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Transforming the Future: The Impact of Artificial Intelligence in Korea

Korea

Soo Jung Chang, Hamin Lee, Sumin Lee, Samil Oh (all from Bank of Korea); Zexi Sun, and Xin Cindy Xu (IMF)

SIP/2025/013

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Transforming the Future: The Impact of Artificial Intelligence in Korea

Prepared by Soo Jung Chang, Hamin Lee, Sumin Lee, Samil Oh, Zexi Sun, and Xin Cindy Xu*

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March 2025

ABSTRACT: This paper examines the economic impact of Artificial Intelligence (AI) in Korea. Korea is among the global frontrunners in AI adoption, with higher adoption rates among larger, younger, and technologically advanced firms. AI holds the promise for boosting productivity and output, though the effects are more pronounced among larger and mature Korean firms. About half of jobs are exposed to AI, with higher exposures among female, younger, more educated, and higher income workers. Korea's strong innovation and digital infrastructure highlights its AI readiness, while enhancing labor market flexibility and social safety nets are essential to fully harness AI's potential.

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Transforming the Future: The Impact of Artificial Intelligence in Korea

Korea

Prepared by Soo Jung Chang, Hamin Lee, Sumin Lee, Samil Oh (all from Bank of Korea); Zexi Sun, and Xin Cindy Xu (IMF)[1]

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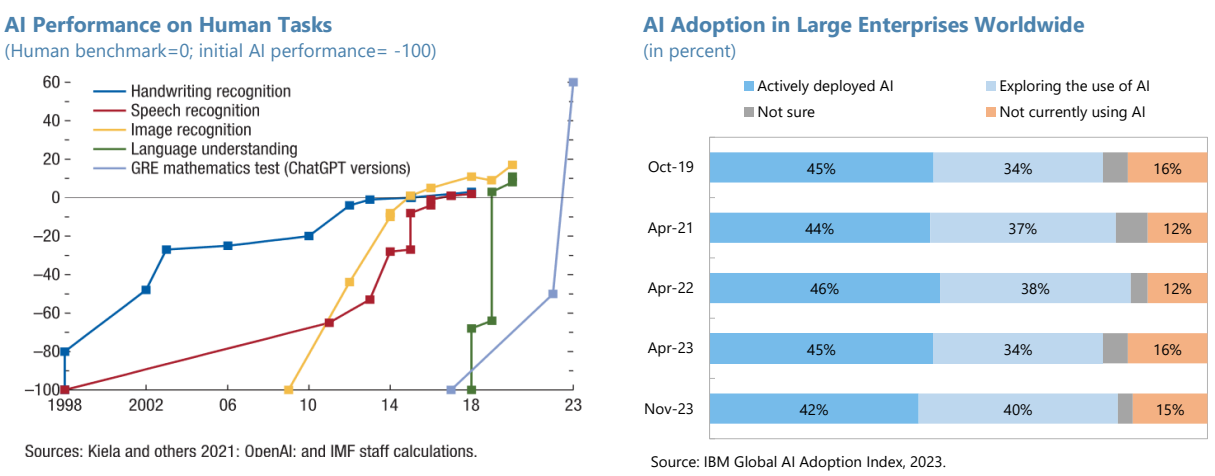
CONTENTS

TRANSFORMING THE FUTURE: THE IMPACT OF ARTIFICIAL INTELLIGENCE IN KOREA[1]

A. Introduction

1. Artificial Intelligence (AI) has emerged as a transformative force globally (Figure 1). AI represents a wide range of technologies designed to enable machines to mimic human cognitive abilities (Cazzaniga et al., 2024). Recent advances in AI, notably the emergence of generative AI (GenAI) that includes systems such as large language models and generative pretrained transformers, have marked a leap in the ability of technology to outperform humans in several cognitive areas (IMF WEO, April2024). According to the IBM 2023 survey, a significant share of large enterprises (over 1,000 employees) globally has adopted AI, with 42 percent of surveyed IT Professionals deploying AI and an additional 40 percent reporting active exploration in November 2023[2].

Figure 1. AI Innovation and Adoption in the World



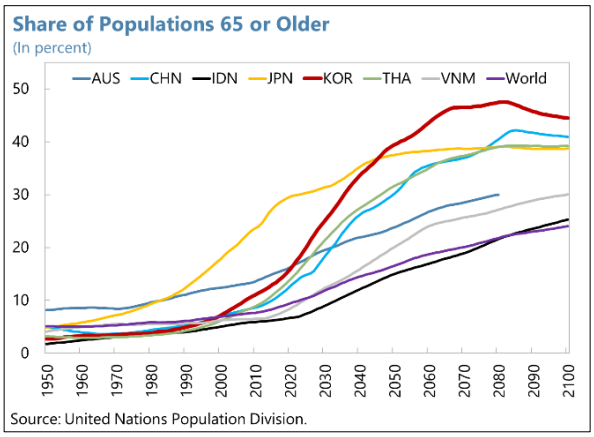
Note: Left figure is from IMF WEO, April 2024 Chapter 1, based on a number of tests in which human and AI performance were evaluated in five different domains, from handwriting recognition to language understanding. For the GRE mathematics test, the human benchmark is set at the median percentile, with –100 in 2017 reflecting the publication of the seminal paper on GPTs. AI = artificial intelligence; GRE = Graduate Record Examination; GPTs = generative pretrained transformers. Right figure is from the IBM Global AI Adoption Index, 2023.

2. In a rapidly aging economy like Korea, AI adoption could have a profound impact. AI offers both opportunities and challenges for aging economies. As populations age, economies face

[1] Prepared by Soo Jung Chang, Hamin Lee, Sumin Lee, and Samil Oh (all BoK), Zexi Sun and Xin Cindy Xu (all IMF).

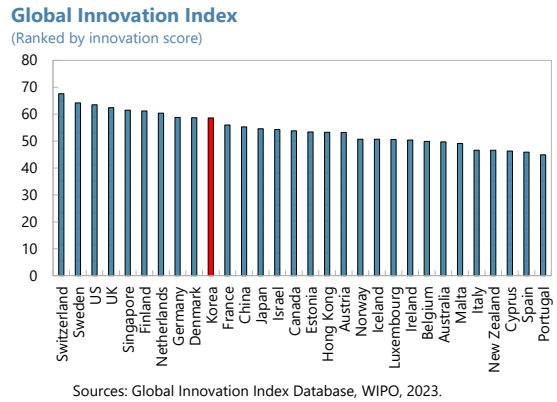
[2] The IBM 2023 survey covers 2,342 IT Professionals at large enterprises (with over 1,000 employees) from Australia, Canada, China, France, Germany, India, Italy, Japan, Singapore, Korea, Spain, UAE, UK, US, Brazil, Mexico, Peru, Argentina, Chile, and Colombia. Participants must be employed full-time, work at companies with more than 1,000 employees, in a manager or higher-level role, and have at least some knowledge about how IT operates and is used by their company. See more details in IBM global AI adoption index.

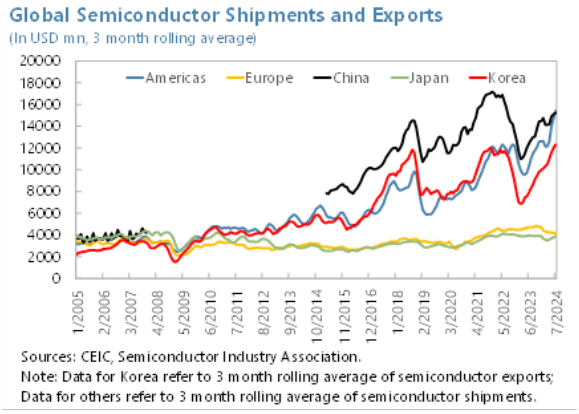
potential labor shortages, slowdowns in productivity and increased pressures on healthcare and pension systems. AI can play a pivotal role in addressing these issues by complementing human labor, enhancing productivity, improving healthcare, and providing innovative solutions for elderly care. Meanwhile, AI could also cause job displacement, reduce worker incomes, and increase inequality, especially for the elderly group as they tend to face more challenges adapting to technology changes. As during the introduction of past general-purpose technologies, the impact of AI on economic outcomes, remains highly uncertain.



