the number of existing firms (n_t). Accordingly, the first term in Equation (8) represents the within effect, the second term is the between effect, the third term is the entering effect, and the fourth term is the exiting effect.

In this paper, we calculate the real labor productivity of individual firms using financial data between fiscal 1980 and fiscal 2019 for Japanese listed firms and then apply the above decomposition (see Appendix 2 for details on the financial data).[12] Similar to the industry

[12] When using data for listed firms, there are cases in which labor productivity suddenly changes due to reorganizations and other factors. In this paper, we follow prior studies by Fukao *et al.* (2021b) and Bloom *et al.* (2020a) and eliminate as outliers the highest and lowest 2% in labor productivity from our analysis of resource

analysis, our analytical results show that changes in labor productivity for listed firms, which are mostly large firms, are largely accounted for by the within effect (Figure 16).[13] This is also similar to the results in previous studies (e.g., Fukao (2012)). At the same time, the contributions of the entry effect and the exit effect are small. Also, the contribution of the between effect remains small, suggesting that the reallocation of production resources among firms is lagging as well. Furthermore, if we perform the same analysis on each firm's TFP, instead of labor productivity, over time, the contribution of the within effect remains large while the contributions of the other effects remain small (Figure 17).[14]

We also conduct a similar analysis for U.S. firms. The contribution of the between effect is much greater in the United States than it is in Japan (Figure 16). The average contribution of the between effect during the sample period (1981–2019) is 0.50% point in the United States as opposed to -0.18% point in Japan. In addition, for U.S. firms, both the entry effect and the exit effect have a visible impact on labor productivity, suggesting that the turnover of firms is at work. Meanwhile, in both the United States and Japan, the exit effect is negative in some years, indicating that firms with relatively high productivity growth are exiting the market. Regarding this point, Nakamura, Kaihatsu, and Yagi (2019) suggest that there may be beneficial exists of firms from the market, such as those with mergers and acquisitions (M&A).

(Analysis of low-productivity firms)

In an economy with limited resource reallocation among firms, firms with relatively low productivity could remain in the market. To explore this point deeper, we analyze the labor productivity of individual firms, following OECD (2017) and Nakamura, Kaihatsu, and Yagi (2019), both of which focus on the stagnation of low-productivity firms. The results of the analysis are as follows.

First, in Japan, the pace of productivity improvement is sluggish for the group of firms whose labor productivity is relatively low. We draw the distribution of labor productivity of individual firms at the top and bottom 10th and 20th percentiles for each year and find that the labor productivity of firms located in the top 10th and 20th percentiles has clearly continued to increase (Figure 18). On the other hand, labor productivity of firms in the bottom 10th and 20th percentiles has been flat, suggesting that initiatives to improve productivity are lacking at firms with

reallocation.

13 When compared with Japan's macro labor productivity rates, the growth rate of aggregate labor productivity of listed firms fluctuates more widely, tending to be higher during expansionary phases and lower during contractionary phases, but the general direction is about the same for both.

14 Using data on individual small- and medium-sized enterprises to measure TFP growth rates, Iida (2021) shows that the within effect and the between effect have been in decline since the 2008 global financial crisis.

relatively low productivity. Figure 19 shows the distribution of productivity of individual firms for each decade. The data show that, although the distribution has shifted to the right over time, reflecting the gradual increase in average macroeconomic labor productivity, the base of the distribution has widened in recent years, and the gap between firms with high productivity and those with low productivity has opened up. Note that, because this analysis is based on levels of labor productivity, differences among industries in the capital equipment ratio might be affecting the analytical findings. In order to take this into account, we break the sample down by industry and look at the changes in distribution. We then find that the gap between firms with high productivity and those with low productivity is widening in all industries, confirming that the stagnation of firms with low productivity, regardless of industry, is putting downward pressure on Japan's macro labor productivity (Figure 20).

Second, we observe that those firms in the group with relatively low labor productivity are not exiting the market, but are staying in business with low productivity. Here, we define "low-productivity firms" as those firms that are in the bottom 20% in terms of labor productivity each year. Figure 21 illustrates the distribution of labor productivity for individual firms every few years, starting with fiscal 2010 and traces the productivity levels of firms classified as low-productivity firms in fiscal 2010 to three years later (fiscal 2013), five years later (fiscal 2015), and eight years later (fiscal 2018).[15] We see that for most firms classified as low-productivity firms in fiscal 2010, the distribution subsequently remained skewed toward the left over the long term, indicating that these firms continue to have low productivity.

To illustrate this point more clearly, in Figure 22, we calculate the probability that a firm classified as low-productivity in a given year will continue to show low levels of productivity in subsequent years. Therefore, this probability decreases as productivity improves and/or such firms exit the market. Looking at the result, we see that in Japan, about 40% of those classified as low-productivity firms in a given year remain in a state of low productivity eight years later. On the other hand, in the United States, most of the low-productivity firms had emerged from their low-productivity status after eight years (including exiting firms), showing that the market stagnation of low-productivity firms stands out in Japan.

The results of these analyses indicate that the existence of low-productivity firms in Japan is putting downward pressure on the macro labor productivity growth rate, pushing down the average in the calculations.

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[15] Firms that exited the market in the intervening period are, of course, excluded from the distribution of productivity. Of the low-productivity firms in fiscal 2010, 5.0% had exited by three years later, 7.0% had exited by five years later, and 13.5% had exited by eight years later.

(The environment surrounding business entry and exit)

We review the lack of progress in reallocating production resources from the standpoint of entry and exit by firms (Figure 23). As identified in many previous studies, Japan has lower entry and exit rates than the United States, and hence resource reallocation through this channel is limited.

Miyagawa (2018) contends that one reason why the entry is low in Japan is a lack of entrepreneurial spirit (or so-called animal spirit). In Japan, awareness of entrepreneurial opportunities and capabilities is lower as well as fear of failure is higher in comparison to other major countries (Figure 24). Additionally, Morikawa (2018) points out that strict capital constraints hinder starting up firms. When managers who have started their own businesses are asked about the difficulties they faced when starting their businesses, many of them cite cash flow and fundraising (Figure 25). While venture capital is the most popular means of fundraising for start-ups in the United States, in Japan, self-funding and financial institutions are among the top options (Figure 26). On this point, the founders are usually required to put up some of their own capital when applying for a start-up loan from a financial institution, and this might be contributing to the low rate of start-ups. In addition, Hoshi and Kashyap (2013) argue that the existence of various regulations (such as the lengthy administrative procedures required in starting up a business) acts to hinder entrepreneurship. Morikawa (2018) contends that the background to the low entry rate of firms can ultimately be explained in large part by the values and cultural factors above all, after examining the various factors mentioned above.

Summing up the discussion in section 3-3, we can outline the status of reallocation in Japan as follows. Japan's labor productivity growth rate can be attributed mainly to the within effect, and the contribution of the between effect among firms and industries is consistently low. Because low-productivity firms have remained in the market for a long time, production resources have tended to remain with these firms. Thus, the reallocation of resources to firms with higher productivity and new firms is not occurring at a sufficient level, and this might be contributing to the stagnation of productivity in the economy as a whole.

3-4. The labor market

Thus far, we have considered the background to the stagnation of labor productivity from the standpoints of capital accumulation, the efficiency of utilization and technological progress, and reallocation. The role played by the labor market will also be key to overcoming these issues and achieving economic growth. In the following, we examine the causes of labor productivity stagnation by focusing on the labor market. How can low-productivity firms retain the labor force in the first place? As shown in Table 3, low-productivity firms also tend to have lower growth rates in wages and value-added than firms with higher productivity. Why have the factors of production not been shifting over to firms that have higher wages and the growth potential?

Let us look at the impact of labor market mismatches on labor productivity. This refers to cases wherein the job-seeker's skills do not adequately align with the skills demanded by employers (Yamada (2017)). If mismatches cause workers to remain in low-productivity sectors, growing firms are not likely to have enough labor that they need; thus, macro productivity declines (Barnichon and Figura (2011), Borio *et al.* (2015)). A liquid labor market could also lead to the smooth transmission of cutting-edge technologies and skills from frontier firms that are highly productive and innovative to other firms (Nakaso (2017)). In major countries, there exists a modestly positive correlation between labor mobility and the growth of labor productivity (Figure 27). Nakaso (2017) points out that, for Japan, the low labor mobility contributes to downward pressure on labor productivity. Looking at data on labor movements, although the number of people changing jobs has increased somewhat in recent years, the ratio of people changing jobs did not go above the 5% level at its most recent peak in 2019 (Figure 28). The ratio of people changing jobs who saw a wage increase of at least 10% in their new job is also only about 25% (Figure 29).

Then, if labor mobility is improved, will this necessarily increase labor productivity? Kiyotaki and Zhang (2018) point out that increased labor mobility does not lead to the accumulation of human capital. Lucas (1988) and Mankiw *et al.* (1992) incorporate human capital into the production function and argue that if human capital does not accumulate, the rate of productivity growth will go down. Adding the amount of human capital input H_t to Equation (1) above gives us the following:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} H_t. \tag{9}$$

If we proceed as in Equations (2) and (3), we obtain the following equation:

$$\Delta g_t = \alpha(\Delta k_t - \Delta l_t) + \Delta a_t + \Delta h_t, \tag{10}$$

where h_t is the logarithm of H_t. In other words, the growth rate of labor productivity can be explained as the growth rates of capital accumulation, TFP, and human capital accumulation. Many empirical studies have been conducted in Japan and abroad, and among them, Konishi (2003), Nemoto (2013), and Akai *et al.* (2014) assert that the accumulation of educational experience and other human capital causes output to increase. Kurosawa *et al.* (2007) and Hara *et al.* (2011) state that employee education improves productivity.

One interpretation of the relationship between labor mobility and labor productivity is that improving labor mobility need to be accompanied by an appropriate reallocation of resources and the accumulation of human capital. In other words, through improving labor mobility, the reallocation of resources from low-productivity sectors to high-productivity sectors is needed to proceed. To that end, workers in low-productivity sectors will have to acquire the necessary skills in order to work in high-productivity sectors. Thus, if the labor market becomes more liquid along with recurrent education, it will likely lead to productivity improvement.

Looking at the state of employee education in Japan, while firms actively invest in their full-time employees, they tend not to invest as much in non-regular employees, which indicates that the accumulation of human capital (skills improvement) of non-regular employees may not be progressing (Figure 30). In short, non-regular employment is increasing as more women and the elderly have entered the labor force in recent years, but these workers are not receiving adequate vocational education. Although the tendency to refrain from investing in non-regular employees with few years of service is probably common in many countries, Europe and the United States have many public programs that encourage the accumulation of human capital and these systems likely play a part in providing job training for non-regular employees (Figure 31). Regarding the importance of human capital, Momma (2020) argues that recurrent education is essential for meeting the challenges of the changing times, such as digitization and decarbonization. In recent years, mainly overseas, we have seen cases of "reskilling," in which employees who have acquired skills through in-house training are reassigned to departments with higher productivity within the firm. For example, some IT firms in the United States provide warehouse workers with a year-long in-house training program to learn skills such as software development engineering, before transferring them to departments that provide cloud services. It is thus essential to accumulate human capital and achieve labor productivity improvement.

4. Economic growth and labor productivity during the COVID-19 pandemic

How has the COVID-19 pandemic affected Japan's economic growth and labor productivity? Real GDP has been on an improving trend since it fell sharply in the April–June 2020 quarter. Still, even after more than a year, it has not recovered to the pre-pandemic level (Figure 32). On the other hand, growth was positive overall for real labor productivity (output volume per hour worked) from the January–March 2020 quarter to the April–June 2021 quarter (Figure 33). This is due to the fact that, although GDP declined substantially, labor input decreased even further, and the same trend is observed in major developed countries. As pointed out by Fernald *et al.* (2021) and Criscuolo (2021), productivity improvements since the spread of the pandemic are due mainly to the decline in the amount of labor input, and hence we need to closely monitor whether the trend is sustainable.

We now also examine the "scarring effect," in which a sharp decline in economic activity continues to depress the rate of economic growth through the failure of financial intermediation and prudent investment. With the spread of the pandemic, many industries initially curtailed their business activities, but the manufacturing and information services sectors recovered particularly rapidly thereafter. Put another way, the slowdown in economic activity has increasingly been concentrated in face-to-face services industries such as accommodations as well as eating and drinking services, which means that the pandemic has taken on the color of a "sectoral shock" (Figure 34). This differs from the major shocks of the past, such as the bursting of the bubble economy as well as domestic and global financial crises, and one can argue that it is unlikely that scarring effects will manifest themselves in the macroeconomy in the current phase (Figure 35). On the other hand, we need to be aware of the risk of a prolonged downturn in the face-to-face services sector, as mentioned above, and of the risk that the Japanese economy's long-standing problems (e.g., sluggish response to environmental changes) will become more serious with the spread of the pandemic. It is possible that the scarring effect might become apparent through these channels. We need to continue to monitor the situation closely.

In the following section, based on the above points, we will discuss how the factors of changes in the labor productivity growth rate (capital accumulation, efficiency of utilization and technological progress, reallocation, and the labor market) that have been discussed in the previous section can be evaluated in the context of the spread of the COVID-19 pandemic.

4-1. Capital accumulation

The slowdown in the growth rate of capital accumulation was a major issue prior to the pandemic, but since the pandemic began, various types of investment declined overall (Figure 36). Capital investment excluding software investment has declined in both manufacturing and nonmanufacturing sectors due to the pandemic. R&D spending in the manufacturing sector also declined in fiscal 2020. This decline in various types of investment will likely suppress future labor productivity through a lower capital equipment ratio. The same is true overseas as Le Roux (2021) points out that rising uncertainty has put downward pressure on the pace of capital accumulation in Europe. Note that, as mentioned above, with production activity recovering in manufacturing and other industries, capital investment turned around fairly rapidly when compared with past crises. However, the slowdown in the pace of capital accumulation that began before the spread of the pandemic has not been reversed as firms remain cautious about capital investment relative to their earnings. In addition, it is necessary to closely monitor the effects of supply-side constraints (e.g., semiconductor shortage).

It is also worth noting that during this period, software investment has continued to increase as the adoption of digital technologies expanded in an effort to curtail the spread of COVID-19. In particular, in sectors that were previously considered low growth in labor productivity, such as retail and food and drinking services, active investment was made in software in order to advance digitization (Figure 37). Although software investment does not necessarily account for a large share of total capital investment, the accumulation of such IT-related investment and the utilization of digital technology, which we look at next, may contribute to boosting labor productivity.

4-2. Efficiency of utilization and technological progress

In the previous sections, we discussed the possibility that, in Japan, IT capital has traditionally been used inefficiently and that investments have not led to productivity improvements. Mischke *et al.* (2021) and Criscuolo (2021) point to the possibility that the negative shock from the pandemic stimulates innovation. Although currently, there is not enough evidence to conclude that new innovation has occurred, it is possible that the utilization of digital technology is advancing as the movement of people and things have been restricted because of the pandemic. As concrete examples, we would like to discuss trends in working from home (WFH) and online consumption below.

