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The Impact of Aging and AI on Japan's Labor Market: Challenges and Opportunities

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The Impact of Aging and AI on Japan's Labor Market: Challenges and Opportunities

Prepared by Kohei Asao, Haruki Seitani, Ara Stepanyan, and TengTeng Xu*

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ABSTRACT: This paper explores the complex roles of demographic changes and technological innovation in shaping Japan's labor market. We use regression analysis to assess the impact of population aging on labor productivity and shortages. Our findings indicate that the aging workforce contributes to labor shortages and potentially weighs on labor productivity. We also investigate occupational level data to identify the complementarity and substitutability of AI in occupational tasks as well as skill transferability. Our research reveals that Japanese workers face lower exposure to AI compared to their counterparts in other advanced economies, thereby constraining AI's potential to mitigate labor shortages. Furthermore, the disparities in skill requirements across occupations with different AI exposures highlight the importance of facilitating labor mobility from displaced jobs to those in demand.

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WORKING PAPERS

The Impact of Aging and AI on Japan's Labor Market: Challenges and Opportunities

Prepared by Kohei Asao, Haruki Seitani, Ara Stepanyan, and TengTeng Xu[1]

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I. Introduction

Japan's economy is undergoing a profound transformation, primarily driven by the aging population, a demographic trend that is projected to persist in the coming years. Japan has the highest share of people aged 65 and older in population, which is expected to increase further. Concurrently, advancements in technology, particularly in artificial intelligence (AI), are poised to reshape the labor market landscape with certain roles rendered obsolete while the demand for new skills is on the rise. Japan has been at the forefront in automation as a way to sustain productivity amid demographic headwinds.

This paper aims to investigate the intricate interplay between the population aging and AI in influencing Japan's labor market. We employ regression analysis to examine the impact of aging on labor productivity and labor shortages. Utilizing occupational level data, we look into complementarity and substitutability of AI with human-performed tasks and construct a skill distance index to assess the transferability of skills across various occupations.

Our findings reveal that population aging is contributing to the acute labor shortages faced by Japanese firms and weighing on labor productivity. Our analysis implies that sectors more affected by population aging tend to report higher labor shortages 5 years later. Furthermore, we find that aging in the labor force is negatively associated with labor productivity growth in Japan.

Our analysis also highlights the limited role for AI to address Japan's labor shortages and importance of facilitating labor mobility to capitalize on the benefits brought about by AI. We document that Japanese workers have a lower exposure to AI compared to other advanced economies, which limits the potential for AI to alleviate labor shortages. Moreover, the pronounced differences in skill requirements between occupations with varying levels of AI exposure underscore the critical role of policy interventions in facilitating labor mobility from displaced occupations to those in demand.

This paper is organized as follows. In section II, we present key stylized facts of Japan's demographic and automation trends. In section III, we outline the methodology used in the paper. Section IV discusses main findings of our analysis. Section V presents key conclusions.

II. Stylized Facts

Japan has been experiencing significant demographic shifts. The share of population aged 65 or older in 2023 at 29 percent is by far the highest in the world (Figure 1). This trend of rapid aging is projected to continue, driven by very low fertility rates (Asao et al.,2024a), with the share of the senior population expected to rise further amidst an overall decline in the total population. The share of the population aged 65 or older is expected to reach 40 percent by 2070. Population aging has had an important influence on labor market outcomes of seniors and firms' decisions to invest in labor-saving technologies. However, the recent evidence, presented in the April 2025 WEO, suggests that population aging is also associated with improvements in health outcomes of seniors enabling them to have a longer and productive work span. This could potentially mitigate the negative impact of aging on labor supply.

Japan's seniors have a higher labor force participation rate but work less hours compared with peers, in part owing to government policies. While facing demographic headwinds, Japan has made notable progress in increasing labor force participation among both women and seniors (Asao et al.,2024b). Japan's labor force participation among senior workers is one of the highest among OECD countries (Figure 1). Government policies to increase public pension eligibility age from 60 to 65 starting in 2001 and mandate employers to offer employment opportunities for workers aged 60-65 since 2006 have contributed to this outcome. [1] However, seniors in Japan work fewer hours compared with peers. While this could, in part, be their social choice, there are policy frictions that can discourage longer working hours among seniors in Japan. First, pension benefits are cut if seniors earn more than a certain income threshold, which creates incentives for seniors to reduce their working hours and incomes.[2] Second, breadwinner's income deduction is phased out once dependents exceed a certain income threshold, which may encourage dependent seniors to adjust their earnings to remain within the limit.[3]

Japan's seniors are an important source of labor supply across all industries and have witnessed an increase in labor mobility. While manufacturing and wholesale/retail industries have the largest number of workers aged 60 and older, the share of senior workers is higher in service-related and construction industries. In terms of gender, a relatively large share of senior men works in construction, whereas senior women are more likely to be employed in the medical-related services sectors. Labor mobility (measured by the share of new hires that have changed jobs) has been trending upwards for workers aged 65 and above since early 2000s, while that for the total workforce has been flat. By gender and age cohort, men aged 65 and above have had the highest rise in mobility rate over the past decades.