3. As a leading innovator and semiconductor producer, Korea is highly exposed to AI. Korea is widely recognized as a leading technology innovator and consistently ranks high on various global innovation indexes (Figure 2). Notably, Korea is home country to some of the world's top technology companies and semiconductor manufacturers. AI technologies require advanced processing capabilities, leading to increased demand for high-performance computing chips, such as GPUs (Graphics Processing Units) and specialized AI processors. Korean companies have been investing in the development and production of these chips, catering to the needs of AI systems. In 2024H1, Korean semiconductor exports have significantly expanded, benefiting from the global AI boom, accounting for about 23 percent of global chips exports (Figure 2). While the global AI boom presents significant opportunities, challenges also exist for the Korean chip industry, including from intense global competition, technological complexities, geopolitical tensions and trade disputes, and the need for continuous innovation.

Figure 2. Korea As a Top Innovator and Chip Producer





4. Literature on the economic impact of AI has been growing, but comprehensive studies on Korea remain limited. A large body of existing research has focused on potential labor market effects in advanced economies, including the job displacement impact (e.g. Felten, et al., 2021 and

2023) and complementary roles of AI (Pizzinelli, et al. 2023). Some studies have also assessed the aggregate productivity and output gains from the AI adoption, with a wide range of estimates (e.g. Acemoglu, 2024; Briggs and Kodnani, 2023; McKinsey, 2023). A few studies have investigated the relationship between AI use and firm performance (e.g. OECD, 2023). The recent IMF work (Cazzaniga, et al. 2024) has provided a comprehensive analysis of the multifaceted economic impact of AI across developing and advanced economies. Relevant literature is also growing in Korea, including the recent work by Han and Oh (2024) and the Korea Development Institute (KDI, 2023) on the impact of AI on the Korean labor market and the AI-related policies and regulations (KDI, 2024). But a comprehensive assessment of the broad economic and policy implications of AI adoption in Korea - across labor market, firm productivity, industry development, and the society's readiness for AI transition - seems lacking.

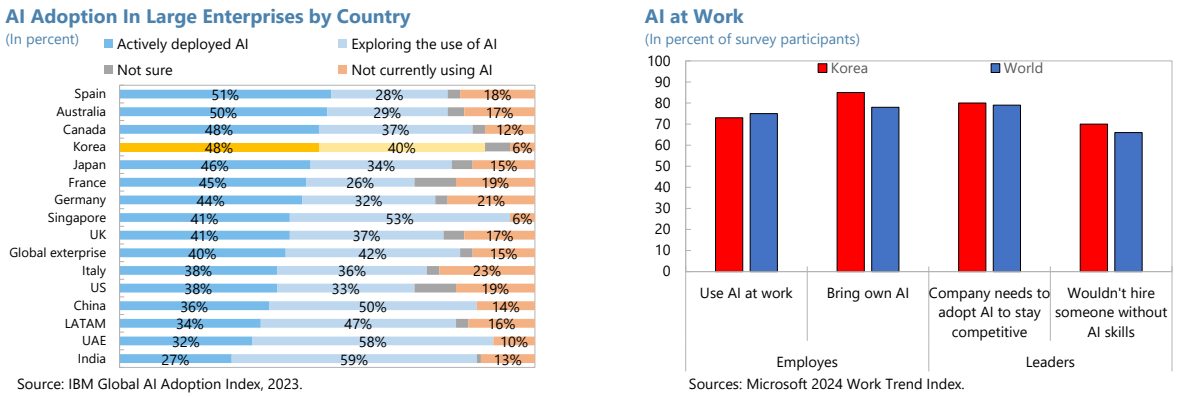
5. Drawing on recent literature, this paper aims to shed light on the multifaceted economic impact of AI in Korea. Section 2 presents some stylized facts on AI adoption in Korean firms and workers. Section 3 examines the labor market impact of AI, including complementary and displacement effects, based on the Korean labor survey data. Section 4 assesses the impact of AI on productivity and output, including model-based estimates and firm-level empirical analysis. Section 5 analyzes Korea's readiness for AI transition and identifies key areas for improvements relative to global leaders. Section 6 concludes with policy recommendations to help fully harness AI's potential while also safeguarding vulnerable groups in Korea.

B. AI Adoption

6. Korea is among the global frontrunners in AI adoption (Figure 3). According to the IBM 2023 survey, 40 percent of IT Professionals at large Korean enterprises reported using AI, on par with the sample average of 20 surveyed countries, while an additional 48 percent reported active exploration in November 2023, the second highest among 20 surveyed countries. Only 6 percent of surveyed Korean enterprises reported not using or exploring AI, compared with the sample average of 15 percent, among the lowest (together with Singapore) in 20 surveyed countries. Korean workers are actively using AI at work. According to the Microsoft "2024 Work Trend Index" survey, 73 percent of Korean knowledge workers are utilizing AI at work, slightly less than the global average (including 31 surveyed economies) of 75 percent.[3] About 80 percent of Koreans workers are bringing their own AI tools to work, higher than 78 percent globally. Moreover, 80 percent of Korean business leaders believe that their companies need to adopt AI to stay competitive and 70 percent indicate they would not hire candidates without AI skills, also higher than the global average.

[3] The Work Trend Index survey was conducted by an independent research firm among 31,000 full-time employed or self-employed knowledge workers (those who typically work at a desk) across 31 markets (1000 full-time workers each market) in early 2024. See more details in 2024 Work Trend Index Annual Report.

Figure 3. Korea At Global Forefront in AI Adoption

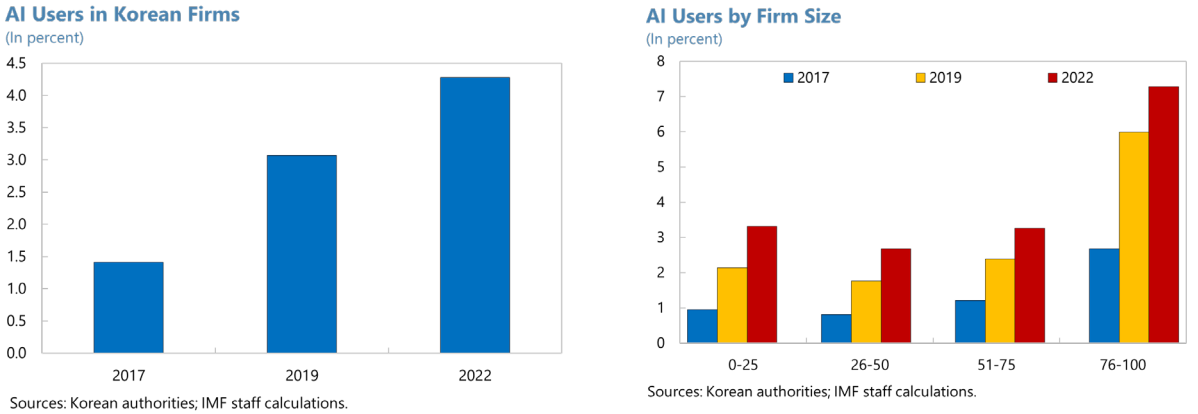


Source: IBM Global AI Adoption Index, 2023.

Sources: Microsoft 2024 Work Trend Index.