Regarding the status of implementation of WFH in Japan, as Takizawa (2021) points out, while WFH was extremely rare prior to the pandemic, it has become fairly common since the spread of the pandemic (Figure 38). Using location data from mobile phones to measure the frequency of commuting to the office, Sakuma *et al.* (2021) suggest that WFH may be catching on, particularly in places that already had the infrastructure for WFH prior to the pandemic (such as large firms and the telecommunications sector).[16]

Some analyses show that WFH improves productivity overseas (Bloom *et al.* (2015), Barrero *et al.* (2021)). In Japan, in a survey for employees conducted by the Japan Productivity Center in May 2020, immediately after the onset of the pandemic, many respondents indicated that WFH lowered their efficiency. However, in subsequent surveys, the number of respondents

[16] Analyses that use data from sources other than previously released macroeconomic statistics (so-called alternative data) have been increasing in number recently. Kameda (2022) introduces analyses that use alternative data at the Bank of Japan. In addition, the Bank of Japan has established a section with alternative data analyses and related research on its website.

who stated that WFH improves their efficiency has increased (Figure 39). Morikawa (2020, 2021a, 2021c) conducted a survey on employees and firms and has found that the expansion of WFH decreases productivity. However, firms that had introduced WFH prior to the pandemic tend to see a smaller decline in productivity from WFH than those that had not previously introduced WFH. These studies suggest the possibility that, even if WFH initially depresses productivity, it may improve productivity as the use of digital technology takes hold.

As the impact of the pandemic is lessening, some major U.S. IT firms have set the number of days that employees must work in the office, thereby formulating policies that combine work in the office with WFH. It will be necessary to closely monitor what an optimal combination of the two is and how such policies will affect productivity. Meanwhile, Kawaguchi and Motegi (2020) assert that the introduction of WFH could lead to insufficient monitoring of workers, causing productivity to fall, and therefore firms should change labor management when they introduce WFH. In another study on WFH, Hara and Kawaguchi (2022) take the view that the expansion in WFH has increased husbands' burden of housework and that the gender norms are also changing in the direction of husbands and wives being required to assume equal roles in the family.

Regarding online consumption, it has risen in many countries since the onset of the pandemic (OECD (2020), Bounie *et al.* (2020)). There has also been a marked increase in Japan, but there are differing views as to whether this change will be sustained (Figure 40). Watanabe and Omori (2021) analyze credit card usage history and find that, although online consumption increased sharply during the pandemic, this is mainly due to a temporary increase in such consumption by those who have been using it in the past and that it may return to its previous trend when the pandemic is over. On the other hand, Nakajima *et al.* (2022) analyze data from a smartphone app that provides personal financial management services and tailor-made dataset based on the *Survey of Household Economy* by the Ministry of Internal Affairs and Communications, and show that after the onset of the pandemic, many people started making purchases online and that a large part of this group has continued to buy online even after the COVID-19 new infection cases started to decline. Consequently, the authors argue that the expansion of online consumption will continue in the future.

In other countries, existing studies show that the productivity of firms actively using online commerce is relatively higher than firms not using it. Kinda (2019) conducts an analysis using individual firm data in 77 countries and finds that firms that use online sales have higher TFP levels by about 30%, which is statistically significant, than those that do not. In addition, the Bank of England (2020) shows that labor productivity in the U.K. wholesale and retail sectors grew significantly in the 2010s and argues that this is perhaps owing to the expansion of online consumption.

As mentioned above, the trend toward the use of digital technologies, such as WFH and online consumption, in the face of the pandemic is a positive sign for productivity. However, it must be reminded that such a move is slow in Japan in comparison with other countries. Before the pandemic, the spread of both WFH and online consumption in Japan was lagging behind that of the United States and other major countries, and it has remained limited during the pandemic as well (Figures 41 and 42). Additionally, as stated previously, software investment in Japan since the onset of the pandemic has constantly been increasing, but the rate of growth has been slowing (Figure 43). Meanwhile, the pace of growth in software investment in the United States is largely steady, suggesting that there is a major difference between the two countries in the willingness to invest. If Japan continues to lag behind in its efforts to utilize digital technology, there is a risk that the gap compared to the United States and European countries in terms of productivity growth and innovation may widen.

4-3. Reallocation

(Corporate dynamics)

Many analyses show that the reallocation of resources including labor among industries and firms has progressed in the United States and Europe since the onset of the pandemic and that this has helped improve labor productivity (de Vries *et al.* (2021), Bloom *et al.* (2020a), Andrews *et al.* (2021), ECB (2021)). In Japan, on the other hand, no active movement toward resource reallocation has been observed until now. If we estimate the effects of resource reallocation among industries as in the previous sections, its contribution to labor productivity is extremely small, even since the onset of the pandemic (Figure 44). We also do not observe any noticeable increase in the number of people moving from face-to-face services industries (accommodations, eating and drinking, life-related services and amusement), which were hit hard by the pandemic, to other sectors (Figure 45).

However, some developments that could lead to higher labor productivity are observed with respect to corporate dynamics. First, there is a clear increase in the number of entering firms in the wake of the pandemic (Figure 46). While the specifics regarding those firms, such as which industries they are classified as, are not available, start-ups are on the rise overseas as well. On this point, ECB (2021), which cites an analysis in the United States, points out that there may have been an increase in start-ups in response to new demand, such as online-related businesses and delivery services. In this regard, Sablik (2021) argues that in the United States, start-ups founded by people who had lost their jobs due to the pandemic led to an uptick in the overall number of start-ups. Meanwhile, the number of business closures and dissolutions has increased, but the number of bankruptcies has remained at a low level. Miyakawa *et al.* (2021) argue that institutional and regulatory factors such as government support have suppressed the exit of firms.

Second, looking at M&A, acquisitions of domestic firms by domestic firms (the IN-IN type) have been increasing (Figure 47). This is possibly due to firms aggressively investing in growing areas or selling off some businesses to concentrate on their core businesses during the pandemic. If resource allocation is optimized through M&A, it is expected to boost labor productivity.

(The effect of corporate aid programs)

As mentioned above, even since the spread of the pandemic, the exit of firms due to bankruptcy and other reasons has been curbed thanks to large-scale corporate support measures by the government and other organizations. This trend is observed in many countries, and aid programs introduced since the start of the pandemic are considered to have been effective in protecting firms and households when business activity was being forcibly suppressed by lockdowns and other public health policies (Gourinchas *et al.* (2021)). In addition, the various support measures have helped to avoid the negative macroeconomic impact triggered by firms that would have been able to continue to operate under normal socioeconomic conditions being forced out of the market by the temporary and large-scale shock of the pandemic.

At the same time, some are concerned that a series of large-scale corporate aid programs could preserve firms with low productivity and weak earnings that would otherwise have trouble surviving in normal times (Demmou *et al.* (2021)). Caballero *et al.* (2008) and Andrews and Petroulakis (2019) point out that if production resources remain in so-called zombie firms, high-growth firms will be unable to secure the production resources they need to increase their capital equipment ratios and make technological innovations, and this could lead to macroeconomic stagnation in productivity. Note that these discussions presume that if zombie firms exit the market, the factors of production will be reallocated to healthy firms. Some argue that the smoothness of the actual redistribution is subject to uncertainty (Salant and Siegel (2016)) and that even if zombie firms are eliminated and reallocation is achieved, the degree of its impact on productivity will be limited (Obstfeld and Duval (2018)).

Among the empirical studies conducted since the onset of the pandemic, Gourinchas *et al.* (2021) investigate the attributes of firms receiving corporate aid in developed countries including Japan, and show that such programs have been "poorly targeted," as 90% of the firms receiving corporate aid are "firms that could have survived even without government assistance" while only 5% are "firms that are actually surviving because of government assistance."[17] Meanwhile, the percentage of zombie firms in the latter group was only about 10%–20%, and it is unlikely that the various support measures led to the rescue of such firms; thus, the authors argue that the support measures had the effect of curbing bankruptcies without large side effects. Morikawa (2021b) points out that firms with the lowest productivity before the pandemic have taken advantage of financial support programs and employment adjustment subsidies, and warns that if the emergency policies remain in place for a prolonged period, there would be a negative impact on the productivity of the entire economy. Performing a similar analysis, Hoshi *et al.* (2021) show that the firms with lower credit scores used the aid programs more proactively, and argue that these firms could become a "reserve army of zombies" in the future.

Yamada *et al.* (2022) have surveyed studies both in Japan and abroad, and calculated—based on estimation methodologies in previous studies—the ratio of "zombie firms" in Japan that were surviving partly because of a lower interest burden even though their earnings remained poor in terms of the interest coverage ratio (ICR) (Figure 48).[18,19] According to their study, no clear change has been recently observed in the number of zombie firms. In this regard, while it is possible that aid programs have enabled some firms to increase their ICRs and avoid becoming zombie firms, we will need to monitor how the number of zombie firms changes as aid programs are scaled back and how the spread of the pandemic affects corporate dynamics over the medium- to long-term.

4-4. The labor market

As summarized in the previous sections, the labor market in Japan has traditionally had low mobility. In addition, the accumulation of human capital does not appear to have progressed sufficiently, and these factors are thought to have contributed to the slump in labor productivity.

As we already noted, since the outbreak of the pandemic, the movement of labor among industries and firms has been limited and the labor mobility has remained low. It is also possible that the accumulation of human capital lagged during this period, which could lead to downward pressure on labor productivity. Indeed, the labor participation rates of women and the elderly, which had been trending upward in recent years, plunged in the spring of 2020 and

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[17] Regarding this point, FSB (2021) argues that during the initial phase of the pandemic, it was necessary to take measures to support businesses by targeting a wide range of firms on a large scale with speed.

[18] Yamada *et al*. (2022) define firms that meet three conditions—an interest-rate condition ((interest paid < average contracted interest rates on loans (stock basis)) or (current-period borrowings > prior-period borrowings)), an ability-to-pay condition (ICR < 1), and a growth condition (corporate longevity of at least 10 years)—for three consecutive years as zombie firms.

[19] As of now, there has been limited analysis measuring the number of zombie firms since the outbreak of the pandemic. Favara *et al.* (2021) find that there has been no increase in zombie firms among U.S. firms.

have yet to return to their pre-pandemic levels (Figure 49). The Japan Institute for Labour Policy and Training (2021) states that the pandemic caused many people to give up looking for a job and enter the non-labor force population, while Yamada (2021) warns that recent trends, such as the increase in female workers, have come to a halt. Hoshi *et al.* (2022) show that during the pandemic, full-time workers approaching re-employment time at age 60 or 65 may have missed the opportunity to find new jobs. As a result, the loss of opportunities to receive training at work could hold back the accumulation of human capital (D'Adamo *et al.* (2021)). Also, in terms of the accumulation of human capital within firms, according to the *Basic Survey of Human Resources Development* by the Ministry of Health, Labour and Welfare, the amount of investment related to human resource development in 2020 decreased significantly (Figure 50). Others point out that along with opportunities for vocational education, those for academic education have also declined in many countries due to lockdowns and other public health measures (IMF (2021), ECB (2021)). The impact of these factors on the accumulation of human capital over the medium- to long-term needs to be closely monitored.

5. Conclusion: The Japanese economy in the post-COVID-19 era

This paper reviews the background to the stagnation in labor productivity in recent years in Japan and discusses the impact of the COVID-19 pandemic. The results can be summarized as follows.

Looking at the background to the recent slump in labor productivity, first, the pace of capital accumulation in Japan has generally slowed. Second, with regard to the efficiency of utilization and technological innovation, there are issues in the utilization of capital stock. Although investment in software and R&D is increasing, related investment (investment in human resources) to make use of it is lacking and hence such investment may not be leading to productivity improvements or economic growth. Third, problems exist in the efficient allocation of production resources among industries and firms, and low-productivity firms are staying in the market for a long time. Compared with the United States and other developed countries, the turnover of firms through the entry and exit of companies is also not functioning effectively in Japan. Meanwhile, labor participation of women and the elderly (mainly in non-regular employment) has been increasing, but human resource investment in non-regular employment is lacking, and consequently the accumulation of human capital has been limited.

Next, regarding the impact of the pandemic, first, it has further depressed the pace of capital accumulation. Second, in terms of the efficiency of utilization and technological innovation, while there are signs of progress in the utilization of digital technologies, such as the expansion of WFH and online consumption, this trend has been less pronounced in Japan than in other countries thus far. Third, regarding the reallocation of resources, while there are no clear signs of an increase of zombie firms that are normally less viable, there are some signs of positive change, such as an increase in start-ups. However, an effort to promote the turnover of these firms is on a small scale, and the movement of labor among industries remains limited; hence, for Japan as a whole, it seems that there has been no major change in the fact that the efficiency of resource reallocation remains a problem. In light of the above, it is hard to argue that any progress has been made during the pandemic in resolving the problems that Japan has been facing with regard to improving labor productivity. Going forward, if labor productivity is to improve and sustainable economic growth is to be achieved, Japan needs to encourage the positive trends that have been observed in some areas and to steadily resolve the problems it is facing. The various analyses in the previous sections are conducted using limited data obtained after the onset of the pandemic, and it goes without saying that more detailed analyses will need to be conducted in the future, pending the accumulation of further data.

The problems involved in improving labor productivity mentioned in this paper are by no means new as they have been pointed out in previous studies. Nonetheless, we want to emphasize that the outbreak of the COVID-19 pandemic has once again brought to the fore the problems built up in Japan over the years. Of course, overcoming these problems is easier said than done. What exactly do we need to do to overcome these challenges? We discuss the importance of integral and collaborative measures as follows.

First is the combination of capital accumulation and utilization. As digitalization progresses, investment in intangible assets such as software and R&D is becoming increasingly important. While increasing such investment is, of course, important, this alone will not improve productivity. If software is to be used in business, workers need to be trained in order to make most of that software. To apply the results of R&D to business, it is necessary to understand the needs of consumers and other stakeholders, and then link them to product development. During this process, it might be necessary to go through a reorganization. Capital accumulation and investment in human capital need to be promoted simultaneously, and systems that can efficiently use the accumulated capital need to be built.

Second is the combination of reallocating the factors of production and labor market reforms. Reallocating the factors of production, labor resources in particular, will cause major friction and be difficult to implement. In order to increase the turnover of firms, it is necessary to create an environment in which firms can enter the market with ease and to make the labor market more flexible, while at the same time accelerating the movement toward "learning new skills through re-learning and then moving on to the next workplace" by enhancing recurrent education and other means. Given that the industrial structure is likely to change in the future due to decarbonization and digitalization, there is a strong need to promote the reallocation of production resources accordingly.

Third is the combination of the aforementioned labor market reform and changes in workers' attitudes. Looking at the current state of recurrent education, we find that many adults in the United States and Europe are enrolled in graduate schools and other institutions of higher education, but such cases remain rare in Japan (Figure 51). Yamada (2017) finds positive correlations between labor productivity and adults' participation rate in vocational training. He also points out that in the United States and European countries, the general thinking is that individuals are responsible for their own career development, and many workers proactively invest in themselves; thus, the improvement of individual professional skills leads to increased macro productivity. In addition, he mentions the possibility that the formation of occupational communities in the process of enhancing professional skills will increase the labor mobility through the formation of human networks. For recurrent education to be effective, just setting up a system (e.g., establishing educational institutions) is not enough, and workers need to take a proactive stance toward learning as well. As cases of workers remaining in the same workplace for their entire careers are decreasing, it is necessary for workers to independently look at their career development and acquire necessary skills (Figure 52). To raise such awareness, it is important to educate workers and students about the importance of career planning.[20]

To reiterate, the problems with Japanese productivity that are discussed in this paper are not standalone issues but interdependent. It will be important for the economy and society as a whole to develop an optimal framework for productivity improvement and a prescription for achieving it.