Automation, in part promoted by the government, has been Japan's natural response to an aging workforce. Japan has been at the forefront with the adoption of industrial robots, which has been supported by various government initiatives. Industry-level data on software stock per capita from 2002 to 2022 show that Japan's software investments—an essential aspect of automation—are negatively correlated with the share of workers aged 34 and younger, suggesting that an aging population may have accelerated automation. In 2022, Japan had one of the highest robot densities in the manufacturing industry (Figure 2). Within manufacturing, electrical machinery and auto industries are the primary users of robots, while the use of robots in non-manufacturing remains limited. It also ranks among the top globally for annual installations of industrial robots and is one of the world's leading producers of robots. Over the past few years, the export value of robots from Japan is about three times that of domestic shipments of robots. Intensive automation has significantly reduced the share of routine occupations in employment since 2000 (Figure 2).[4]

[1] As of June 2025, employers are obliged to ensure employment for employees aged 60-65 by implementing one of the following options: (1) raising the retirement age from 60 (the legally allowed minimum) to 65, (2) offering continued employment to those interested, or (3) abolishing the retirement age. Additionally, for employees aged 65-70, employers are obliged to make efforts to ensure employment by implementing one of the authorized options (e.g., offering continued employment for those interested). In 2024, 64 percent of companies set the retirement age at 60.

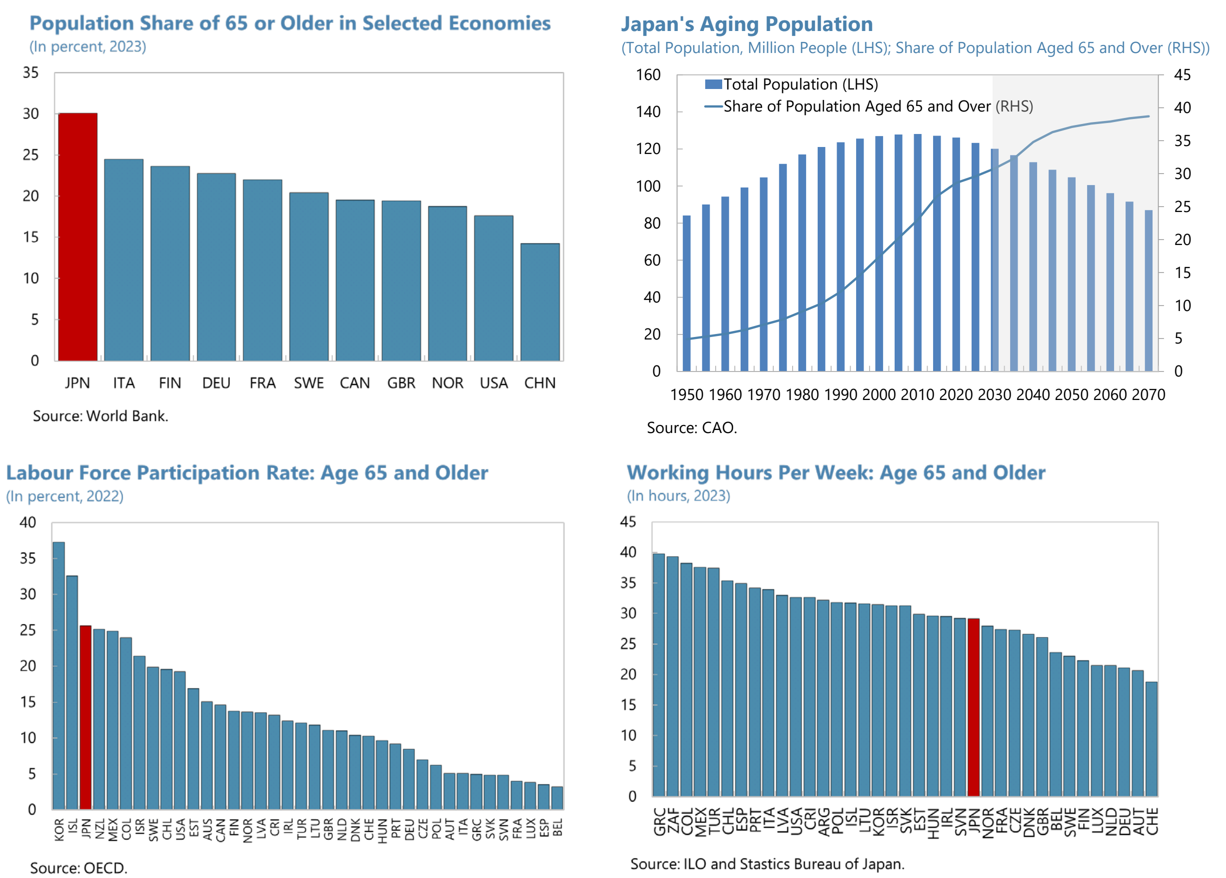
[2] If the total amount of wages and the pension (received from the Employees' Pension Insurance) of employees aged 65 and over exceeds 510,000 yen (FY25 threshold) per month, part or all of the pension benefits will be cut. This measure affects 16 percent of the pension recipients in 2022.

[3] The current corporate practices under the minimum retirement age policy (see footnote1) allows corporates to offer non-regular jobs to workers aged 60 and above with less stringent employment protection and greater flexibility. The greater flexibility enables senior workers to adjust their working hours to remain within lower income tax brackets and avoid cuts in pension benefits.

[4] Following the approach in Acemoglu and Autor (2011) and Kikuchi, Fujiwara and Shirota (2024), we divide occupations in Japan into three main categories: routine, abstract and manual. Routine includes manufacturing process workers, machine operation workers and construction and mining workers. We mainly focus on manufacturing and construction routine workers that are most likely to be affected by automation.