7. AI usage is rising in Korean firms, notably among large, young, and tech-related firms (Figure 4). According to the Korean Statistics Survey of Business Activities, the share of AI users among Korean firms has increased from 1.4 percent in 2017 to 4.3 percent in 2022. The increase is broad-based across different types of firms by size, age, and industries. The AI adoption rate is notably higher among larger (those with assets above the 75th percentile), younger (those aged below 5 years), and more tech intensive firms (those with patents and those actively exploring a variety of technologies). Firms mainly use AI for product development, followed by manufacturing, sales, marketing strategy, and organizational management. Among industries, the information and communication industry (ICT) recorded the highest AI adoption rate of about 18 percent in 2022, followed by professional services. The observed pattern seems largely consistent with peer countries documented in OECD (2023).

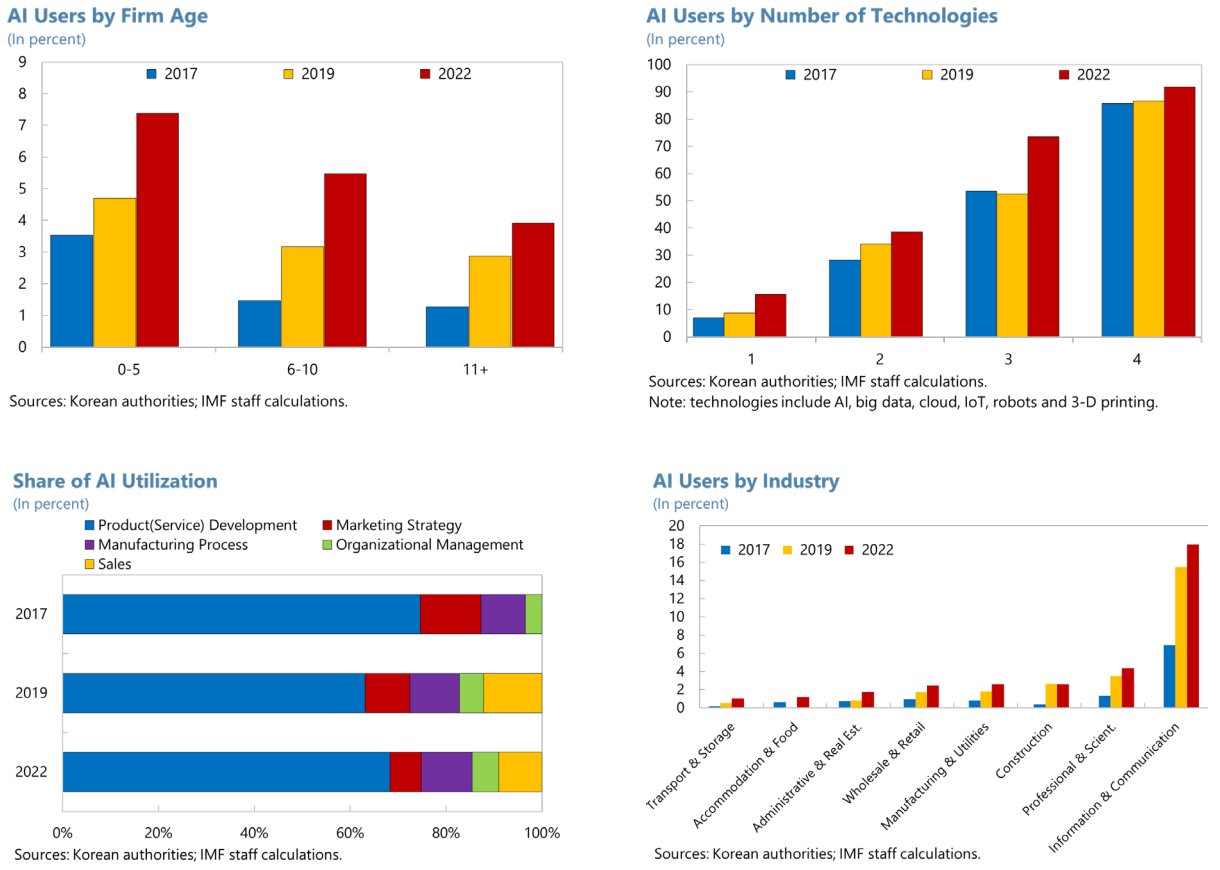
Figure 4. Rising AI Usage in Korean Firms



Sources: Korean authorities; IMF staff calculations.

Sources: Korean authorities; IMF staff calculations.

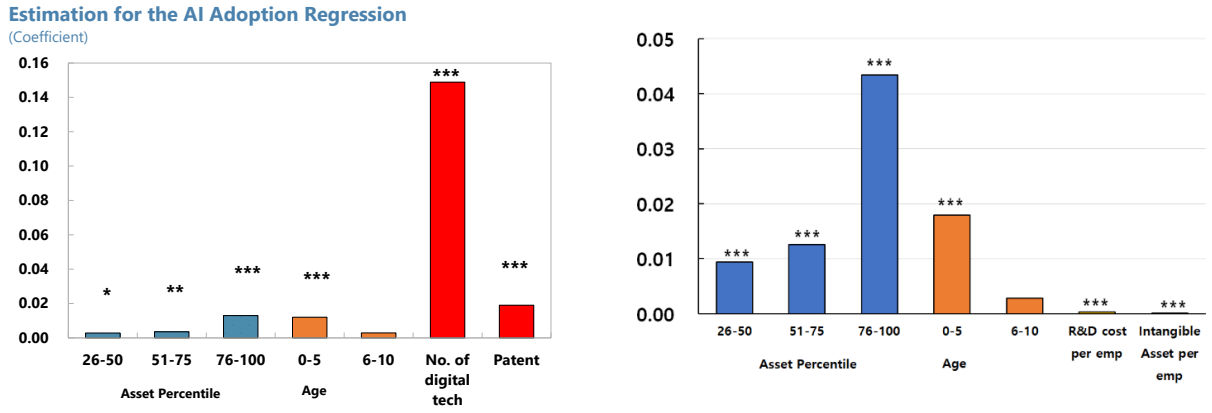
Figure 4. Rising AI Usage in Korean Firms (concluded)



Note: Chart data is authors' calculations from Korea Statistics, Survey of Business Activities. Firm size is measured by quantiles of firm asset size. Technologies include AI, big data, cloud, IoT, robots, and 3-D printing.

8. Empirical analysis confirms the significant role of firm size, age, and complementary assets in driving AI adoption. Since unconditional correlation between AI use and firm characteristics may be influenced by the composition of various industry sectors, we conduct a regression analysis to identify the key factors driving AI adoption in firms. Specifically, we use a linear probability model, with AI usage (0-1 dummy) as the dependent variable, and key firm characteristics discussed earlier as explanatory variables. Complementary factors encompass digital capabilities (measured by the number of digital technologies excluding AI) and innovativeness (measured by patent ownership, R&D expenditure per employee, and intangible asset per employee). We also account for year and 2-digit industry fixed effects. The estimation results, shown in Figure 5, indicate that larger, younger, tech-related, and innovative firms are more likely to adopt AI, even after controlling for other factors. Furthermore, the results remain consistent across different model specifications.

Figure 5. Estimation Results for the Adoption Regression



Sources: Korea Statistics, Survey of Business Activities; and authors' calculations

Note: The y-axis of the graph represents the regression coefficient. Statistical significance based on robust standard errors is reported above bars: *** p<0.01, ** p<0.05, * p<0.1. Year and industry fixed effects coefficients are not reported.