[20] The Council for the Creation of Future Education of Japanese government (held on December 27, 2021) also addressed the creation of conditions for promoting recurrent education.

(Appendix 1) A discussion on productivity measures

This paper focuses on Japan's low capital equipment ratio and TFP growth rate in recent years, and discusses the factors affecting labor productivity. Although Fukao (2010) and other studies focus on the TFP in particular to analyze the low growth rate, analyzing the labor productivity has the following advantages. First, as discussed in the framework of growth accounting in section 2, because labor productivity is a productivity indicator in a broader sense, it allows us to discuss productivity from a broader perspective. Second, labor productivity is simpler to measure. The growth rate of TFP is a residual; hence, the calculation results will differ, depending on how the distribution ratio and the amount of capital input are quantified. For example, as Fueki and Kawamoto (2009) point out, to accurately capture economic conditions in terms of capital input, it is desirable to consider the capital utilization rate, but it is not easy to measure such a rate in nonmanufacturing sectors.

Theoretically, it is known that the growth rates of labor productivity and TFP follow the same trends in a steady state, and in fact, the long-term evaluation of productivity trends does not change much regardless of whether we look at labor productivity or TFP. Using the framework of growth accounting, we can obtain a balanced growth path ($\Delta y_t = \Delta k_t$) in which output and the amount of capital input grow at the same pace in a steady state. Substituting this condition in a steady state for Equation (2) in section 2, we can derive the following relationship:

$$(\Delta k_t - \Delta l_t) = \Delta a_t/(1-\alpha). \qquad \text{(A1)}$$

Equation (A1) shows that in a steady state, growth in the capital equipment ratio $(\Delta k_t - \Delta l_t)$ follows the same trend as the growth of TFP Δa_t. Substituting this in Equation (4) in section 2 gives the following:

$$\Delta g_t = \Delta a_t/(1-\alpha), \qquad \text{(A2)}$$

which shows that the growth rate of labor productivity in a steady state Δg_t follows the same trend as the growth rate of TFP Δa_t.

When looking at labor productivity, it should be noted that the average level of the capital equipment ratio differs by industry. This needs to be reminded when comparing countries that have vastly different industrial structures (e.g., developed countries and emerging countries). In such cases, it would also be useful to discuss TFP, which is not affected by the capital equipment ratio.

(Appendix 2) Methodology of estimating the productivity of firms

＜Overview of the data＞

- Firms in the sample

Japan: about 1,800 firms* per year (firms listed on the First and Second Sections of the Tokyo Stock Exchange, the First and Second Sections of the Nagoya Stock Exchange, the Sapporo Securities Exchange, and the Fukuoka Stock Exchange, excluding financial and insurance companies).

United States: about 2,500 firms* per year (firms listed on the New York Stock Exchange and NASDAQ, excluding financial and insurance companies).

*Only those for which labor productivity can be calculated using the following method are included in the sample.

- Time periods

Japan: Fiscal 1980–2019.
United States: 1980–2019.

- Data sources

Japan: "Industrial Financial Data" by the Development Bank of Japan, "NEEDS-Financial QUEST" by Nikkei Inc., National Accounts of Japan (SNA) by the Cabinet Office, "Monthly Labour Survey" by the Ministry of Health, Labour and Welfare.
United States: Refinitiv Eikon, Haver Analytics.

＜Estimates of labor productivity＞

- Method of estimating individual firms' labor productivity

Labor productivity = Real value-added / amount of labor input.

Japan:

・ Real value-added: Nominal value-added (= net sales − cost of sales − selling, general and administrative expenses + labor costs + personnel costs included in selling and administrative expenses) deflated using GDP deflators by industry.

・ Amount of labor input: Number of employees multiplied by hours worked per person by industry.

United States:

- Real value-added: Nominal operating profit deflated using GDP deflator by industry.
- Amount of labor input: Number of employees multiplied by hours worked per person by industry.

- Method for calculating macro labor productivity (aggregate of the individual firms): Average of each firm's labor productivity weighted by the firm's share of labor input.

＜Estimates of TFP＞

- Method for estimating individual firms' TFP:[21]

$$lnTFP_{i,t}$$

$$= \left(lnY_{i,t} - \overline{lnY_t}\right) - \frac{1}{2}\left(SL_{j,t} + \overline{SL_t}\right)\left(lnL_{i,t} - \overline{lnL_t}\right) - \frac{1}{2}\left(SK_{j,t} + \overline{SK_t}\right)\left(lnK_{i,t} - \overline{lnK_t}\right)$$

$$+\left(\overline{lnY_t} - \overline{lnY_T}\right) - \frac{1}{2}\left(\overline{SL_t} + \overline{SL_T}\right)\left(\overline{lnL_t} - \overline{lnL_T}\right) - \frac{1}{2}\left(\overline{SK_t} + \overline{SK_T}\right)\left(\overline{lnK_t} - \overline{lnK_T}\right),$$

where *ln* denotes the value of the logarithm, *T* denotes the benchmark year (Fiscal 1980), *j* denotes the industry, and *i* denotes the firm. The bars over the variables denote the averages of the samples for each year. The variables are as follows.

Y: Real value-added
K: Tangible fixed assets
L: Amount of labor input
SL (cost share of labor): Employee compensation by industry/GDP
SK (cost share of capital) = 1 − SL

- Method of calculating macro TFP (based on the aggregate of individual firms): average of each firm's TFP weighted by the firm's share of nominal value-added.

[21] For details on the method for calculating individual firms' TFP, see Fukao and Kwon (2006) and Nishimura *et al.* (2005).

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Table1: Estimation results: impacts of investments in intangible assets on labor productivity

Dependent variable: Growth rate of real labor productivity, Independent variable: Investment in intangible assets

	A:1995-2017 (full sample)			B:1995-2010			C:2011-2017		
k (number of lags)	A1	A2	A3	B1	B2	B3	C1	C2	C3
0	0.26 ***	0.27 ***	0.25 *	0.14	0.17	0.23	0.27	0.26	0.22
	(0.16)	(0.05)	(0.15)	(0.18)	(0.13)	(0.18)	(0.17)	(0.06)	(0.14)
1	-0.14	-0.16 **	-0.13	0.11	0.28	0.35 ***	-0.27	-0.29 ***	-0.23
	(0.18)	(0.07)	(0.18)	(0.14)	(0.18)	(0.12)	(0.26)	(0.08)	(0.18)
2		-0.03	-0.04		-0.16	-0.19		-0.10	-0.08
		(0.08)	(0.04)		(0.19)	(0.20)		(0.10)	(0.06)
3		0.12	0.12		0.09	0.16		0.24 *	0.19
		(0.11)	(0.09)		(0.20)	(0.20)		(0.14)	(0.13)
4		-0.09	-0.27		-0.14	-0.38		-0.06	-0.22
		(0.09)	(0.19)		(0.18)	(0.29)		(0.11)	(0.15)
5			0.31			0.26			0.28
			(0.24)			(0.40)			(0.19)
6			-0.09			-0.20			0.05
			(0.15)			(0.49)			(0.11)
7			-0.03			0.26			-0.17
			(0.12)			(0.30)			(0.14)
Sum of all lags	0.11 ***	0.11 **	0.12 *	0.25 **	0.25 *	0.49 ***	-0.01	0.04	0.04
	(0.03)	(0.05)	(0.07)	(0.10)	(0.13)	(0.18)	(0.09)	(0.11)	(0.16)
N	483	416	347	323	256	187	160	160	160
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note 1: Investment in intangible assets is the share of investments in software and R&D to all investments.
Note 2: Figures in parentheses are standard errors.
Note 3: *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively.

Table 2: Correlations between investments in different classes of intangible assets

Japan

	Software	R&D	Human capital	Organizational reform
Software	1.00	0.84	-0.53	-0.26
R&D		1.00	-0.48	-0.36
Human capital			1.00	0.91
Organizational reform				1.00

United States

	Software	R&D	Human capital	Organizational reform
Software	1.00	0.98	0.98	0.99
R&D		1.00	0.96	0.98
Human capital			1.00	0.98
Organizational reform				1.00

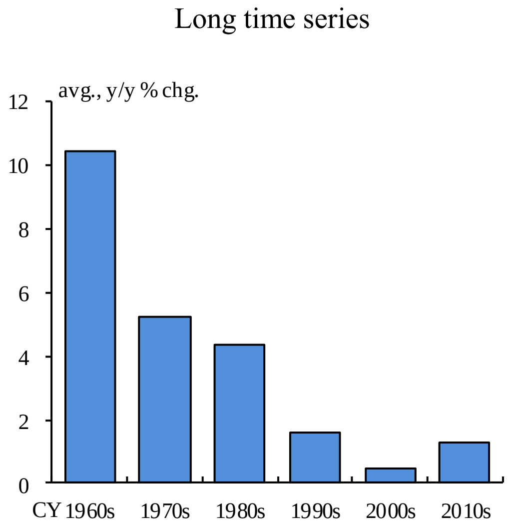
Sources: Research Institute of Economy, Trade and Industry; INTAN-Invest.
Note: Correlation coefficients between investments in different classes of intangible assets between 1995 and 2015.

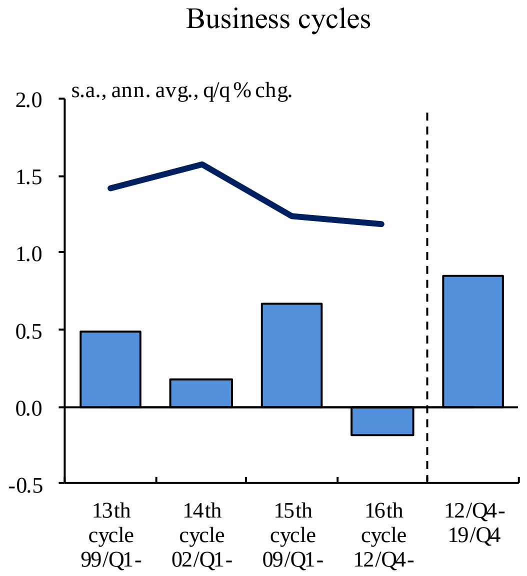
Table 3: Average growth rates of low productivity firms between FY 2000 and FY 2019

Low-productivity firms		Non low-productivity firms	
Labor costs per staff	Value added	Labor costs per staff	Value added
0.08%	−0.22%	0.40%	0.04%

Sources: Development Bank of Japan; Nikkei NEEDS-Financial QUEST; Cabinet Office; Ministry of Health, Labour and Welfare.
Note: In each fiscal year, firms in the bottom 20% of productivity are defined as "low-productivity firms" and all other firms are defined as "non low-productivity firms." Each figure is a simple average of the firms in each category.

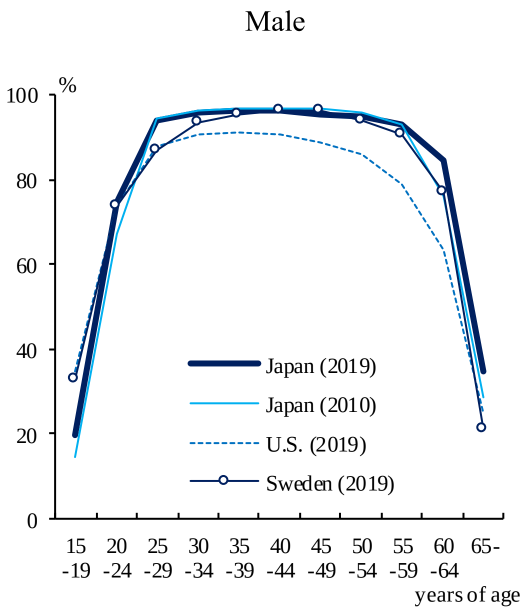
Figure 1: Real GDP

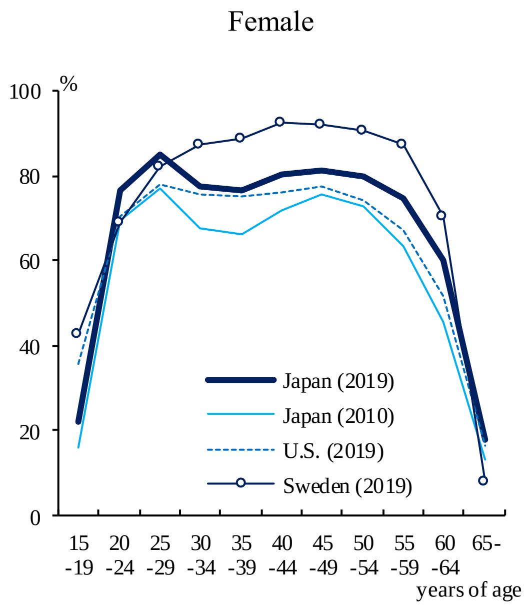




Source: Cabinet Office.
Note: The line in the right panel shows the average growth rate during the expansion phase (from the trough to the peak) in each business cycle.

Figure 2: Labor force participation rate

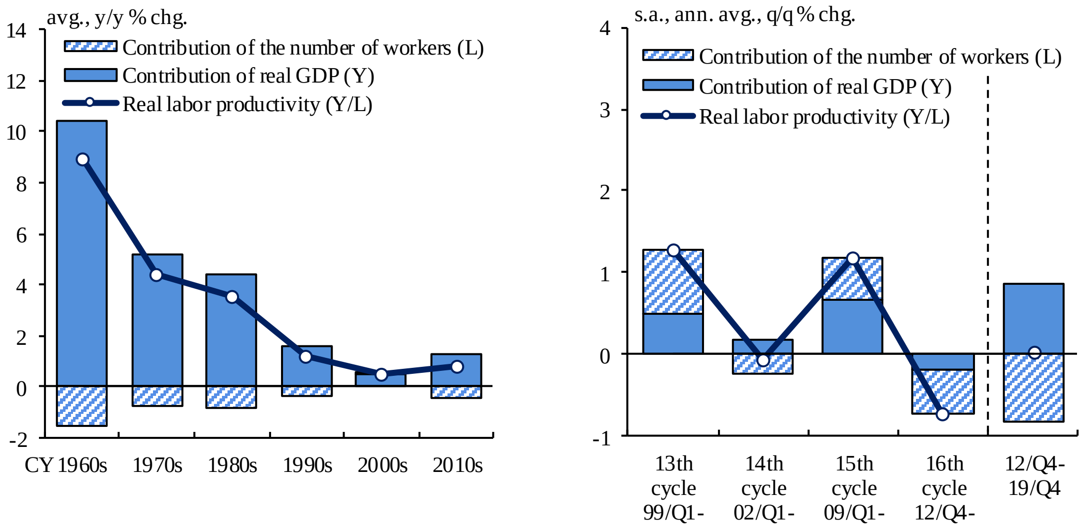




Sources: Ministry of Internal Affairs and Communications; OECD.

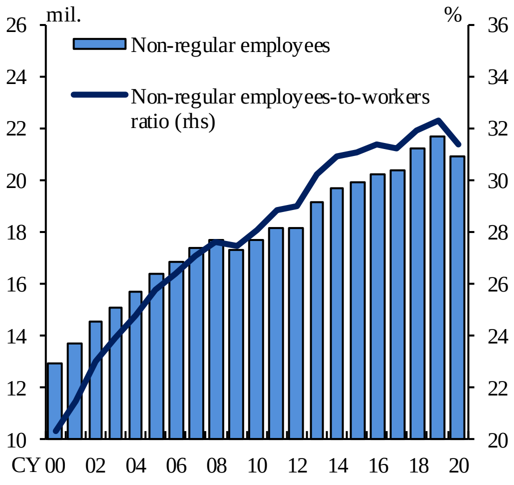
Figure 3: Real labor productivity (per worker)

Long time series   Business cycles



Sources: Cabinet Office; Ministry of Internal Affairs and Communications.