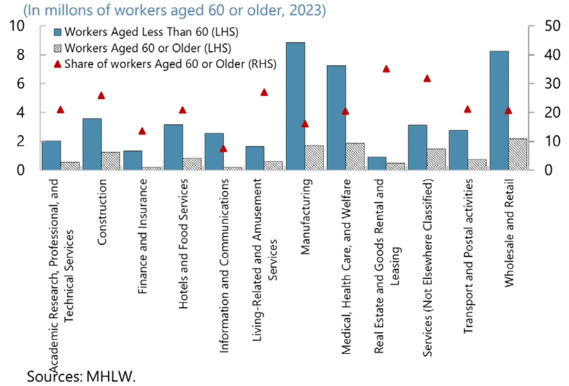
Despite high labor force participation, increasing labor mobility among seniors, and accelerated investments in labor-saving automation, labor shortages worsened. Labor shortages in Japan have intensified over the last decade reaching a record high in 2024 (Figure 3). While labor shortages eased somewhat during the pandemic, they have surpassed pre-pandemic peaks recently. In 2024, around half of surveyed Japanese firms indicated a lack of qualified full-time employees to meet their operational needs. Construction, ICT, and medical services are sectors facing the most severe labor shortages. Even in sectors with relatively less severe labor shortages, still about 30 percent of firms reported shortages. New job opening to application ratio—an alternative measure for labor shortages—while slightly below pre-pandemic peak, remains elevated by historical standards (Figure 3).

Figure 1. Aging and Labor Market Outcomes



Senior Workforce, by Industry

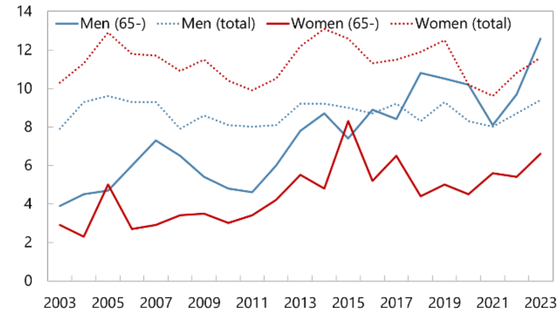
(In millons of workers aged 60 or older, 2023)



Sources: MHLW.

Labor mobility, by sex and age group

(In percent of new hires who have changed jobs)

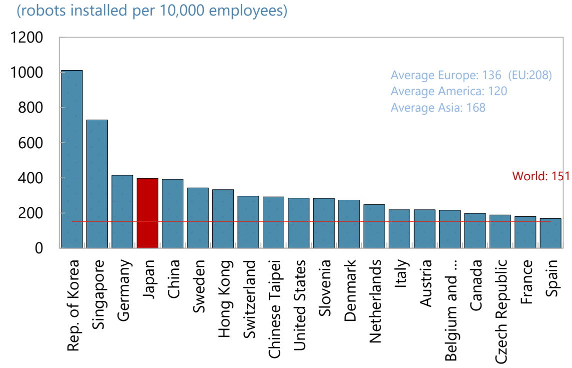


Source: MHLW.

Figure 2. Japan: Aging, Automation, and Labor Market

Robot density in the manufacturing industry, 2022

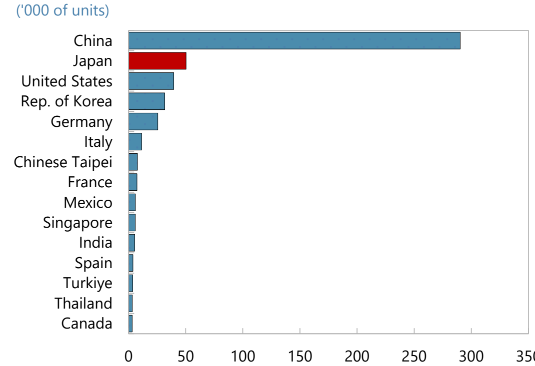
(robots installed per 10,000 employees)



Sources: International Federation of Robotics

Annual installations of industrial robots 15 largest market, 2022

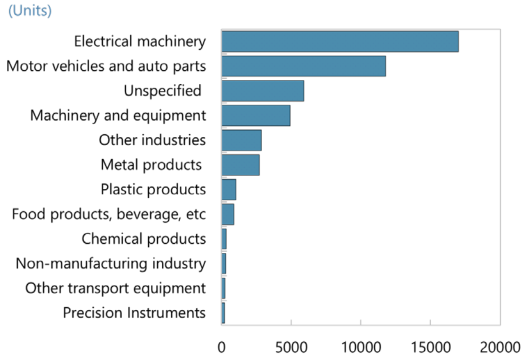
('000 of units)



Sources: World Robotics 2023

Shipments of Manipulators and Robots by industries (2023)

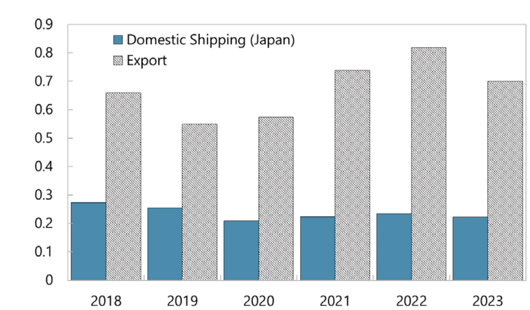
(Units)