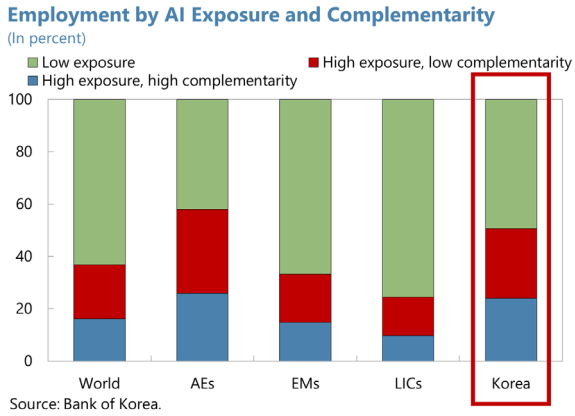
C. AI and Labor Market

AI Exposure and Complementarity

9. About 50 percent of jobs in Korea are exposed to AI. To examine the impact of AI on jobs, it is common to conceptualize occupations as a collection of tasks and to assess which of these tasks may be replaced or enhanced by technological advancements. Building on the work of Cazaaniga, et al. (2024), we utilize a conceptual framework grounded in Felton et al. (2021, 2023) and Pizzinelli, et al. (2023) to measure the extent to which human labor is exposed to and complemented by AI. Felten, et al. (2021, 2023) defines "exposure" to AI as the degree of overlap between AI capabilities and the human skills required in various occupations. Meanwhile, Pizzinelli, et al. (2023) develops an index of potential AI complementarity, measuring the extent to which an occupation is shielded from AI-induced job displacement. Based on these two criteria, occupations can be classified into three categories: "high exposure, high complementarity"; "high exposure, low complementarity"; and "low exposure." In Korea, approximately 50 percent of employment falls within high-exposure occupations, with 24 percent in high-complementarity and 27 percent in low-complementarity (Figure 6). The proportion of high-exposure occupations in Korea is slightly lower compared to some other advanced economies (AEs).

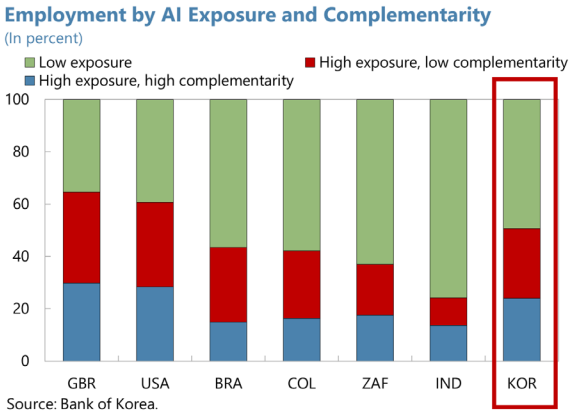
Figure 6. Employment Shares by AI Exposure and Complementarity

Country Groups v.s. Korea



Source: Bank of Korea.

Selected Countries v.s. Korea

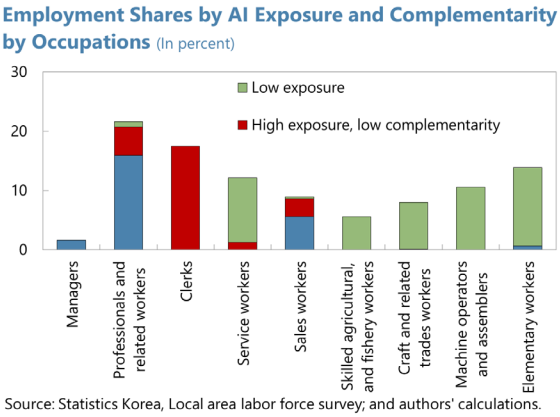


Source: Bank of Korea.

Note: Chart data is authors' calculations from Statistics Korea, Local area labor force survey, following Cazzaniga and others (2024). AEs = advanced economies; EMs = emerging market economies; LICs = low-income countries; World = all countries in the sample.

10. Professional occupations will likely benefit from AI, while clerical jobs are at risk of displacement by AI. Korea has a significant portion of workforce employed in professional occupations, which are characterized by both high exposure and high complementarity to AI, as well as in clerical roles, which exhibit high exposure but low complementarity (Figure 7). Due to this distribution of employment across both low- and high-complementarity occupations, Korea may experience a more polarized impact from the structural changes driven by AI. On one hand, there is an increased risk of job displacement and negative income effects for workers in high-exposure, low-complementarity roles. On the other hand, Korea is well-positioned to capitalize on the growth opportunities presented by AI, thanks to its larger share of employment in high-exposure, high-complementarity occupations.

Figure 7. Employment Shares by AI Exposure and Complementarity by Occupations



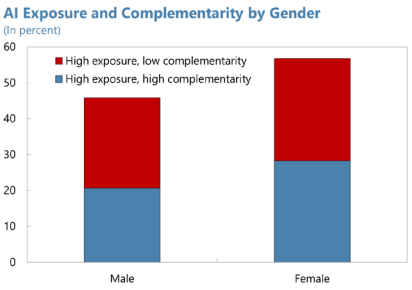
Source: Statistics Korea, Local area labor force survey; and authors' calculations.

11. Exposure to AI is higher among women, more educated workers, and younger individuals, but this is balanced by a greater potential for complementarity with AI (Figure 8).

Women are more likely to work in high-exposure occupations compared to men. Since this exposure is roughly evenly split between low and high-complementarity jobs, women face both greater risks and greater opportunities. In terms of education, higher levels of education correspond to a larger share of employment in high-exposure occupations, especially in roles with high complementarity to AI. This suggests that, unlike traditional technologies, AI may have a stronger impact on highly skilled workers. However, the risks of higher exposure are offset by greater complementarity potential. Lastly, younger workers are more likely to be in high-exposure occupations than older workers, largely due to their higher levels of education.

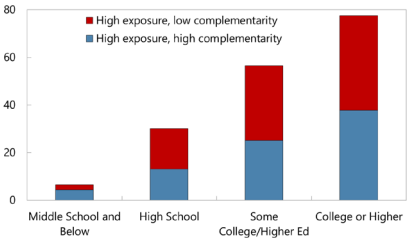
Figure 8. Share of Employment in High Exposure Occupations by Demographic Group

By Gender



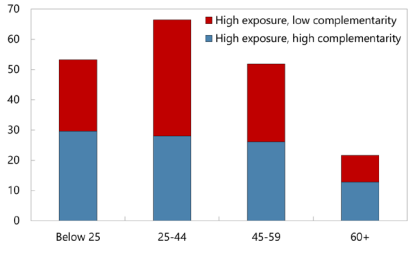
Source: Bank of Korea.

By Education



Source: Bank of Korea.

By Age



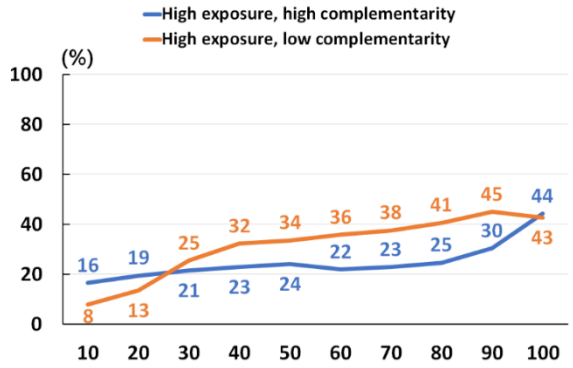
Source: Bank of Korea.

Note: Chart data is authors' calculations from Statistics Korea, Local area labor force survey, following Cazzaniga and others (2024).

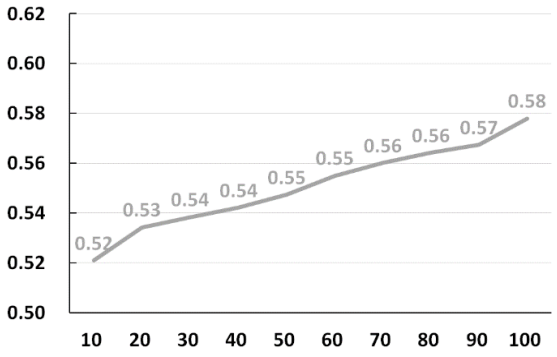
12. AI exposure tends to be higher for high-income groups, but potential gains from AI also increase with income (Figure 9). The share of employment in high-exposure occupations rises gradually as earnings deciles increase. This contrasts with previous waves of automation, where the risk of displacement was greatest for middle-income earners. However, jobs with high potential for AI complementarity are more concentrated among upper-income groups. The positive correlation between income and complementarity aligns with findings on education levels, suggesting that the benefits of AI are likely to disproportionately favor higher-income earners.