Figure 4: Non-regular employment

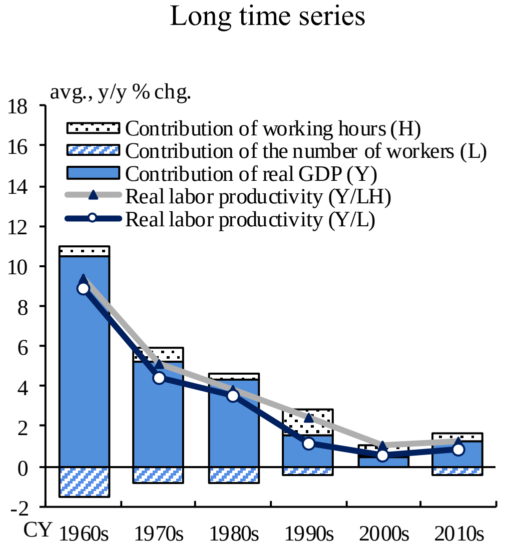


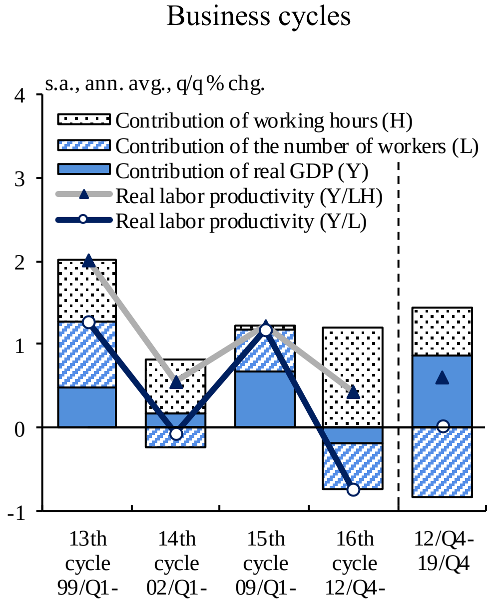
Source: Ministry of Internal Affairs and Communications.

Figure 5: Working hours per worker

Source: Ministry of Health, Labour and Welfare.
Note: The line shows the yearly working hours.

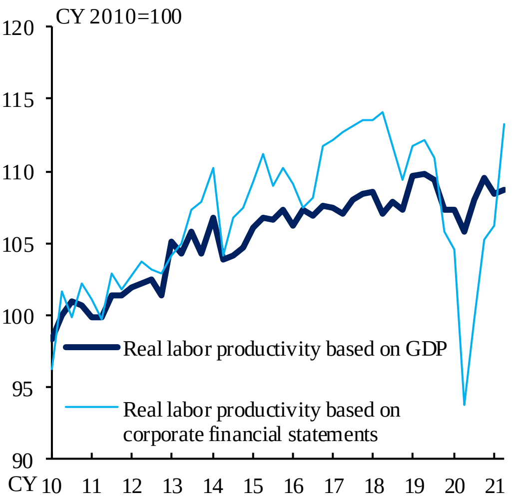
Figure 6: Real labor productivity (per hour worked)





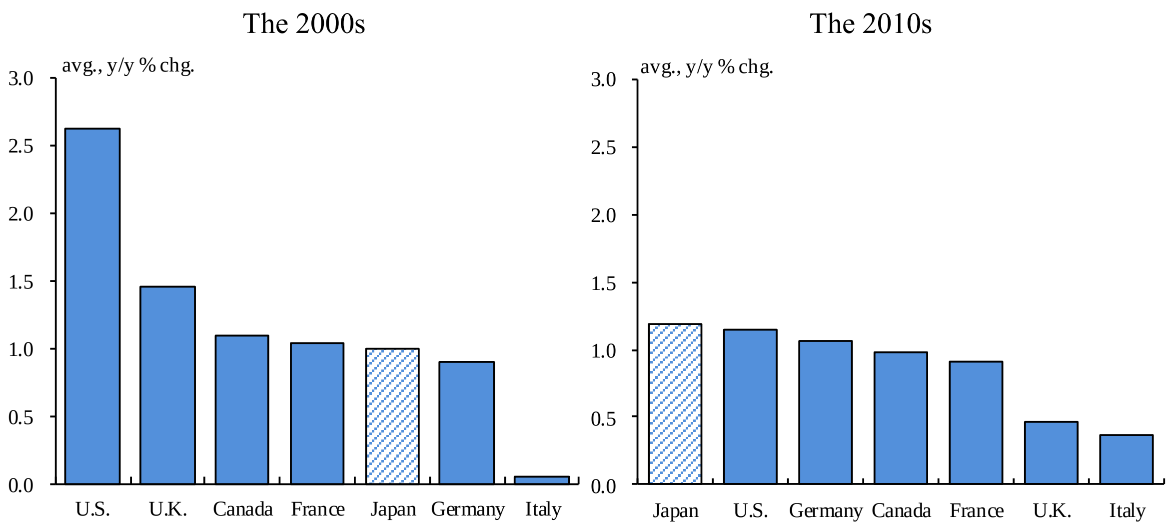
Sources: Cabinet Office; Ministry of Internal Affairs and Communications.

Figure 7: Real labor productivity (GDP base and corporate financial statements base)



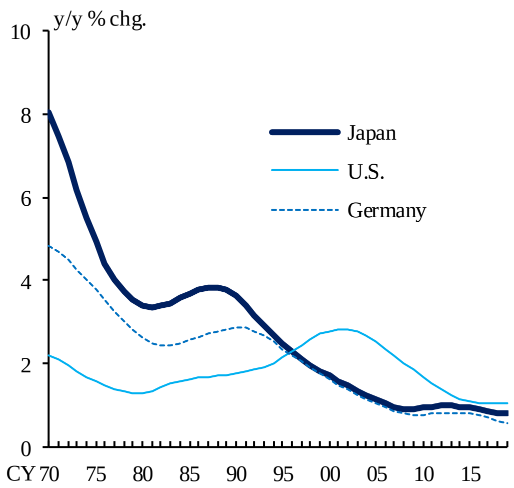
Sources: Cabinet Office; Ministry of Internal Affairs and Communications; Ministry of Finance.
Note: Real labor productivity based on GDP is calculated as productivity per hour worked.

Figure 8: Real labor productivity (per hour worked, G7)



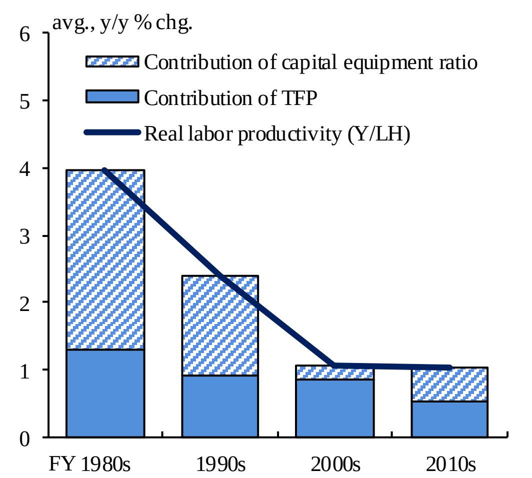
Source: Conference Board.
Note: Figures are real labor productivity per hour worked denominated by PPP exchange rates.

Figure 9: Real labor productivity (per hour worked, G7, time series)



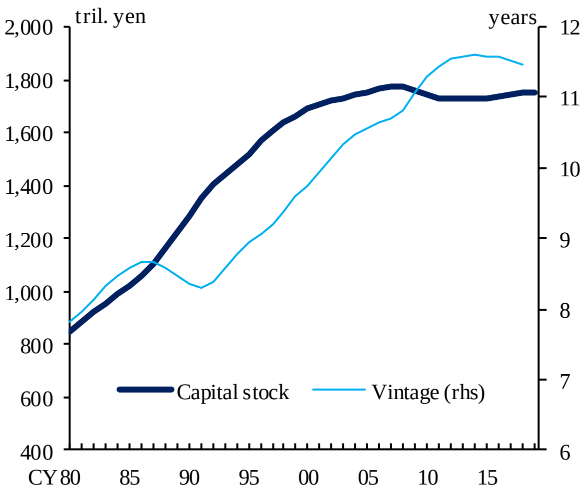
Sources: Cabinet Office; Ministry of Internal Affairs and Communications; Conference Board.
Note: The lines show the trends of the growth rates of real labor productivity calculated from the HP filter.

Figure 10: Decomposition of real labor productivity (per hour worked)



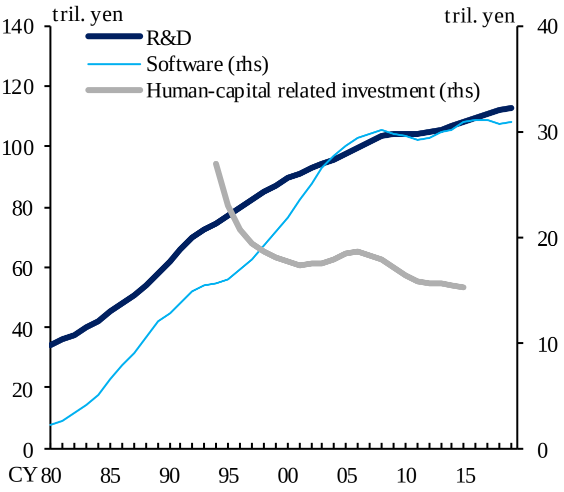
Sources: Cabinet Office; Ministry of Internal Affairs and Communications; Bank of Japan.
Note 1: Figures for capital equipment ratio are computed by subtracting TFP from labor productivity.
Note 2: TFP is calculated by staff members of the Bank of Japan.

Figure 11: Stock of tangible assets



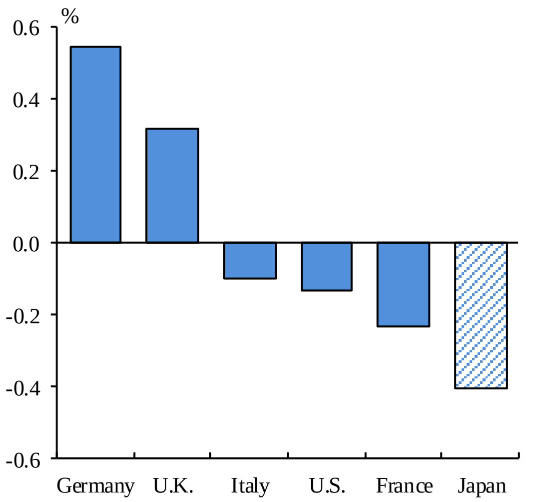
Sources: Cabinet Office; Bank of Japan (2020).
Note: The stock is measured in real terms.

Figure 12: Stock of intangible assets



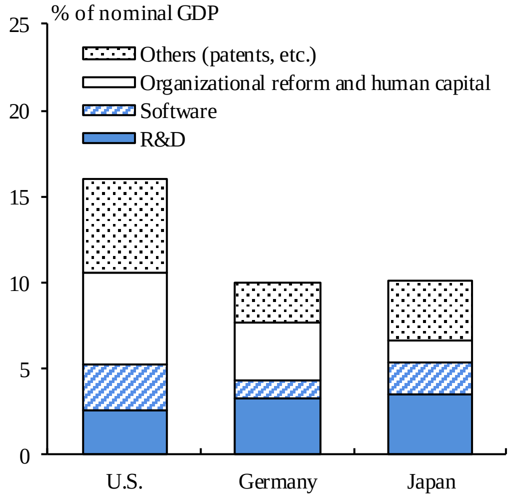
Sources: Cabinet Office; Research Institute of Economy, Trade and Industry.
Note 1: The stock is measured in real terms.
Note 2: Human-capital related investment is the sum of investment in firm-specific human capital and investment in organizational reforms.

Figure 13: Country effects on investment in intangible assets



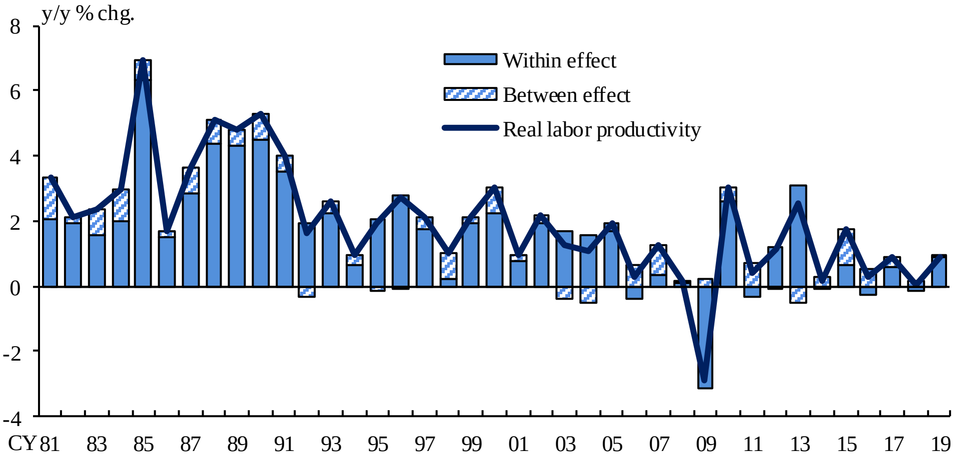
Note 1: The country effects are based on Specification A2 in Table 1.
Note 2: The figure shows the relative size of the country effects when the sum of the country effects of major countries is set to be zero.

Figure 14: Investment in intangible assets



Sources: Research Institute of Economy, Trade and Industry; INTAN-Invest.
Note: Average between 2010 and 2015.