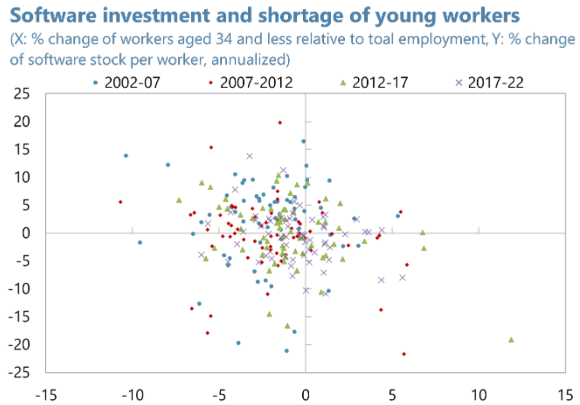
Sources: Japan Robot Association

Manipulators and Robots: Domestic Shipment and Export Trends

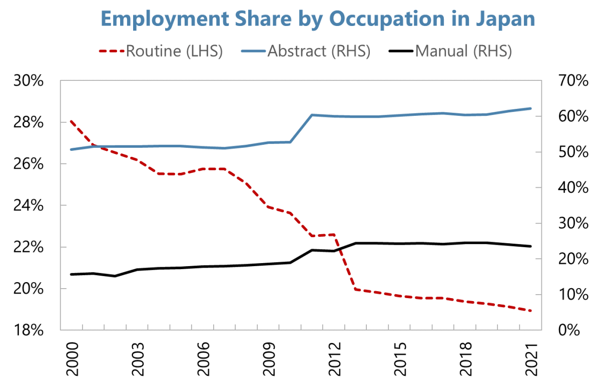
(Trillion yen)



Sources: Japan Robot Association

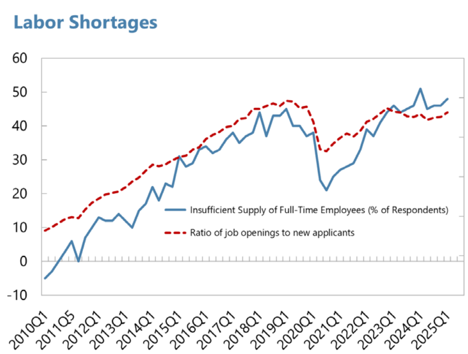


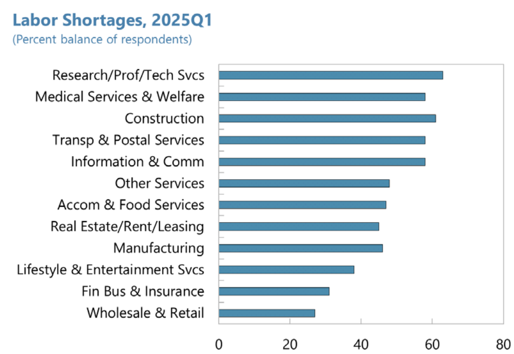
Sources: MIAC, RIETI



Sources: ILO and IMF Staff Calculations.

Figure 3. Japan: Labor Shortages





Sources: Japan Labor Force Survey, Ministry of Health, Labor and Welfare, Haver Analytics, and IMF staff calculations.
Note: Labor shortages refer to 1) the net percentage of surveyed businesses or organizations that report a lack of qualified full-time employees to meet their operational needs and 2) the ratio of job openings to applicants.

III. Methodology

We follow three main approaches to investigate the implications of aging and advances in AI on the Japanese labor market. First, regression analysis is used to explore the implications of aging on labor shortages and productivity. Second, we analyze the complementarity and exposure of different occupations to AI in Japan's labor market using Japan's Labor Force Survey. Third, we construct a measure of skill distance between occupation pairs to assess skill transferability of Japan's labor force.

A. REGRESSION ANALYSIS

We use panel regression approaches to explore the implications of aging on labor shortages and productivity, and the impact of automation on productivity. Regressions are estimated on sector-level data with sector-specific and time-fixed effects on an annual frequency. In our analysis we used the share of workers aged 15-34 or 55 and above in total employment to represent aging. To analyze the impact of aging on labor shortages, we estimated the following equation:

$$y_{i.t} = a_i + b_t + y_{i,t-1} + kx_{i,t-h} + \beta Z_{i,t} + u_{i,t}, \tag{1}$$

where $y_{i,t}$ is labor shortages of sector i in period t; $x_{i,t-h}$ is the h year lag of either the share of workers aged 15-34 in total employment or the share of workers aged 55+; $Z_{i,t}$ is a vector of control variables including new job opening rate (measured by new job opening to employment ratio in each sector), value-added growth, labor force growth, wage growth, and change in average hours worked; a_i and b_t are sector and time fixed effects respectively, while $u_{i,t}$ is the error term. Labor shortages are measured as the net percentage of surveyed businesses or organizations that report a lack of qualified full-time employees to meet their operational needs. The analysis covers 2008-2023.

We then analyze the link between labor productivity, measured as output per hour worked, and population aging. Following Barro (2015) and Sala-a-Martin (1996), we estimate the following long-run equation:

$$\Delta y_{i,\,t} = \alpha + b_t + \theta y_{i,\,t-1} + \boldsymbol{\beta_1}\mathbf{X}_{i,\,t} + \boldsymbol{\beta_2} Z_{i,t} + u_{i,t}, \tag{2}$$

where $y_{i,t}$ is logarithm of labor productivity of sector i in period t; $\mathbf{X}_{i,\,t}$ is the share of workers aged 55 and older in sector i at time t; $Z_{i,t}$ is a vector of control variables that characterize the sector i's steady state level of labor productivity, including the share of part-time workers, the share of female workers, and the investment rate. To estimate long-run relations, 10-year averages are used for 2000-2010 and 2010-2021. Data are from Japan Industrial Productivity (JIP) Database (RIETI) and cover 97 sectors.