Figure 9. Occupation Exposures and Potential Complementarity by Income Deciles

High exposure occupations



Potential complementarity



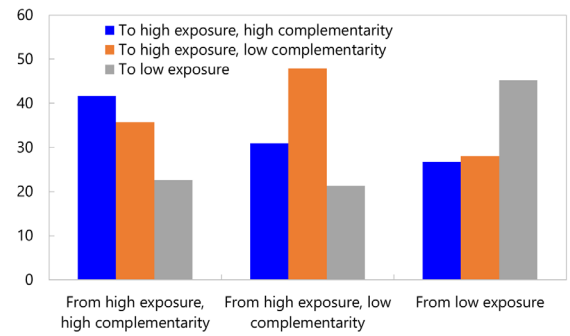
Source: Statistics Korea, Local area labor force survey; and authors' calculations

Worker Reallocation in the AI-Induced Transformation

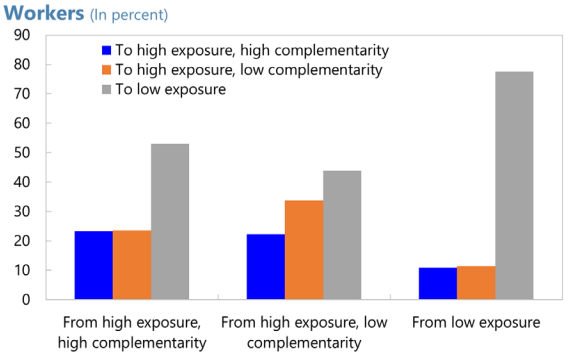
13. Historical patterns of job transitions provide insights into how adaptation to AI might unfold. In the long run, workers will adapt to changing skill demands and shifting sectors, with some transitioning into roles that have high AI complementarity, while others may struggle to keep up. The previous section offered a static snapshot of AI exposure based on the current employment landscape. However, over time, workers are likely to adjust to the evolving labor market. Historical patterns of job transitions can provide insights into how this adaptation might unfold. This section analyzes microdata from Korea (Korean Labor & Income Panel Study) to explore how workers transition between occupations with varying levels of AI exposure and complementarity.

14. College-educated individuals in AI-intensive jobs tend to remain in similar occupation categories when changing roles (Figure 10). The transition probability between occupations shows a stable pattern without significant changes over time(2009~2022). This suggests that the rigid labor market in Korea has remained largely unchanged[4]. Additionally, 31 percent of those leaving low-complementarity jobs transition to roles with higher AI complementarity, signaling a potential path for job ladder. Enhancing this mobility will be a key task for Korea as it seeks to boost competitiveness in an era of expanding AI technology. Interestingly, female workers are more likely than male workers to transition into high-exposure, high-complementarity (HEHC) roles, regardless of their previous job's exposure level. In contrast, non-college-educated workers are predominantly found in low-AI-exposure roles and are less likely to move into high-complementarity positions.

Figure 10. Occupational Transitions for Workers



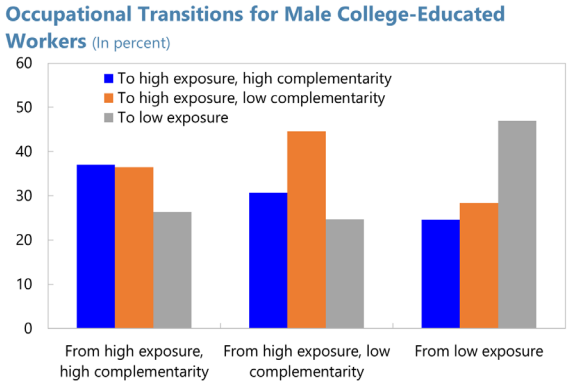
Source: Korean Labor & Income Panel Study; and authors' calculations.



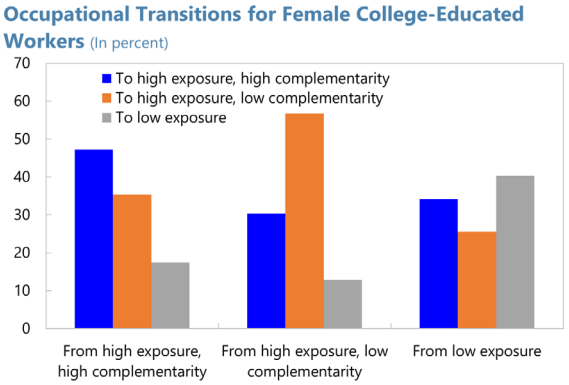
Source: Korean Labor & Income Panel Study; and authors' calculations.

[4] According to OECD, the strictness of employment protection in Korea (2.35) is higher than the OCED average (2.27).

Figure 10. Occupational Transitions for Workers (concluded)



Source: Korean Labor & Income Panel Study; and authors' calculations.

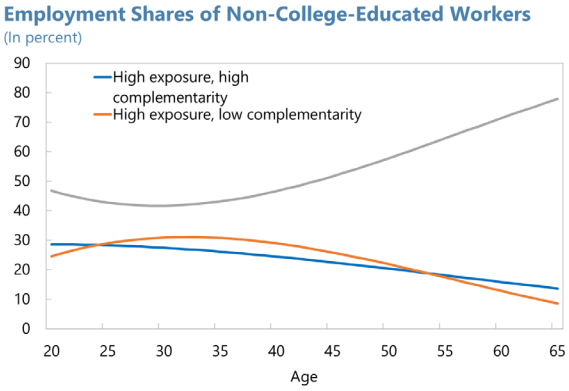


Source: Korean Labor & Income Panel Study; and authors' calculations.

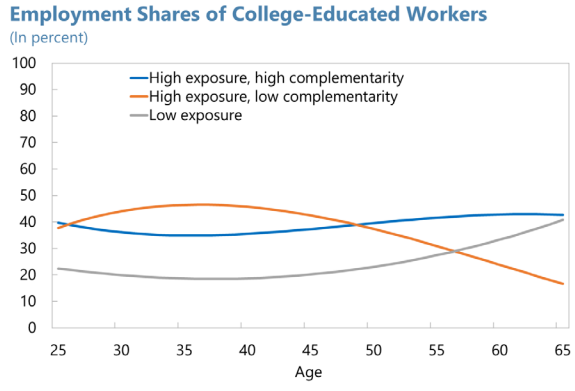
Note: The bars represent the average values from 2009 to 2022.

15. Throughout the life cycle, there was limited mobility between low- and high-complementarity jobs (Figure 11). In the no-college group, the proportion of workers in low-exposure jobs rises significantly with age, while the share of workers in high-exposure jobs declines steadily. Similarly, in the college-educated group, the proportion of HELC (high-exposure, low-complementarity) jobs decreases after age 50, with a corresponding increase in low-exposure roles. This trend suggests that as workers age, they are more likely to transition into simpler, repetitive jobs, potentially due to a shift toward manual labor just before or after retirement.

Figure 11. Life-Cycle Profiles of Employment Shares by Education Level



Source: Korean Labor & Income Panel Study; and authors' calculations.