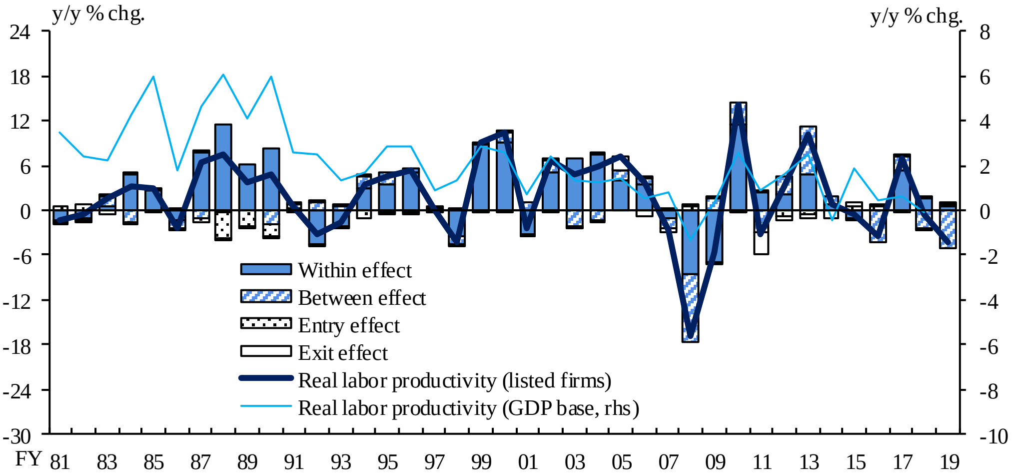
Figure 15: Decomposition of real labor productivity (inter-industry analysis in Japan)



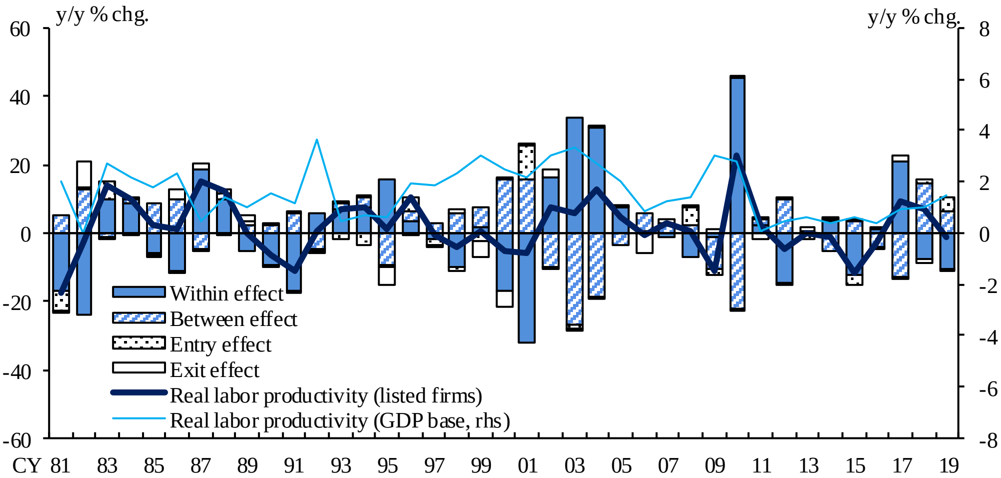
Source: Cabinet Office.
Note 1: Real labor productivity is per hour worked.
Note 2: Figures are authors' estimates based on Nordhaus (2001).

Figure 16: Decomposition of real labor productivity (inter-firm analysis)

Japan

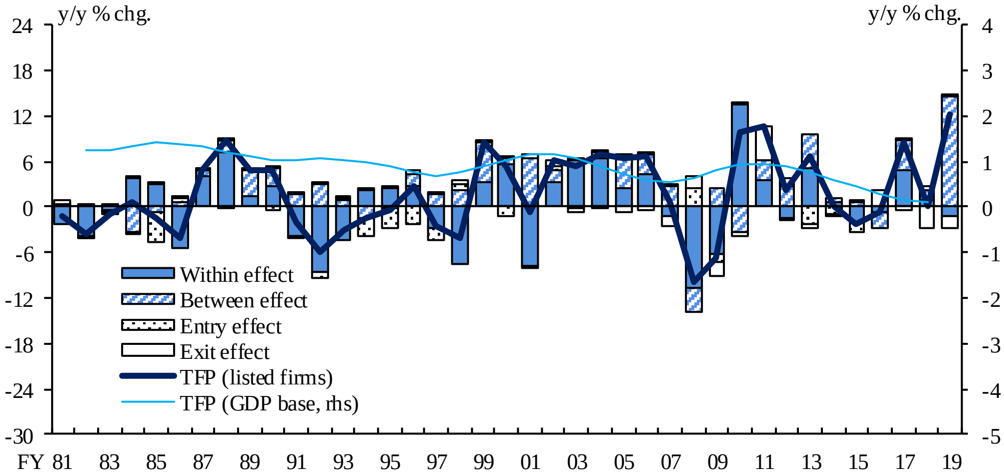


United States



Sources: Development Bank of Japan; Nikkei NEEDS-Financial QUEST; Cabinet Office; Ministry of Health, Labour and Welfare; Refinitiv Eikon; Haver Analytics.
Note 1: Real labor productivity is per hour worked.
Note 2: Figures are authors' estimates based on Melitz and Polanec (2015).

Figure 17: Decomposition of TFP (inter-firm analysis in Japan)



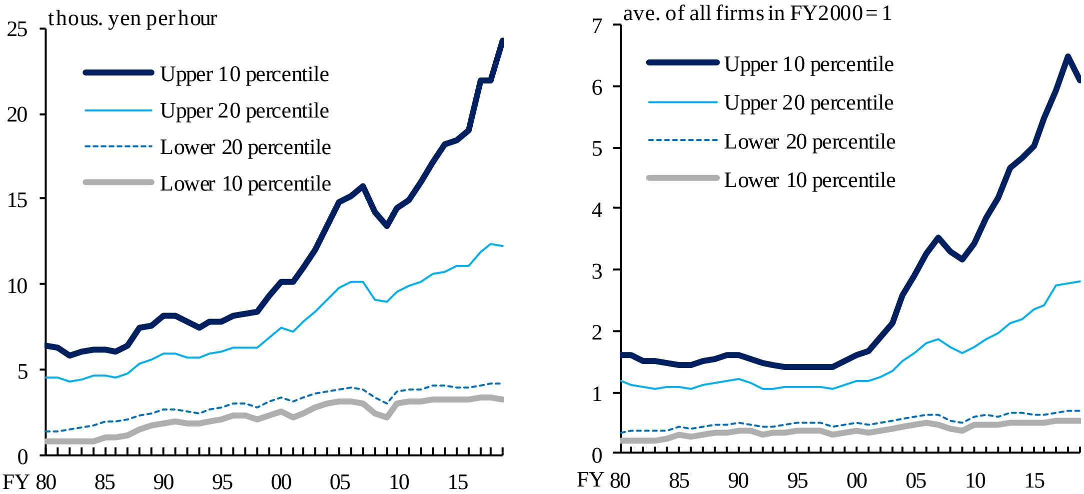
Sources: Development Bank of Japan; Nikkei NEEDS-Financial QUEST; Cabinet Office; Ministry of Health, Labour and Welfare; Bank of Japan.

Note 1: Figures for the TFP (listed firms) are authors' estimates based on Melitz and Polanec (2015).

Note 2: Figures for the TFP (GDP base) are published by the Bank of Japan.

Figure 18: Productivity of listed firms

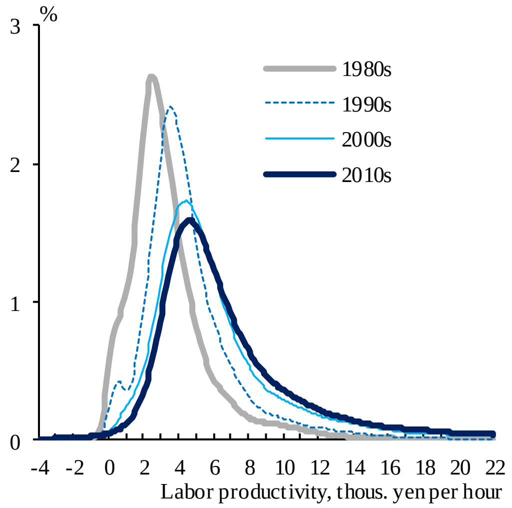
Real labor productivity | TFP



Sources: Development Bank of Japan; Nikkei NEEDS-Financial QUEST; Cabinet Office; Ministry of Health, Labour and Welfare.

Note: Real labor productivity is per hour worked.

Figure 19: Distribution of real labor productivities of listed firms

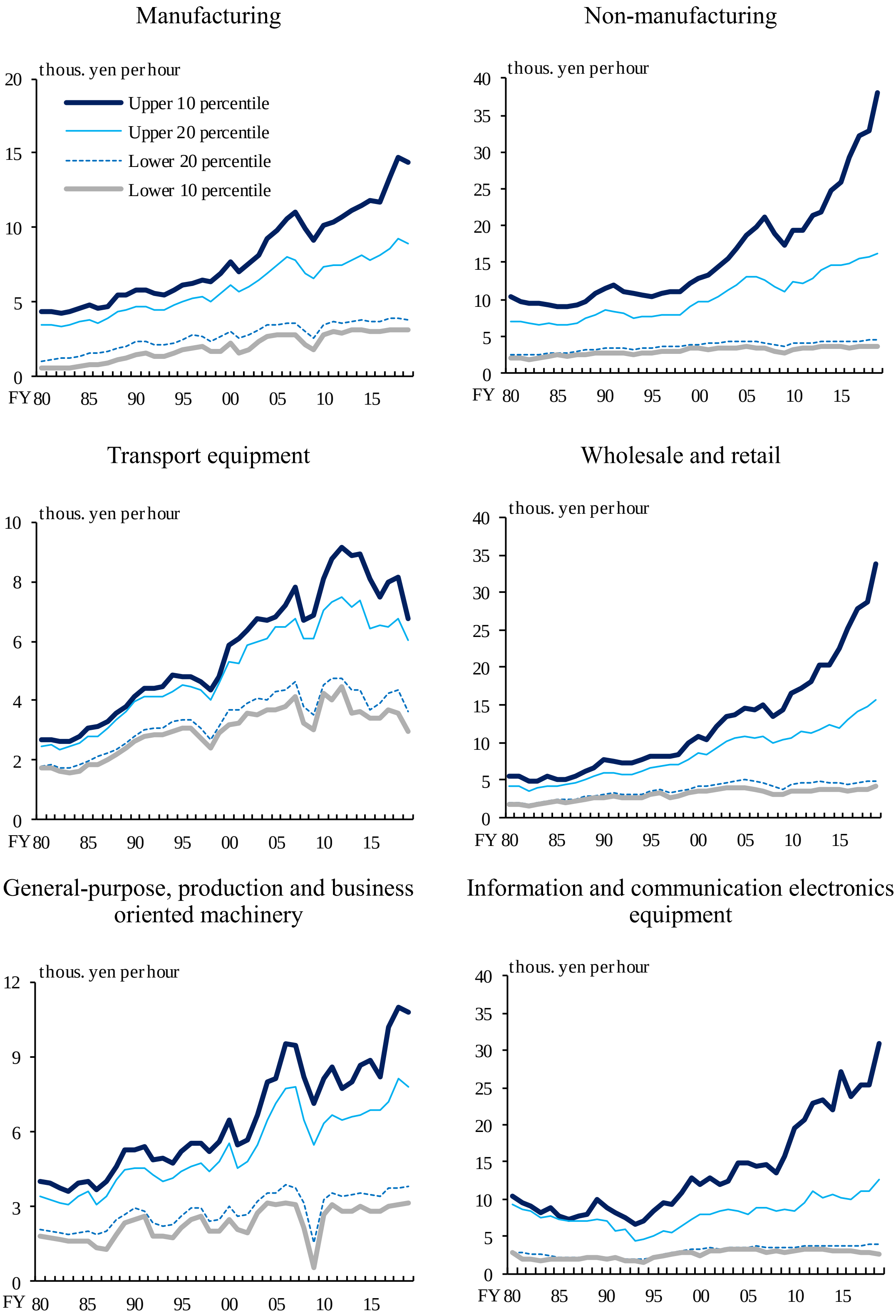


Sources: Development Bank of Japan; Nikkei NEEDS-Financial QUEST; Cabinet Office; Ministry of Health, Labour and Welfare.

Note 1: Real labor productivity is per hour worked.

Note 2: Kernel density estimation.

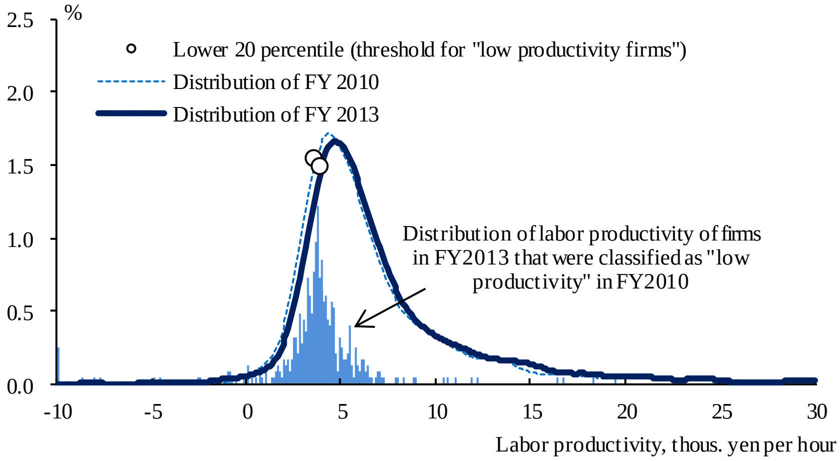
Figure 20: Real labor productivities of listed firms by industry



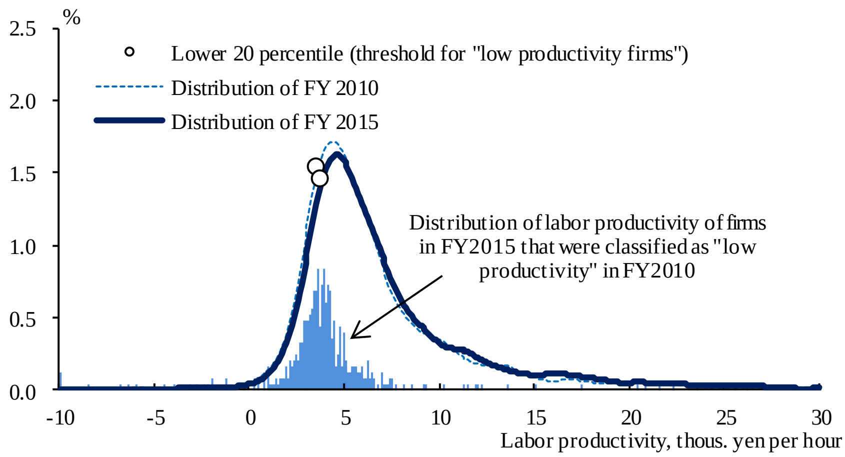
Sources: Development Bank of Japan; Nikkei NEEDS-Financial QUEST; Cabinet Office; Ministry of Health, Labour and Welfare.
Note: Real labor productivity is per hour worked.

Figure 21: Real labor productivities of listed firms: sustainability of being "low productivity"

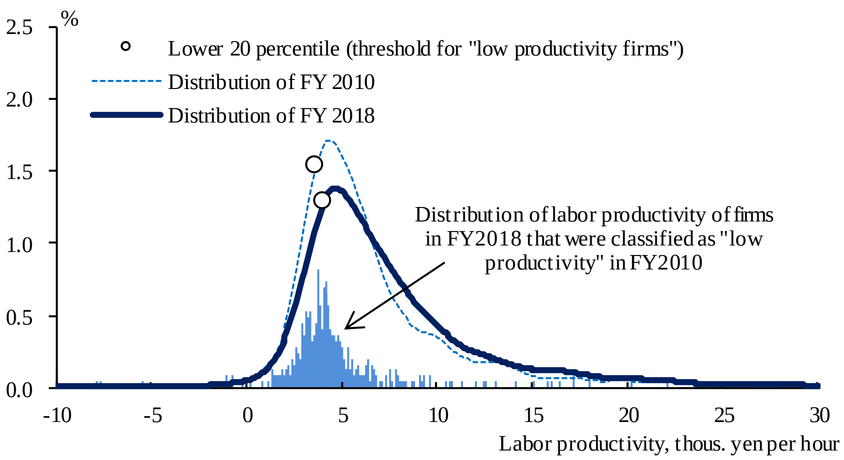
FY 2013



FY 2015

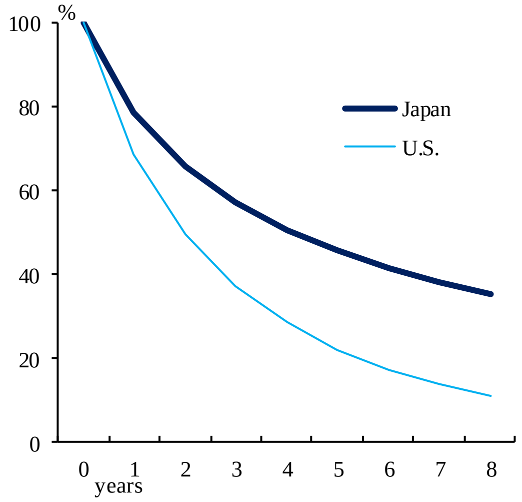


FY 2018



Sources: Development Bank of Japan; Nikkei NEEDS-Financial QUEST; Cabinet Office; Ministry of Health, Labour and Welfare.
Note: The lines represent Kernel density estimations.