B. AI AND LABOR MARKET

To analyze the impact of AI on Japan's labor market, we extend the analysis in Cazzaniga and others (2024) to the Japanese context. Specifically, we analyze the complementarity and exposure of different segments of the labor market to AI using Japan's Labor Force Survey. Exposure to AI is defined as the degree of overlap between AI applications and required human abilities in each occupation, following the definition outlined by Felten, Raj and Seamans (2021, 2023). Complementarity reflects an occupation's likely degree of shielding from AI-driven job displacement but with high complementarity potential (Cazzaniga and others (2024). Similar to Cazzaniga and others (2024), we consider the AI occupation exposure (AIOE) and complementarity for individual occupations relative to the median of AIOE and complementarity. Based on these principles we categorized occupations into three groups:

- *High exposure, high complementarity:* this category refers to occupations with significant potential for AI support, as AI can complement workers in their tasks and decision-making. Examples include science and engineering professionals, judges, and health professionals such as surgeons.

- *High exposure, low complementarity:* this group of occupations are well-positioned for AI interaction, but there is a greater likelihood of AI replacing human tasks. Examples include clerical support workers, sales workers and telemarketers.
- *Low exposure:* in this group, the occupations have minimum or no potential for AI application. For example, this includes personal care workers, protective services workers, and performers.

We then map employment shares from Japan's Labor Force Survey in aggregate and by occupation, gender and age cohort into these three groups. We analyze the share of Japan's labor market that is most likely to benefit from AI adaptation and that is most vulnerable to AI adoption due to potential job replacement effects.

C. SKILL TRANSFERABILITY

The confluence of an aging population and AI adoption will likely heighten the importance of skill transferability between occupations, crucial for labor mobility. Population aging will worsen labor shortages, while AI could displace jobs with high AI exposure and low complementarity. The literature suggests that the likelihood and cost of labor mobility across occupations depend on the similarity of skill sets between occupations. Following Gathmann and Schönberg (2010), we construct a measure of skill distance between occupation pairs using skill content data from Occupational Information Network of Japan.

$$S\_dis_{i,j} = \frac{1}{2}\left(1 - AngSep_{i,j}\right) \tag{3}$$

Where $S\_dis_{i,j}$ is skill distance between occupations *in* and *j,* while $AngSep_{i,j}$ is the angular separation between the skill vectors of the two occupations measured as:

$$AngSep_{i,j} = \frac{\sum_{d=1}^{D}\left(s_i^D \times s_j^d\right)}{\left[\sum_{d=1}^{D}\left(s_i^d\right)^2 \times \sum_{d=1}^{D}\left(s_J^d\right)^2\right]^{\frac{1}{2}}}, \tag{4}$$

where S_i^d is the importance of skill dimension *d* in occupation *i*. *D* is the total number of skill dimensions being considered. The skill distance index ranges between 0 and 1, with 0 indicating that the two occupations require exactly the same set of skills, and 1 that the skills required by one occupation are orthogonal to the skills demanded by the other occupation.

IV. Main findings

Labor shortages are negatively associated with population aging. Our analysis indicates that in sectors that have been more affected by aging (sectors with lower share of employees ages 15-34 or higher share of workers 55 and above), more firms tend to report labor shortages 5 years later (Table 1).[5] The finding is robust to a different model specification and the inclusion of different controls. While we have used 5-year lags to mitigate the endogeneity problem, there still could be some residual endogeneity that might bias the results. From control variables, the new job opening rate has consistent positive association with labor shortages across all the specifications. We also identified considerable persistence in labor shortages highlighting its

[5] As a robustness check, we also used the share of seniors (ages 55 and above) in employment instead of young workers with similar qualitative results.

structural nature. This may also indicate low labor mobility in Japan across sectors. Given the current demographic trends, our findings suggest that labor shortages are likely to intensify further going forward.

Table 1. Japan: Labor Shortages and Aging

Dependent variable: Labor shortages reported by firms by sectors (percent balance)

	(1)	(2)	(3)	(4)
Lagged labor shortages	0.417***	0.298**	0.618***	0.263**
	(0.0876)	(0.125)	(0.0613)	(0.126)
New job opening as percent of total employment	0.455*	1.435***	0.380*	1.352***
	(0.251)	(0.511)	(0.213)	(0.495)
Share of workers age 15-34 (5 year lag)	**-0.168***	**-1.119***	**-0.223*****	
	(0.0960)	**(0.649)**	**(0.0827)**	
Share of workers aged 55+ (5 year lag)				**1.618***
				(0.809)
Labor force growth	0.153			
	(0.173)			
Labor force growth (5 year lag)		-0.111		-0.152
		(0.203)		(0.200)
Sectoral real value added growth	0.0305	0.0380	0.182**	-0.0138
	(0.0866)	(0.103)	(0.0856)	(0.102)
Change in average hours worked	0.245	-0.166	0.679***	0.112
	(0.305)	(0.399)	(0.253)	(0.392)
Wage growth	0.339	0.725**	-0.0983	0.563
	(0.238)	(0.355)	(0.191)	(0.337)
Constant	9.083**	36.52**	-9.812**	-34.26
	(4.431)	(17.50)	(3.874)	(24.50)
Fixed effect	Yes	Yes	Yes	Yes
Time effect	Yes	Yes	Yes	Yes
Observations	121	66	165	66
R-squared	0.82	0.66	0.93	0.30

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Aging seems to have also weighed on labor productivity in Japan. The results suggest that aging in the labor force is negatively associated with labor productivity growth (Table 2).[6] This finding is in line with the literature that identified a negative link between aging and productivity (Wesselius and Maestas, Mullen, and Powell (2023)). The negative and statistically significant coefficient for the initial level of labor productivity provides evidence for conditional convergence among Japanese sectors. As expected, the investment rate has a positive and statistically significant association with labor productivity. However, we were unable to identify any statistically significant link between labor productivity growth and the share of part-time and female workers.[7]

[6] The analysis also controls for the share of part-time and female workers.