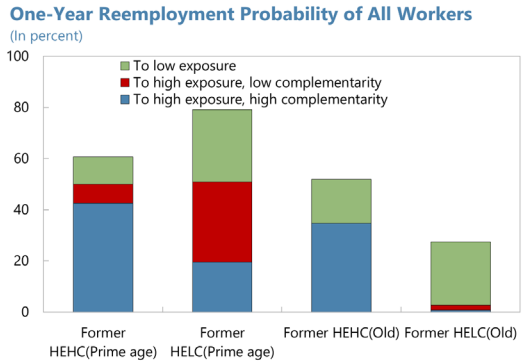
Source: Korean Labor & Income Panel Study; and authors' calculations.

Note: The panel plots the estimated share of employment by age for each exposure category for college- and non-college-educated workers, according to the calculations described in Cazzaniga, and others (2024).

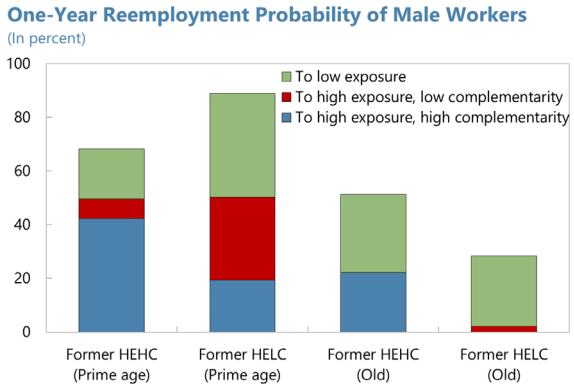
16. Older workers seem to be less adaptable to job mobility, as evidenced by their lower likelihood of finding reemployment after being unemployed (Figure 12). Among those who were unemployed last year, prime-age workers generally have an easier time securing new jobs within one year. For example, only 35 percent of older workers who were previously in HEHC roles managed to find jobs in the same category, compared to 43 percent of prime-age former HEHC workers. Furthermore, almost all older former HELC workers struggled to find positions in

high-exposure roles, with only 25 percent finding jobs in low-exposure categories. In contrast, 31 percent of prime-age former HELC workers found reemployment in the same category, and 19 percent managed to transition into HEHC roles. This suggests that older workers might encounter significant difficulties in adapting to job reallocation driven by AI. By gender, although men have higher overall reemployment rates, women are relatively more likely to move into HEHC roles.

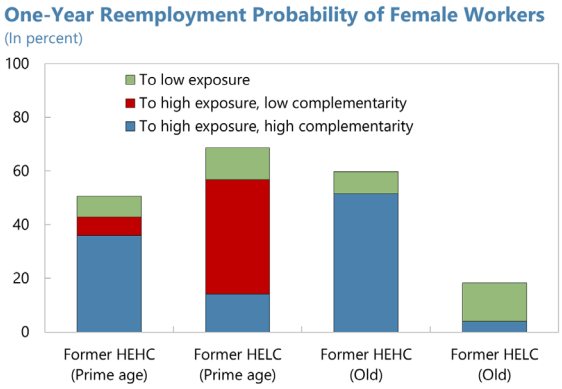
Figure 12. One-Year Reemployment Probability of Separated Workers



Source: Korean Labor & Income Panel Study; and authors' calculations.



Source: Korean Labor & Income Panel Study; and authors' calculations.



Source: Korean Labor & Income Panel Study; and authors' calculations.

Note: The bars represent the average values from 2010 to 2022.

D. AI, Productivity, and Output

Model Estimates: AI vs. Aging Impact on Productivity and Output

17. A model-based analysis explores AI's potential impact through three channels.[5] A task-based model described in Cazzaniga et al. (2024) is used to quantify the impact of AI adoption on productivity and output. In this model, AI takes effects through three channels: (i) labor displacement; (ii) labor complementarity; and (iii) overall productivity increase. First, AI adoption may

[5] See Rockall, Pizzinelli, and Tavares (forthcoming) on the modeling analysis.

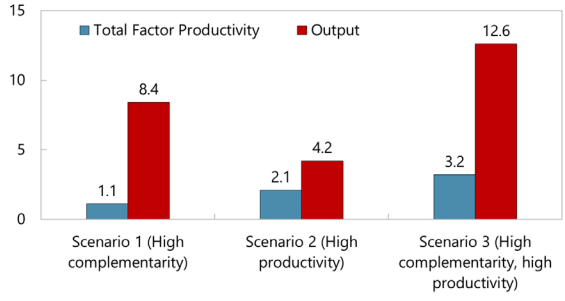
shift some jobs from humans to AI-driven systems, which enhances the productivity of completing these jobs, though at the expense of lower labor demand. Second, AI adoption could complement humans in some jobs without replacing them in these jobs. Third, AI adoption may lead to broad-based productivity gains across all jobs, thereby increasing the overall labor demand. The model is calibrated using the estimated AI exposure and complementarity of jobs in Korea (See Section 3).

18. The impact of AI is measured under three scenarios. AI adoption affects the economy through the labor displacement channels in all three scenarios. Moreover, in Scenario 1, AI affects the economy additionally through the labor complementarity channel. In Scenario 2, AI affects the economy additionally through the overall productivity increase. In Scenario 3, the additional AI impacts work both through the labor complementarity and overall productivity increase channels.

19. AI adoption leads to significant output and productivity gains, especially in Scenario 3 featuring both high labor complementarity and high overall productivity. As shown in the left chart of Figure 13, in Scenario 1, AI adoption leads to 1.1 percent increase in total factor productivity (TFP) and 8.4 percent increase in output. In Scenario 2, AI adoption results in 2.1 percent increase in TFP and 4.2 percent increase in output. In Scenario 3, TFP raises by 3.2 percent and output expands by 12.6 percent as a result of AI adoption. That said, the impact and timing of AI on productivity and economic outcomes still remain uncertain, similar to the past adoption of general-purpose technologies. Existing studies come with a wide range of estimates of the AI impact. For example, for the United States in the next decade, Briggs and Kodnani (2023) projects a large effect of 9.2 percent increase in the TFP, Cazzaniga, et al. (2024) expects the TFP impact to be within the range of 1.3 to 3.9 percent, while Acemoglu (2024) predicts much smaller effects in the range of 0.53 to 0.66 percent.

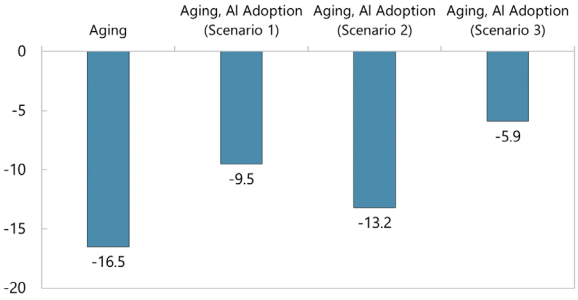
Figure 13. Impact on Productivity and Output: AI, Allocative Efficiency, and Aging

AI Impact on Output and Productivity
(In percent)



Source: Cazzaniga and others (2024) and IMF staff calculations. Note: For details on the model, see Rockall, Pizzinelli, and Tavares (2024). The figure shows the change in total factor productivity and output between the initial and final steady state.

Output Impact: Aging and AI Adoption
(In percent)



Source: Cazzaniga and others (2024); IMF staff calculations. Note: The impact of aging is estimated by assuming a constant labor share of income, constant labor participation rates, constant ratio of part-time workers, and a declining working-age population.