Figure 22: "Survival rate" of low productivity firms

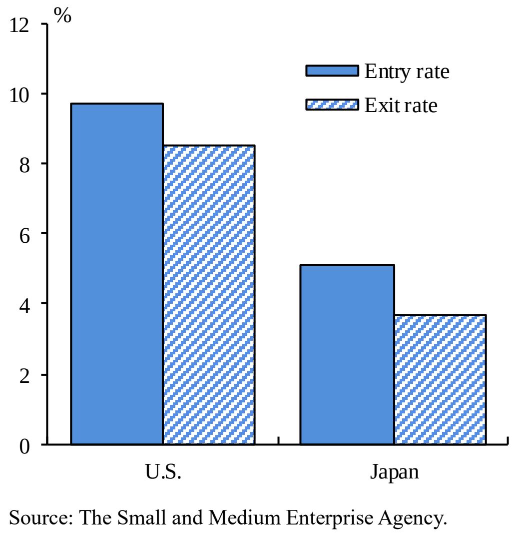


Sources: Development Bank of Japan; Nikkei NEEDS-Financial QUEST; Cabinet Office; Ministry of Health, Labour and Welfare; Refinitiv Eikon; Haver Analytics.

Note: Survival rates of low productivity firms are calculated as follows by using real labor productivity of individual listed firms in Japan and the U.S.

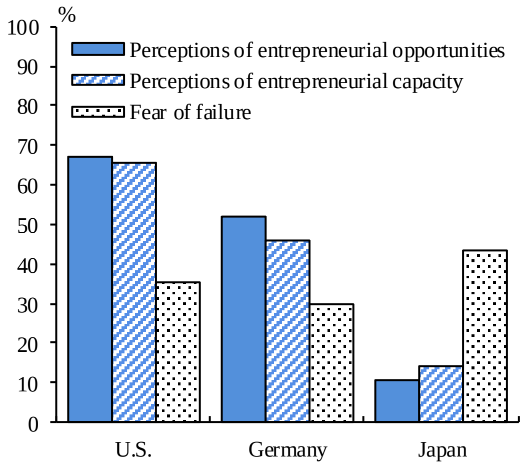
$$\text{Survival Rates of low productivity firms (at T = t)}$$
$$= \frac{\text{number of low productivity firms (under 20 percentile from T = 0 to T = t)}}{\text{number of low productivity firms (under 20 percentile at T = 0)}} \cdot 100$$

Figure 23: Entry and exit rates of firms



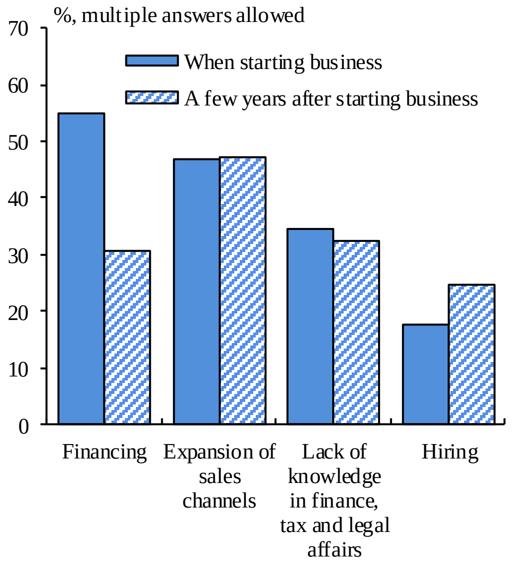
Source: The Small and Medium Enterprise Agency.
Note: Average between 2013 and 2018.

Figure 24: Entrepreneurship



Source: Global Entrepreneurship Monitor.
Note: Based on a survey in 2019 of individuals who might start businesses. Percentage of respondents who have each perception or fear.

Figure 25: Difficulties experienced when opening the business

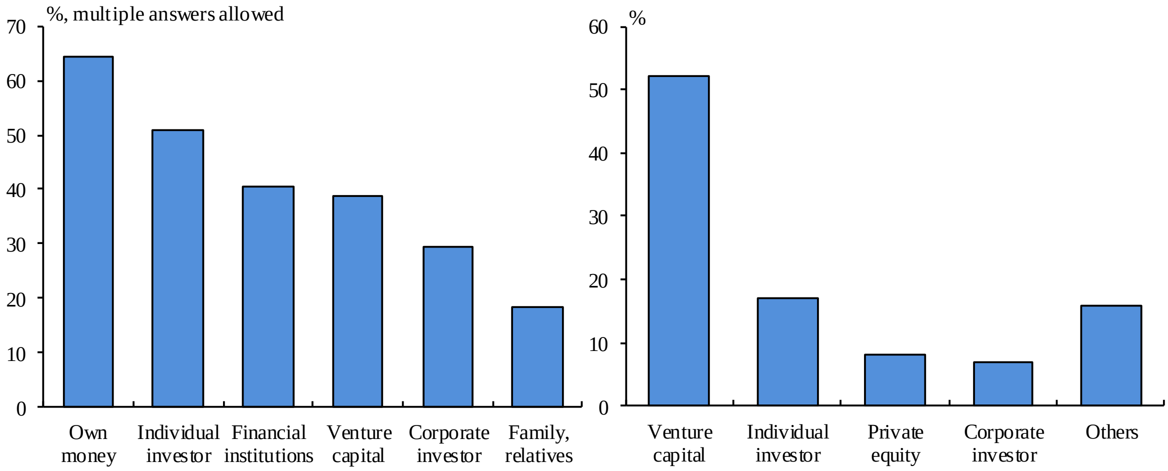


Source: Japan Finance Corporation.
Note: Questionnaire survey on business owners who have experienced starting a business (FY2020).

Figure 26: Financing sources for venture capital firms

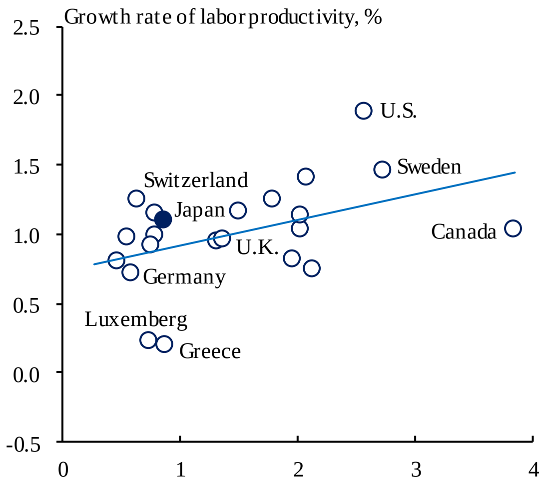
Japan

United States



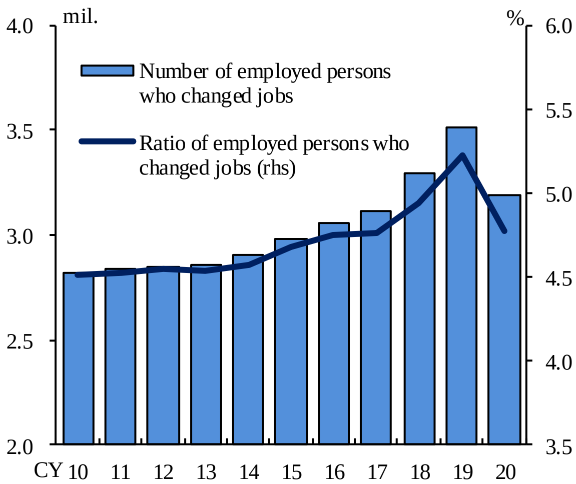
Sources: Venture Enterprise Center; Silicon Valley Bank.

Figure 27: Labor mobility and productivity



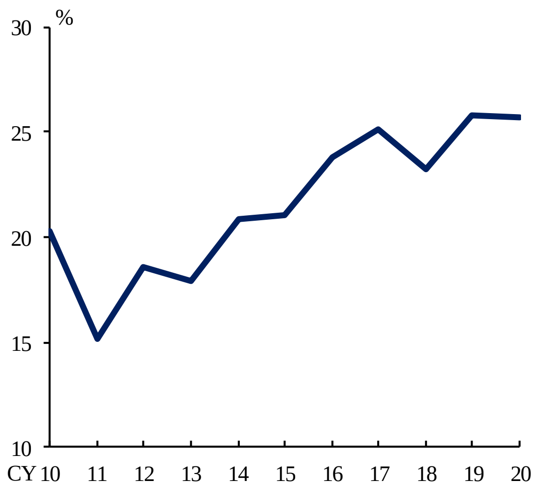
Sources: OECD; Conference Board.
Note 1: Labor productivity is real labor productivity per hour worked.
Note 2: A country's labor mobility is measured by the ratio of the sum of flows in and out of short-term unemployment (unemployed less than one month) to the population aged 15-64 in the respective country.
Note 3: The growth rates of labor productivity and the labor mobility are average values between 2000 and 2019.

Figure 28: Job change



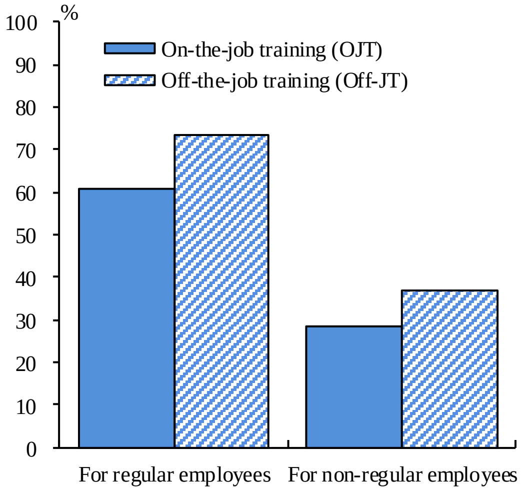
Source: Ministry of Internal Affairs and Communications.
Note 1: Figures are calculated using data for employed persons who changed jobs in the past year.
Note 2: The line represents the ratio of the number of employed persons who changed jobs in the past year to the number of persons who were employed in the past year.

Figure 29: Job change with wage increase



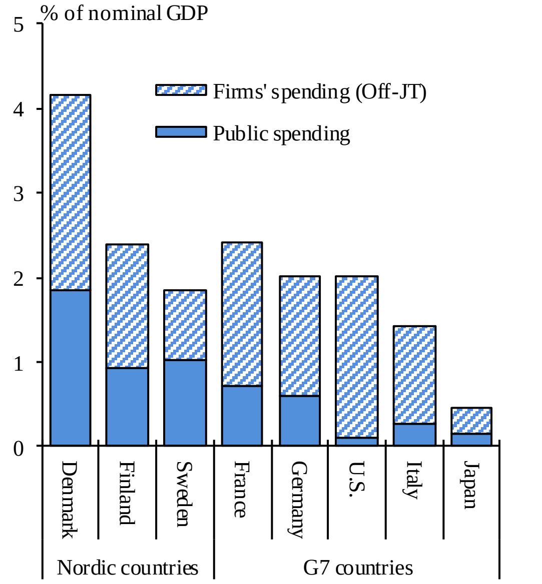
Source: Ministry of Health, Labour and Welfare.
Note: The ratio of employed persons who changed jobs in the past year and whose wages increased by more than 10%.

Figure 30: The share of firms that have vocational training programs



Source: Ministry of Health, Labour and Welfare.
Note: Average of surveys between FY2015 and FY2020. The share of companies that spend on vocational training.

Figure 31: Human capital investment (major countries)

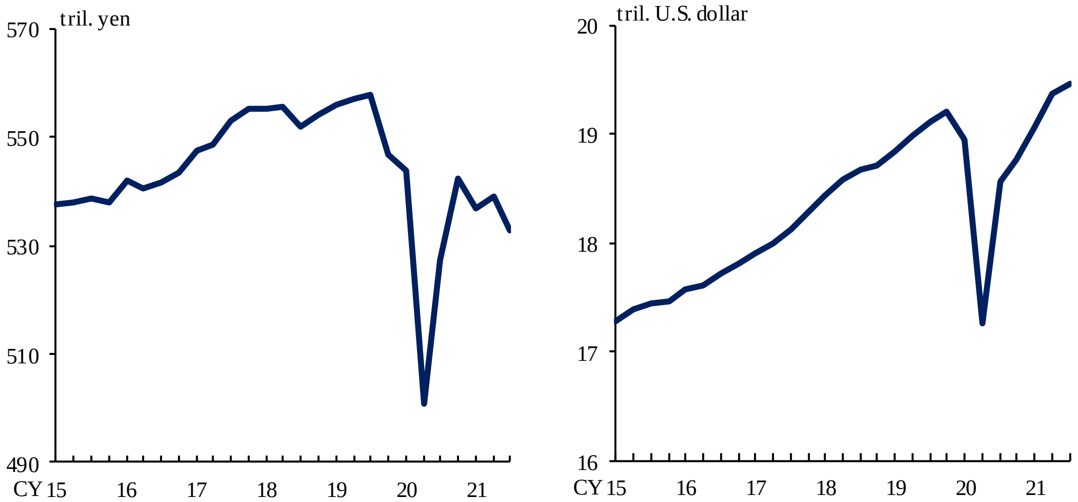


Sources: Research Institute of Economy, Trade and Industry; INTAN-Invest; OECD.
Note: Figures for firms' spending are from 2015 for Japan, 2016 for the United States, and 2017 for the other countries. Figures for public spending are from 2019.