[7] The literature suggests that the productivity impact of part-time and female employment is not uniform, since it depends on job quality, sector, institutional settings, and broader labor market policies.

Japan's workers are relatively less exposed to AI compared with other advanced economies.[8] Japan has a larger share of workers with low exposure to AI compared with other G7 countries, driven by a relatively sizable share of the service workers, possibly due to Japan's aging population. At the same time, the share of workers that have high exposure and low complementarity to AI is larger compared with the United States or Germany (Figure 4). Looking across occupations suggests that managers and professionals tend to concentrate in high exposure and high complementarity occupations in Japan like in other countries, while clerical workers and sales workers are most vulnerable to the adoption of AI, as they have high exposure but low complementarity. In contrast, services workers, security workers, manufacturing processing, packaging/carrying are less exposed to AI, although certain occupations such as manufacturing processing are exposed to automation. By gender, women tend to concentrate in high exposure and low complementarity occupations, with great risks of being displaced. By age group, the cohort of 65 years old and above is least exposed to AI, as most of this age group concentrates in service-related occupations that cannot be easily replaced by AI. However, the 55 to 64 age cohorts' vulnerability to the introduction of AI is somewhat higher and similar to middle-aged groups, as they tend to work in clerical and sales-related occupations with greater risks of being displaced (Figure 4).

Table 2. Japan: Aging and Labor Productivity

Dependent variable: annualized log change of labor productivity by sector

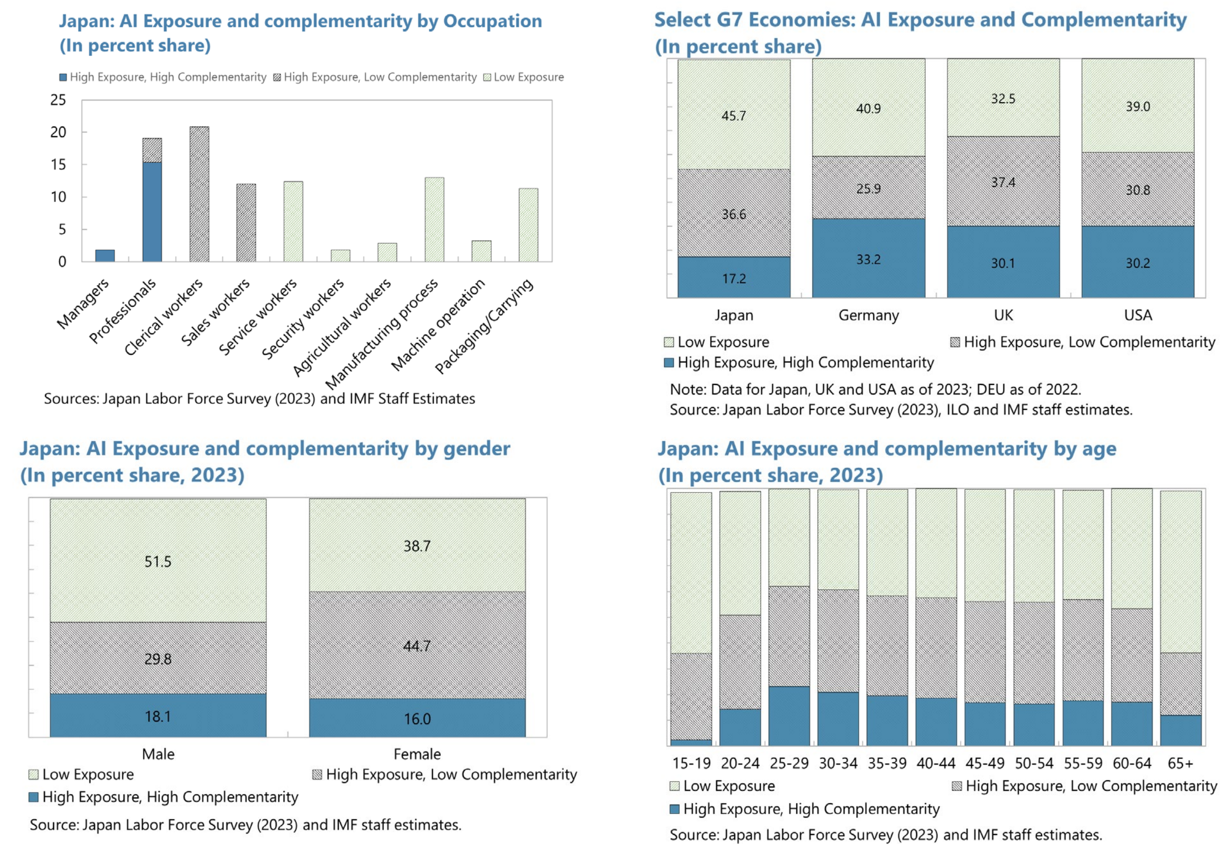
	Coefficient	Std. error
Const.	0.0939	(0.0153)***
Initial level of labor productivity (log)	-0.0215	(0.0039)***
Investment rate (log, 10-year average)	0.0093	(0.0044)**
Share of part-time workers (10-year average)	-0.0118	(0.0386)
Share of female workers (10-year average)	-0.0377	(0.0272)
Share of workers aged 55+ (10-year average)	**-0.1057**	**(0.0367)*** **
Time dummy for 2010-2021	0.0026	(0.0066)
Obs	194	
Sectors	97	
Sample period	2000-2010, 2010-2021	
Adjusted R^2	0.196	

Advances in AI may help mitigate Japan's labor shortages. In 2023, 14 percent of all workers were seniors (Table 3). The share of seniors in the top five sectors that report most severe labor shortages ranges from 2.5 percent (ICT) to 17 (construction) percent. In construction and transportation services sectors, AI may help alleviate aging-induced labor shortages, although the share of occupations with high AI exposure and low complementarity is relatively low. In scientific research and ICT services, seniors are concentrated in professional and clerical occupations. While both face high AI exposure, clerical workers have low complementarity, allowing AI to mitigate aging-induced labor shortages. In medical and healthcare services, AI may have limited room to address aging-induced labor shortages because seniors currently work in

[8] Our findings are robust to using the ILO data for Japan.

occupations with either low AI exposure or high AI exposure and high complementarity. Going forward, more advances in AI could raise the share of high complementarity in occupations where seniors are prevalent, which would help further alleviate labor shortages.