20. The negative effects of an aging population can be mitigated through AI adoption. Demographic shifts caused by aging are expected to pose a significant challenge to Korea's long-term economic growth. The aging population is expected to reduce the total size of the labor force, while shifting a portion of it from younger full-time workers to older part-time workers, both

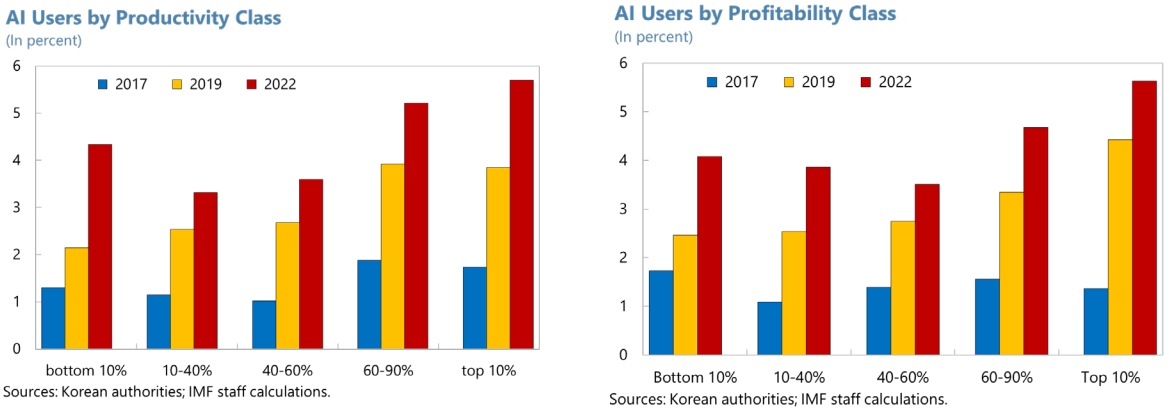
of which reduce overall labor inputs. Based on the UN projections of population trends[6], assuming the labor share of income as well as labor force participation rates (LFPR) across gender and age groups remain constant[7], this would translate into a 16.5 percent decline in output from 2023 to 2050. However, the output gains from AI adoption could largely offset this decline. As illustrated in the right chart of Figure 13, under different scenarios, AI adoption is expected to offset the aging-induced decline in output to varying degrees. The largest offset occurs in Scenario 3, where AI adoption impacts the economy through all three channels.

Empirical Analysis: The Impact of AI on Firm Productivity in Korea

21. AI Usage is prevalent among firms with higher productivity and profitability. To explore the relationship between AI usage and firm performance, specifically in terms of productivity and profitability, we classified firms into five groups based on the percentiles of their performance distribution. These percentiles are calculated within industries, using the SNA A38 classification, to account for sector-specific differences in performance. Firm productivity is measured by revenue per employee, while profitability is gauged by net income per employee. The proportion of firms using AI tends to be higher in groups associated with greater productivity and profitability (Figure 14).

22. However, AI adoption does not increase uniformly across productivity and profitability percentiles, particularly in 2022. Notably, AI usage among firms in the bottom 10 percent of the productivity and profitability distribution is higher than in the 10-40 and 40-60 percentiles. This higher rate of AI adoption in lower performance tiers may be linked to the greater presence of AI start-ups, as discussed in Chapter 2. In general, new entrants tend to have lower average productivity (Berlingieri et al., 2020), which may explain the higher proportion of AI users among firms in lower performance percentiles.

Figure 14. AI Usage and Firm Productivity/Profitability Class



Sources: Korean authorities; IMF staff calculations.

Sources: Korean authorities; IMF staff calculations.

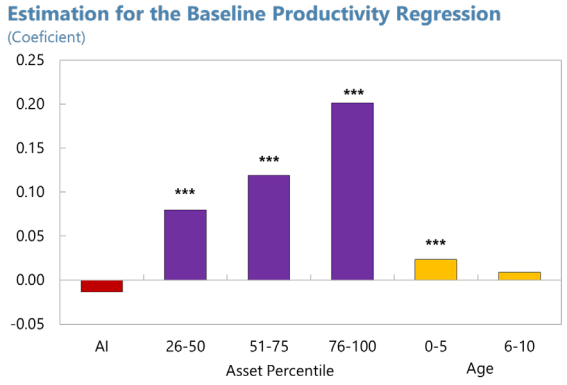
Note: Chart data is authors' calculations from Korea Statistics, Survey of Business Activities. Firm productivity is calculated as revenue/employment, and firm profitability as net income/employment.

[6] The projections from the World Population Prospects 2024 are applied.

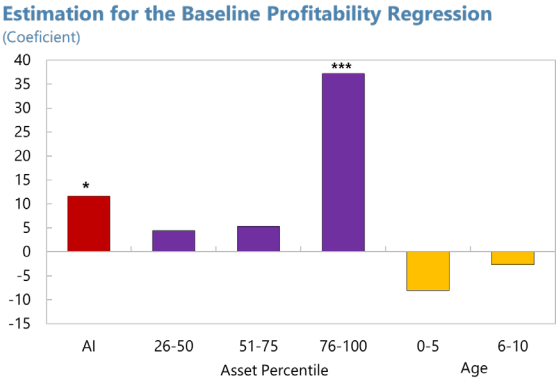
[7] The labor share of income is assumed to be 0.517, according to the Penn World Table, version 10.01.

23. Taking key firm characteristics into account, the impact of AI on firm productivity is not consistently robust. Using firm-level data from the Survey of Business Activities from 2017 to 2022, we conduct a baseline regression. In this model, firm productivity or firm profitability is the dependent variable, while AI use, asset size, and firm age are the explanatory variables. We also control for 2-digit industry sector and year fixed effects and include a lagged(t-1) dependent variable to address potential selection bias. Empirical results show that AI adoption has no significant impact of on firm productivity but does have a positive effect on firm profitability (Figure 15). Larger size firms (notably those above the 75th percentile by asset size) tend to have significantly higher productivity and profitability, consistent with literature.

Figure 15. Estimation Results of the Baseline Productivity/Profitability Regressions



Sources: Korea Statistics, Survey of Business Activities; and authors' calculations.



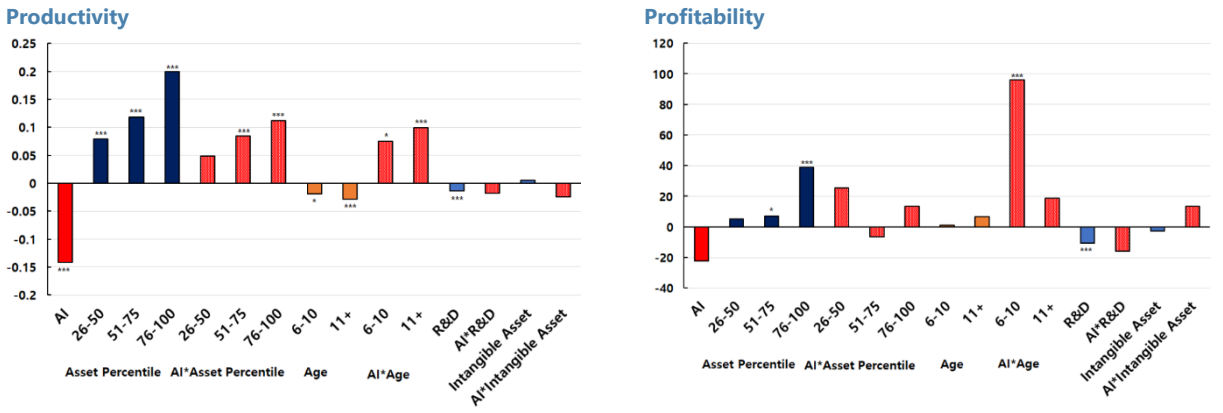
Sources: Korea Statistics, Survey of Business Activities; and authors' calculations.

Note: The y-axis of the graph represents the regression coefficient. Statistical significance based on robust standard errors is reported above bars: *** p<0.01, ** p<0.05, * p<0.1. Year and industry fixed effects coefficients are not reported. AI use is treated as a dummy variable. Asset size is divided into four categories: below 25th percentile, 26-50th percentile, 51-75th percentile, and above the 75th percentile. Firm age is grouped into three categories: 0-5 years, 6-10, and 11 years or more.