Figure 32: Real GDP under the COVID-19 pandemic

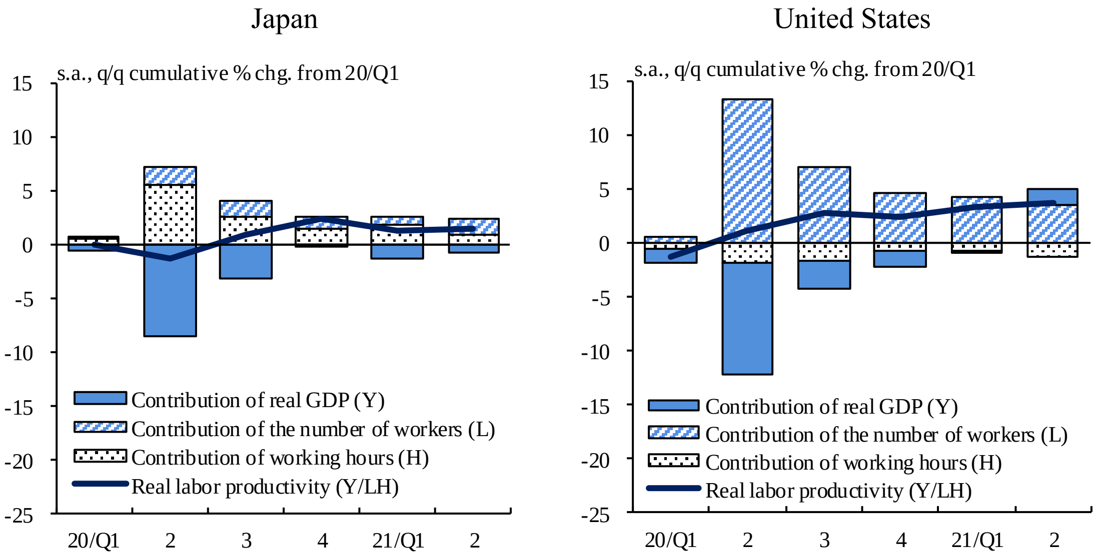
Japan

United States



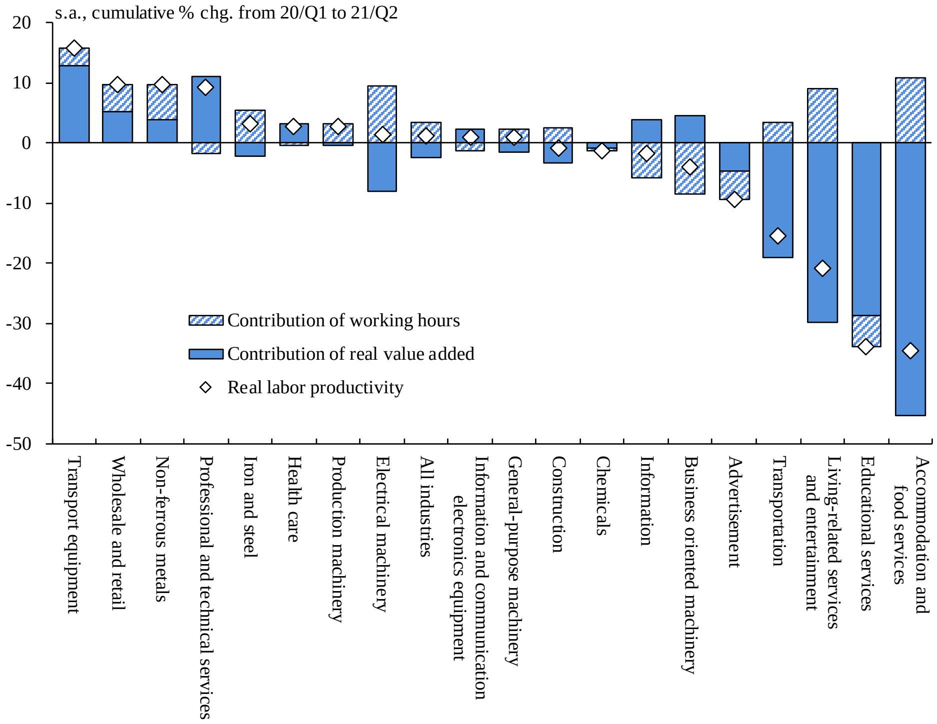
Sources: Cabinet Office; Bureau of Economic Analysis.
Note: Seasonally adjusted and annualized.

Figure 33: Real labor productivity under the COVID-19 pandemic



Sources: Cabinet Office; Ministry of Internal Affairs and Communications; Bureau of Economic Analysis; Bureau of Labor Statistics.

Figure 34: Real labor productivity under the COVID-19 pandemic by industry

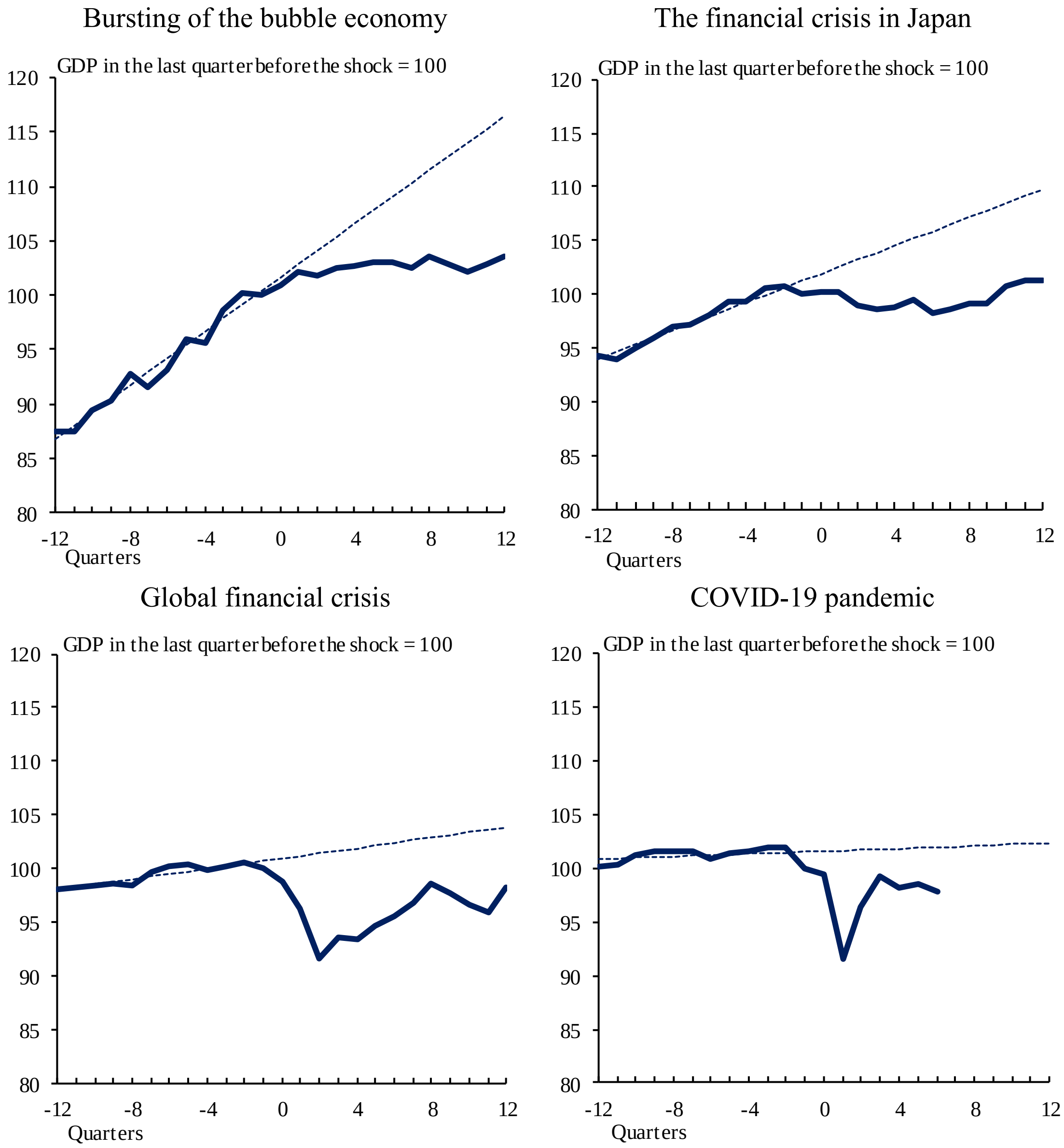


Sources: Ministry of Finance; Cabinet Office; Ministry of Internal Affairs and Communications; Ministry of Health, Labour and Welfare.

Note 1: The real value added is calculated by dividing the nominal value added (the sum of operating profits, personal expenses, and depreciation expenses) by the GDP deflator. Working hours is the product of the number of employed persons and hour worked per employed person in each industry.

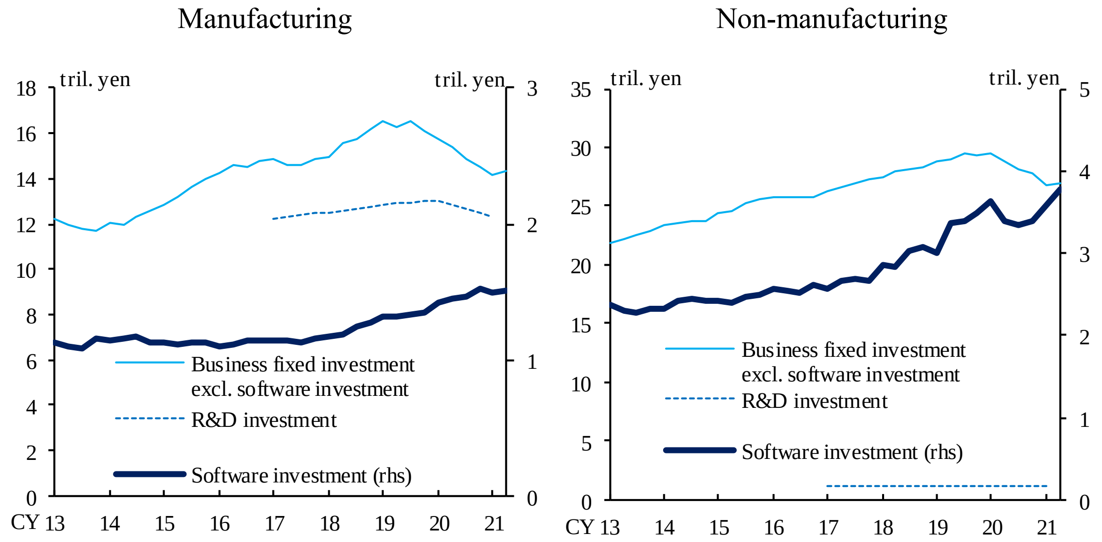
Note 2: Cumulative change is the average rate of change with respect to the January-March 2020 quarter.

Figure 35: Real GDP by phase



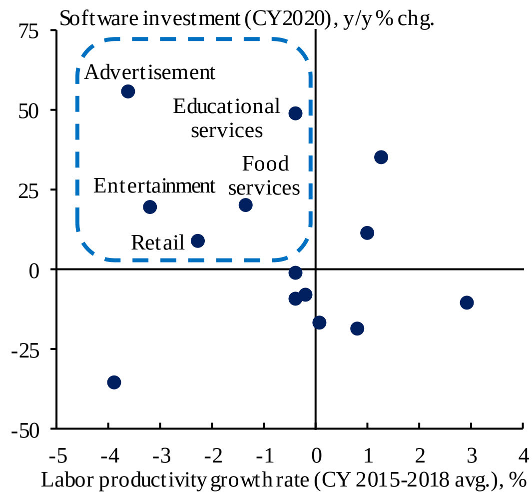
Source: Cabinet Office.
Note 1: The lines represent real GDP when the shock is set to zero at the onset of the shock.
Note 2: The dotted lines show the trends over 12 quarters before the shocks take place.
Note 3: The timing of shocks that occurred are the January-March 1991 quarter for the bursting of the bubble economy, the April-June 1997 quarter for the Japanese financial crisis, the July-September 2008 quarter for the global financial crisis, and the January-March 2020 quarter for the COVID-19 pandemic.

Figure 36: Business fixed investment by sector



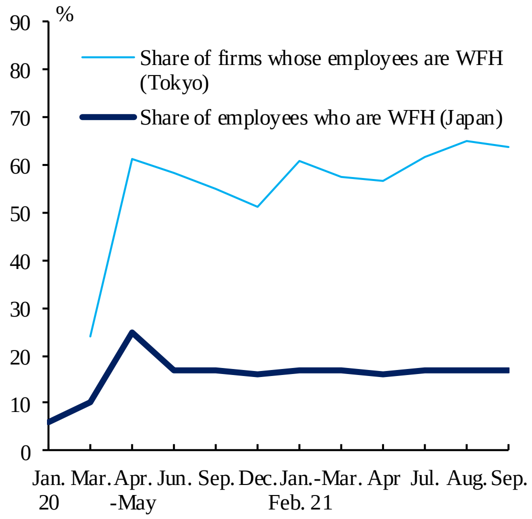
Sources: Ministry of Finance; Bank of Japan.
Note: All figures are annualized values.

Figure 37: Software investment by industry



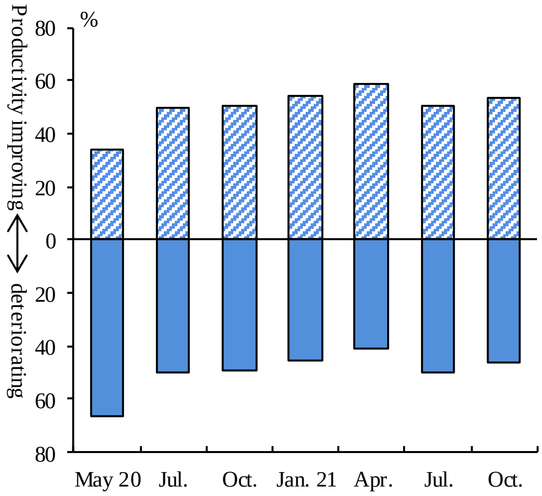
Sources: Research Institute of Economy, Trade and Industry; Ministry of Finance.
Note: Labor productivity is real labor productivity per hour worked

Figure 38: Working from home (WFH)



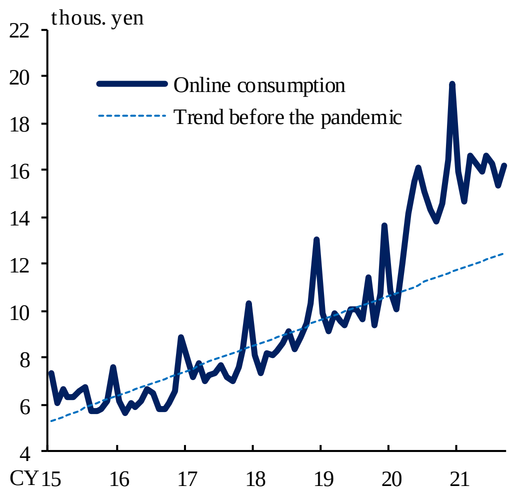
Sources: Nippon Institute for Research Advancement; Tokyo Metropolitan Government.
Note: The share of firms whose employees are working from home is based on a survey of firms in Tokyo with more than 30 employees.

Figure 39: Productivity of WFH



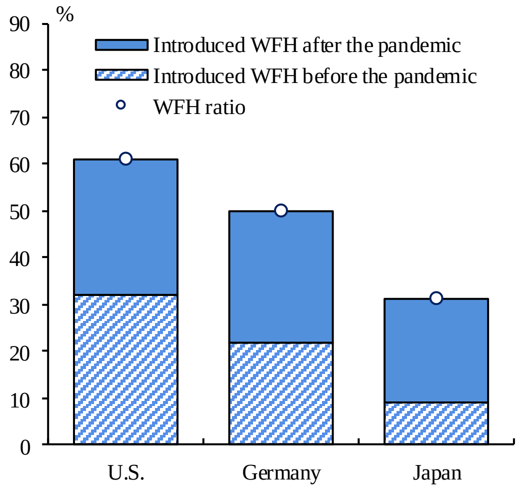
Source: Japan Productivity Center.
Note: Shares of employees who indicated that productivity increased (or decreased) by remote work compared to working in the office.