Figure 4. Japan: AI Exposure by Occupation, Gender, Age Groups and across G7



Skill transferability between different occupations varies considerably, highlighting the role for labor market policies to facilitate labor mobility (Table 4). Our measure of skill distance suggests that both task and knowledge requirements between occupations with high AI exposure and those with low exposure are very different. For example, task distance between professionals and cleaning occupations is 0.99. Similarly, the knowledge distance between sales and manufacturing workers is 0.8. This implies that labor mobility between these two broad categories of occupations will be very hard to achieve, which has important implications for policies on education and training to facilitate mobility. Indeed, fewer than 20 percent of new hires in high AI exposure occupations that switched jobs came from low AI exposure roles, dropping to 10 percent for occupations with both high AI exposure and complementarity (Figure 5). Labor flows into low AI exposure occupations show a similar trend. In contrast, about 30 percent of hires in high AI exposure, high complementarity roles moved from jobs with high AI exposure but low complementarity, aligning with previous research (Cazzaniga et al., 2024). Our findings also suggest high task similarities between managerial and professional workers, both of which are highly exposed to AI and have high complementarity. While differences in task requirements between low and high complementarity occupations with high AI exposure are moderate, their knowledge requirements differ more. Task and knowledge requirement differences across occupations highlight the importance of targeted occupation-oriented active labor market policies to reskill the labor force to help displaced workers move to occupations in demand.

Table 3. Japan: Share of Workers 65+ in Employment by Sectors and Occupation, 2023

	Total	Administrative and managerial workers	Professional and engineering workers	Clerical workers	Sales workers	Service workers	Security workers	Agricultural, forestry and fishery workers	Manufacturing process workers	Transport and machine operation workers	Construction and mining workers	Carrying, cleaning, packaging, and related workers
All industries	13.5	0.6	1.5	1.6	1.3	2.1	0.3	1.5	1.4	0.7	0.7	1.7
Mining and quarrying of stone and gravel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Construction	**16.6**	**1.4**	**1.0**	**2.7**	**0.6**	**0.2**	**0.2**	**0.2**	**1.0**	**0.8**	**8.5**	**0.6**
Manufacturing	8.3	0.6	0.3	1.1	0.3	0.0	0.0	0.0	5.2	0.2	0.1	0.8
Information and communications	**2.5**	**0.4**	**1.1**	**0.7**	**0.4**	0.0	0.0	0.0	**0.4**	0.0	**0.0**	**0.0**
Transport and postal activities	**11.7**	**0.6**	**0.0**	**1.7**	**0.0**	**0.0**	**0.3**	0.0	**0.0**	**6.3**	**0.0**	**2.6**
Wholesale and retail trade	12.7	0.7	0.4	1.6	5.7	0.0	0.1	0.0	1.9	0.1	0.1	2.1
Finance and insurance	4.5	0.0	0.0	1.3	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Real estate and goods rental and leasing	26.6	2.9	0.7	3.6	8.6	8.6	0.0	0.0	0.0	0.7	0.0	2.2
Scientific research, professional and technical services	**13.3**	**0.4**	**7.8**	**2.7**	**0.4**	**0.0**	0.0	**0.0**	**0.4**	**0.0**	**0.4**	**0.0**
Accommodations, eating and drinking services	14.3	0.3	0.3	0.3	0.3	12.1	0.0	0.0	0.0	0.0	0.0	1.8
Living-related and personal services and amusement serv	19.6	0.4	0.4	0.9	0.9	12.9	0.0	0.4	0.4	0.0	0.0	2.7
Education, learning support	10.2	0.3	6.4	1.5	0.0	0.6	0.0	0.0	0.0	0.6	0.0	0.9
Medical, health care and welfare	**11.8**	**0.2**	**3.6**	**1.0**	**0.0**	**5.1**	**0.1**	0.0	**0.1**	**0.9**	0.0	**0.7**
Compound services	4.3	0.0	0.0	2.1	0.0	0.0	0.0	2.1	0.0	0.0	0.0	2.1
Services, N.E.C.	22.5	0.7	1.1	3.3	0.2	1.1	3.5	0.2	1.5	0.9	0.0	10.0

Sources: Ministry of Health, Labor, and Welfare and IMF staff Calculations.
Note: The table shows the share of workers age 65+ for each occupation in each sector. Occupations marked red are those that have high AI exposure and complementarity, blue occupations are the ones with high AI exposure but low complementarity, while the black colored occupations are the ones with low AI exposure. The top five sectors with the most labor shortages are marked green.