Figure 40: Online consumption



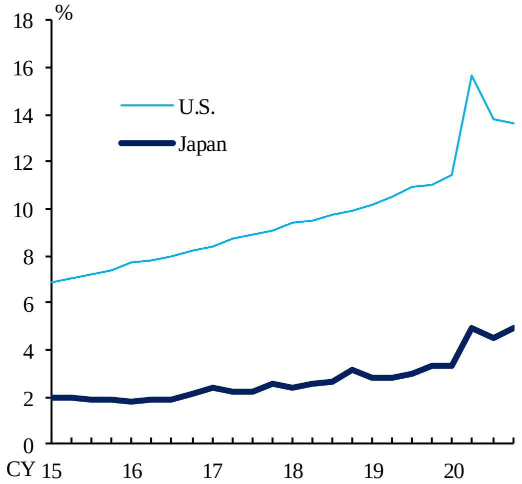
Source: Ministry of Internal Affairs and Communications.
Note 1: Online consumption is the monthly EC spending on goods (excluding EC spending on services such as accommodation charges, fares, package travel expenses and tickets).
Note 2: The trend is the linear time trend calculated from January 2015 to March 2020.

Figure 41: WFH
(major countries)



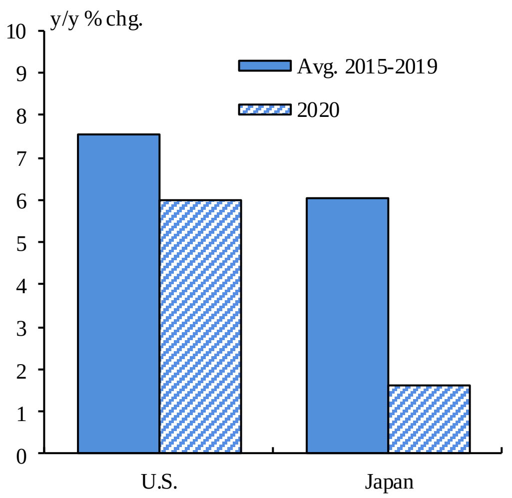
Source: Nomura Research Institute.
Note: Figures are based on a survey of employees in July 2020.

Figure 42: Online consumption
(Japan and the U.S.)



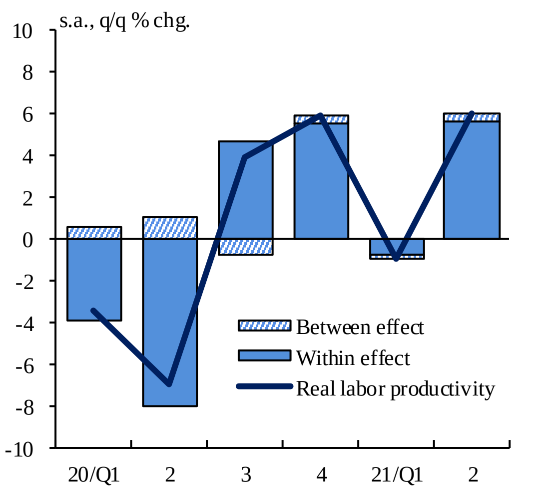
Sources: Ministry of Internal Affairs and Communications; Census Bureau.
Note: For Japan, online consumption is computed by dividing the online spending (obtained from the *Survey of Household Economy*) by the total expenditure (obtained from the *Family Income and Expenditure Survey*). For the United States, online consumption is computed as the share of online sales in total retail sales (seasonally adjusted).

Figure 43: Software investment
(Japan and the U.S.)



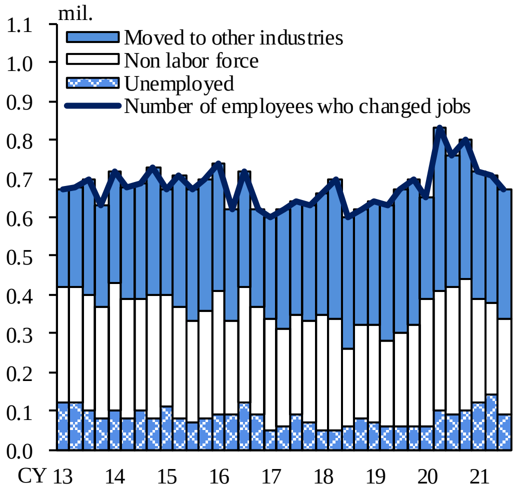
Sources: Haver Analytics; Ministry of Finance.

Figure 44: Decomposition of real labor productivity (inter-industrial analysis in Japan)



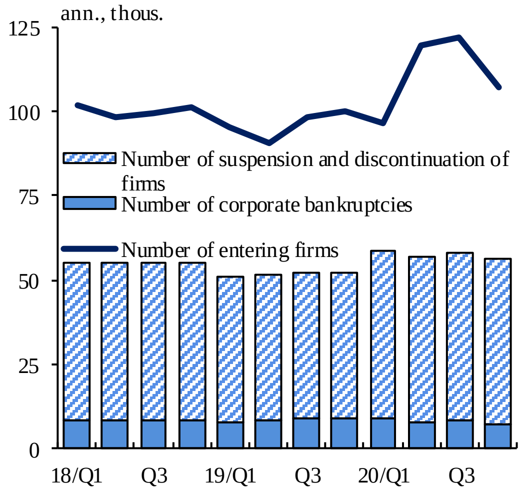
Source: Ministry of Finance.
Note 1: Real labor productivity is calculated as productivity per hour worked.
Note 2: Figures are authors' estimates based on Nordhaus (2001).

Figure 45: Status of employed persons in face-to-face services who changed jobs



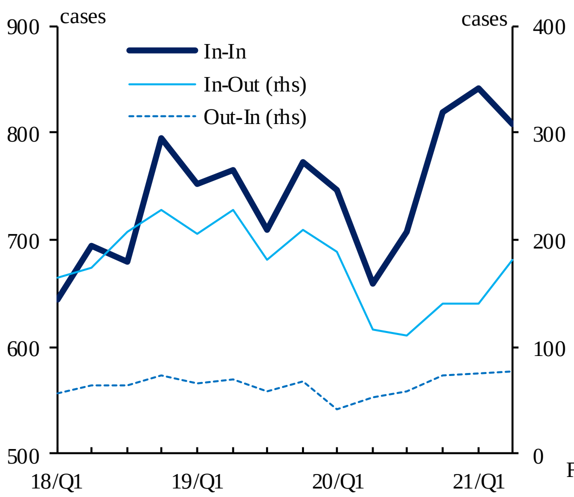
Source: Ministry of Internal Affairs and Communications.
Note: "Face-to-face services" consists of "accommodations, eating and drinking" and "life-related services and amusement." "Moved to other industries" does not include those who moved within face-to-face services industry (e.g., those who moved from "accommodations, eating and drinking" industry to "life-related services and amusement").

Figure 46: Entries and exits of firms



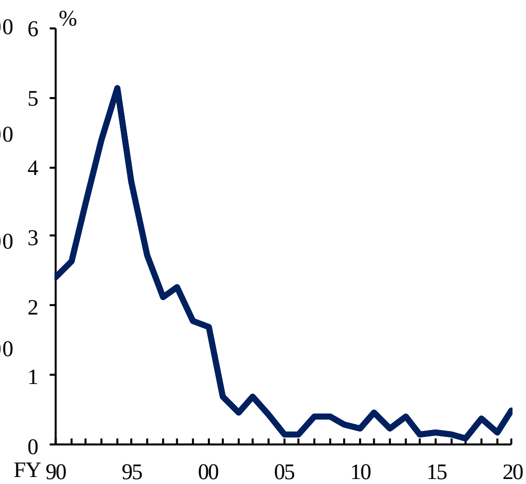
Sources: Ministry of Health, Labour and Welfare; Tokyo Shoko Research.
Note: Figures for the numbers of entering firms and of corporate bankruptcies are seasonally adjusted. Figures for the number of suspensions and discontinuation of firms are based on annual surveys.

Figure 47: M&A



Source: Recof.
Note: "In-In" is M&A of Japanese firms by Japanese firms, "In-Out" is M&A of foreign firms by Japanese firms, and "Out-In" is M&A of Japanese firms by foreign firms.

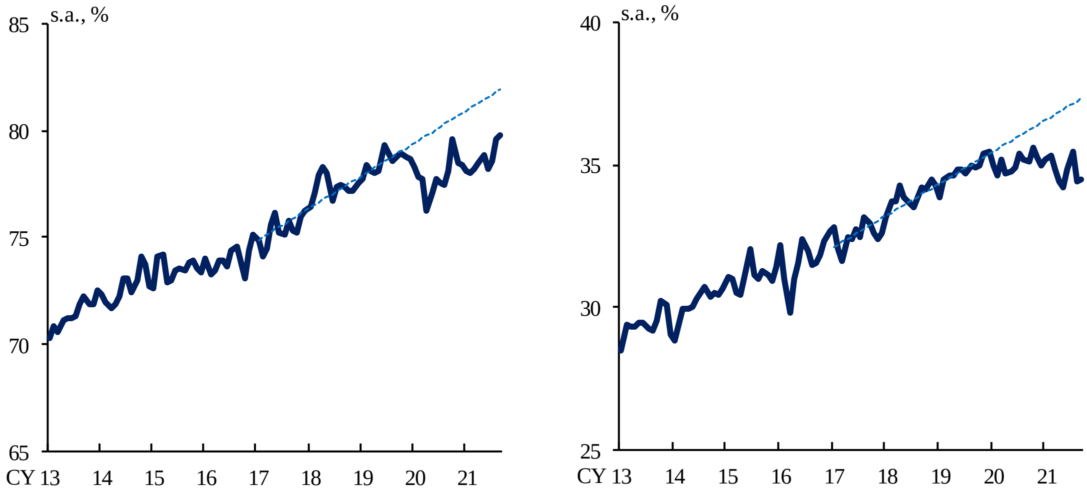
Figure 48: Share of zombie firms



Source: Yamada *et al.* (2022).
Note: Figures are for large firms (listed firms).

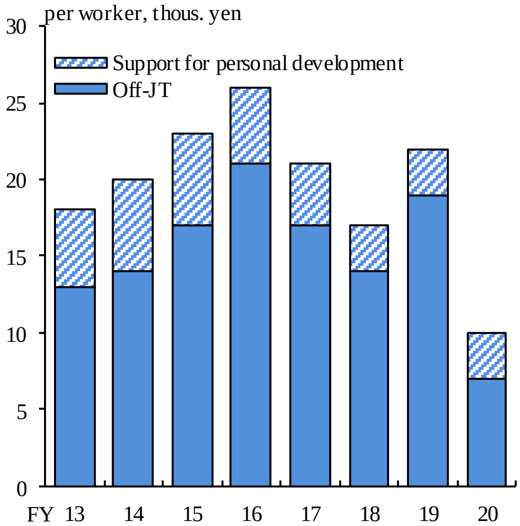
Figure 49: Labor participation rate

Women (aged between 35 and 44)　　Men (aged over 65)



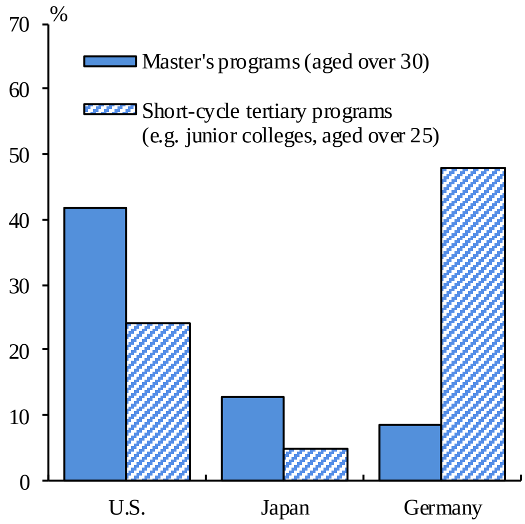
Source: Ministry of Internal Affairs and Communications.
Note: The dotted lines show the trends between 2017 and 2019.

Figure 50: Investment related to human resource development



Source: Ministry of Health, Labour and Welfare.

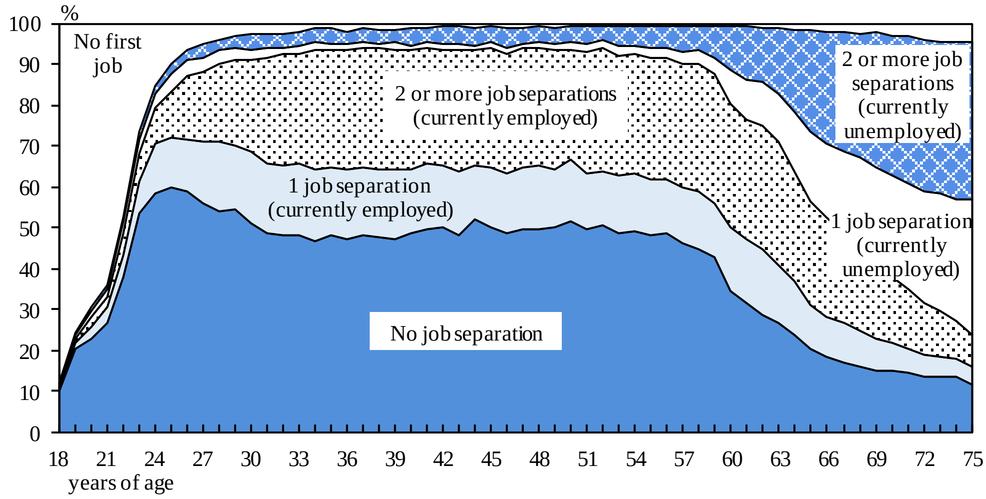
Figure 51: Recurrent education (major countries)



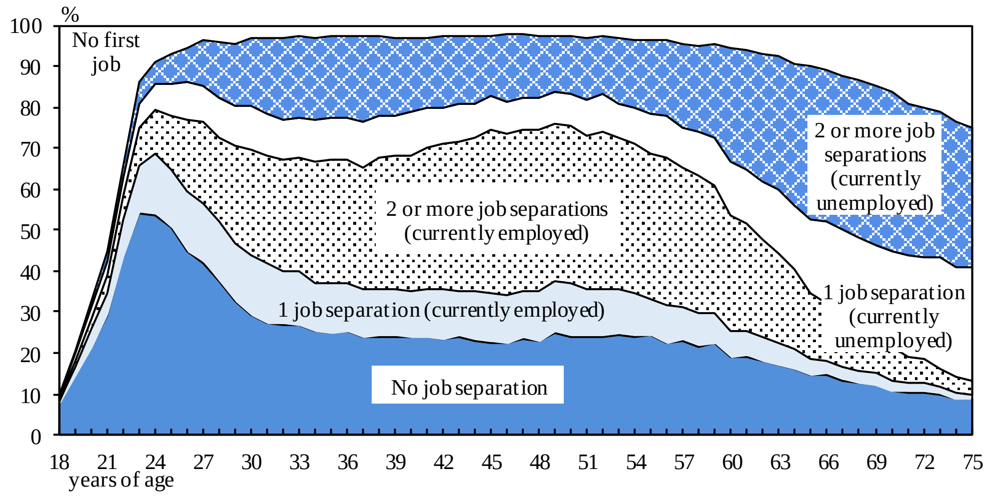
Source: Ministry of Education, Culture, Sports, Science and Technology.
Note: Shares of students who enrolled in educational institutions aged 25 (30) or older in 2017.

Figure 52: The number of job separations from the first job by age

Male



Female



Source: Ministry of Health, Labour and Welfare.
Note: Figures are based on the *Basic Statistical Survey on Employment Structure* in 2012.