Table 4. Japan: Skill Distance Across Occupations

Knowledge / *Tasks*	Administrative and managerial workers	Professional and engineering workers	Clerical workers	Sales workers	Service workers	Security workers	Agricultural, forestry and fishery workers	Manufacturing process workers	Transport and machine operation workers	Construction and mining workers	Carrying, cleaning, packaging, and related workers
Administrative and managerial workers	**0.00**	0.27	0.20	0.16	0.53	0.42	0.64	0.71	0.80	0.57	0.90
Professional and engineering workers	0.08	**0.00**	0.46	0.46	0.52	0.21	0.64	0.64	0.75	0.55	0.91
Clerical workers	0.17	0.18	**0.00**	0.23	0.43	0.38	0.69	0.80	0.68	0.68	0.65
Sales workers	0.22	0.33	0.09	**0.00**	0.33	0.64	0.58	0.79	0.73	0.69	0.72
Service workers	0.80	0.82	0.51	0.42	**0.00**	0.53	0.58	0.87	0.57	0.81	0.41
Security workers	0.14	0.07	0.22	0.39	0.76	**0.00**	0.65	0.65	0.48	0.54	0.66
Agricultural, forestry and fishery workers	0.71	0.74	0.94	0.85	0.58	0.71	**0.00**	0.38	0.39	0.42	0.35
Manufacturing process workers	0.64	0.61	0.90	0.90	0.76	0.61	0.12	**0.00**	0.36	0.21	0.38
Transport and machine operation workers	0.91	0.90	0.92	0.85	0.35	0.78	0.15	0.24	**0.00**	0.37	0.17
Construction and mining workers	0.43	0.48	0.78	0.71	0.81	0.50	0.17	0.13	0.41	**0.00**	0.49
Carrying, cleaning, packaging, and related workers	0.95	0.99	0.80	0.69	0.15	0.92	0.29	0.43	0.11	0.58	**0.00**

Source: Occupational Information Network of Japan and IMF staff calculations.
Note: Skill distance index measures the degree of skill dissimilarity required by two occupations. Skill distance=0 if two occupations require the same skill set and =1 if two occupations require entirely different skill sets. Occupations marked red are those that have high AI exposure and complementarity, blue occupations are the ones with high AI exposure but low complementarity, while the black colored occupations are the ones with low AI exposure.

Table 5. Japan: Occupational Mobility, 2015
(Employed person that switched jobs, percent of total employment)

To \ From	Total	Administrative and managerial workers	Professional and engineering workers	Clerical workers	Sales workers	Service workers	Security workers	Agricultural, forestry and fishery workers	Manufacturing process workers	Transport and machine operation workers	Construction and mining workers	Carrying, cleaning, packaging, and related workers
Administrative and managerial workers	4.9	1.4	0.7	1.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Professional and engineering workers	10.2	0.1	6.3	1.0	0.7	1.1	0.0	0.1	0.4	0.1	0.1	0.2
Clerical workers	12.8	0.2	1.0	7.0	1.8	1.3	0.2	0.1	0.6	0.1	0.1	0.4
Sales workers	12.9	0.0	0.6	1.5	6.0	2.6	0.1	0.0	0.9	0.1	0.1	0.7
Service workers	16.1	0.0	0.9	1.5	2.5	8.3	0.1	0.0	1.3	0.1	0.1	0.9
Security workers	8.8	0.0	0.8	0.8	0.8	0.8	2.4	0.0	0.8	0.8	0.0	0.8
Agricultural, forestry and fishery workers	7.2	0.0	0.5	0.9	0.5	0.9	0.0	0.9	1.4	0.5	0.5	0.9
Manufacturing process workers	11.7	0.0	0.3	0.8	1.2	1.5	0.1	0.1	5.8	0.2	0.3	1.1
Transport and machine operation workers	13.8	0.0	0.5	0.9	0.9	0.5	0.5	0.0	1.8	6.5	0.9	1.4
Construction and mining workers	9.7	0.0	0.3	0.3	0.7	0.7	0.0	0.0	1.3	0.3	5.0	0.3
Carrying, cleaning, packaging, and related workers	17.3	0.0	0.7	1.6	2.0	2.5	0.2	0.2	3.1	0.7	0.4	5.4

Source: Labor Force Survey and IMF staff calculations. Note: Occupations marked red are those that have high AI exposure and complementarity, blue occupations are the ones with high AI exposure but low complementarity, while the black colored occupations are the ones with low AI exposure.

V. Conclusions

Japan's labor market stands at a crossroads, where the intersecting dynamics of aging and AI present both structural challenges and transformative opportunities. This paper finds that the country's ongoing demographic shift is already exerting pressure on labor supply, contributing to persistent and intensifying labor shortages as well as weighing on labor productivity. The continued trend in population aging is likely to exacerbate these challenges. At the same time, advances in AI offer an opportunity to alleviate labor shortages and boost productivity, though it could result in job displacements.

Japan's response to demographic shifts contains valuable lessons. Thanks to the government's policies, Japan achieved an impressive increase in participation rates among women and seniors that has mitigated the impact of population aging on labor supply. However, the higher labor force participation of seniors generally involved shorter hours worked, partly due to some policy-induced disincentives like the income thresholds for pension earners.

Improving labor mobility would be critical to capitalize on benefits offered by advances in AI. Our findings suggest that the nature of Japan's current occupational structure—higher share of occupations with low exposure to AI—and the current state of AI technologies could limit the potential for AI to relieve the pressures of aging-induced labor shortages. However, the progress in AI has been immense and going forward continued advances in AI technologies could increase AI exposure and complementarity in occupations where seniors are prevalent, which would help further alleviate labor shortages. In addition, the analysis in this paper revealed considerable gaps in skill demands between occupations with high exposure to AI and those that have low exposure. This suggests that achieving labor mobility across these occupations may require targeted active labor market policies to facilitate transition from AI-displaced jobs to occupations in demand.

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