24. The productivity-enhancing effect of AI is not universal across firms and is more pronounced in large, mature firms. Firms that invest more in knowledge capital are likely to adopt AI, and this investment itself may contribute to productivity gains in ways unrelated to AI. Consequently, the observed link between AI use and firm performance may reflect the selection of firms that already possess these assets rather than a direct causal effect of AI on performance. To address this, we include complementary factors such as R&D expense and intangible assets-both indicators of investment in knowledge capital-as additional controls in the regression. These factors are represented as dummy variables, with 0 indicating their absence and 1 indicating their presence. Furthermore, as section 2 illustrates, AI adoption is more common among larger and younger firms. To investigate whether the benefits of AI diffusion vary by firm size and age, we extend the regression by including interaction terms between AI use and these variables. This approach allows us to examine how the impact of AI impact on firm performance differs depending on firm size and age. The results indicate that the productivity benefits of AI are evident only in larger, more mature firms (Figure 16). In terms of profitability, the gains from AI adoption are particularly clear for mature firms. Large and mature companies in Korea are experiencing significant improvements in both productivity and profitability, suggesting that major firms are actively leveraging AI and reaping its

benefit. Although these conclusions are tentative, they suggest that advancements in AI could widen the productivity and income gap between firms.

Figure 16. Estimation Results of the Extended Productivity/Profitability Regressions

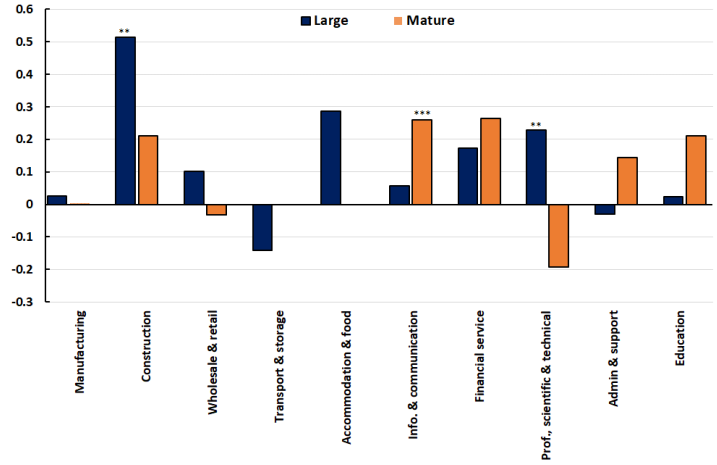


Sources: Korea Statistics, Survey of Business Activities; and authors' calculations.
Note: The y-axis of the graph represents the regression coefficient. Statistical significance based on robust standard errors is reported above bars: *** p<0.01, ** p<0.05, * p<0.1. Year fixed effects coefficients are not reported. R&D and Intangible Asset are treated as dummy variables.

25. There is also notable heterogeneity in the productivity-enhancing effect of AI across different industry sectors. To investigate this variation, we conduct a regression analysis by segmenting the data by industry. Specifically, we apply the same identification model as described previously. The results indicate that productivity gains from AI adoption are most pronounced in larger, more mature firms within certain sectors (Figure 17). Specifically, productivity improvements are observed in larger firms within the Professional, Scientific, and Technical Services, and Construction sectors. Meanwhile, mature firms in the Information and Communication sector show substantial productivity gains. These findings further confirm that a broad-based productivity increase is not yet evident in the early stages of AI adoption. Similar to the distributional impact on the labor market, the results also suggest that AI adoption could have divergent impact across different industries and firms. This heterogeneity might reflect certain industry and firm specific characteristics, including different exposures to AI.

Figure 17. AI Impact and Exposures by Industry Sectors

Estimation for the Coefficients of Interaction Terms between AI use and Large, Mature Firms on Firm Productivity (Industry level)

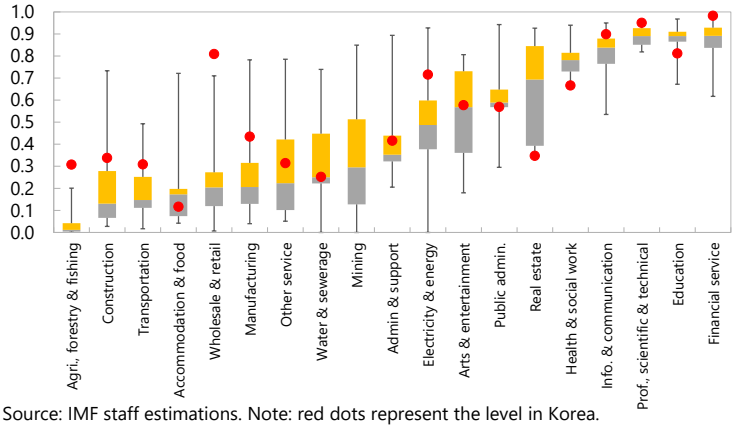


Sources: Korea Statistics, Survey of Business Activities; and authors' calculations.

Note: The y-axis of the graph represents the regression coefficient. Statistical significance based on robust standard errors is reported above bars: *** p<0.01, ** p<0.05, * p<0.1. The interaction terms between AI use and large firm and mature firm respectively indicate the interaction term between AI use and asset size (dummy variable, with 1 indicating above the 50th percentile), and the interaction term between AI use and firm age (dummy variable, with 1 indicating 6 years or more).

Share of Highly Exposed Workers by Sector

(In share of all workers)



Source: IMF staff estimations. Note: red dots represent the level in Korea.

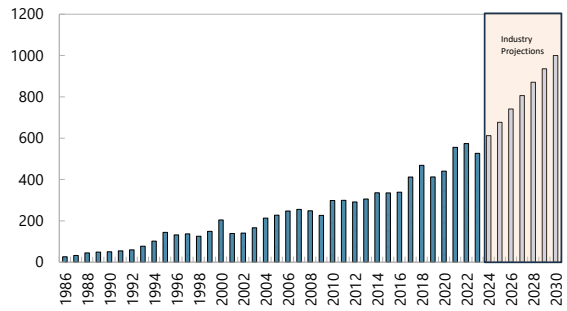
Note: Quarter range bars in the chart shows the range of 16 Asian countries draws on the recent IMF Asia and Pacific Regional Economic Outlook (October 2024) and the authors' own calculations on Korea's exposures.

Stylized Analysis: Global AI Boom and Korean Semiconductor Industry

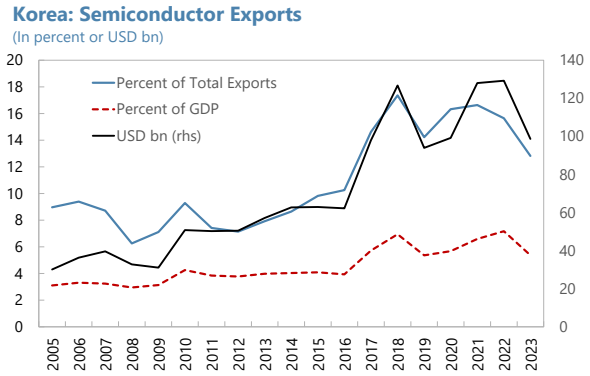
26. Korea is set to benefit from the global AI-boom. In addition to potential productivity and output enhancing effects from the AI adoption, Korea will also benefit from global AI demand through semiconductor exports as a top chip producer, with positive spillovers to employment and growth. According to industrial consensus forecasts, the AI-related semiconductor demand is expected to double the sales of chips to 1 trillion by 2030 (Figure 18). If we assume Korea will

maintain the current market share (about 20 percent of global semiconductor sales), this means a significant boost in Korean semiconductor exports over the medium . That said, uncertainty remains high regarding the AI-driven global semiconductor demand.

Figure 18. AI-Driven Demand and Korea Semiconductor Exports



Sources: Historical data from World Semiconductor Trade Stastics (WSIS) historical billings report; Forecasts based on Gartner, TechInsights, IBS, SIA/WSTS and consensus analyst forecasts for leading semiconductor companies.

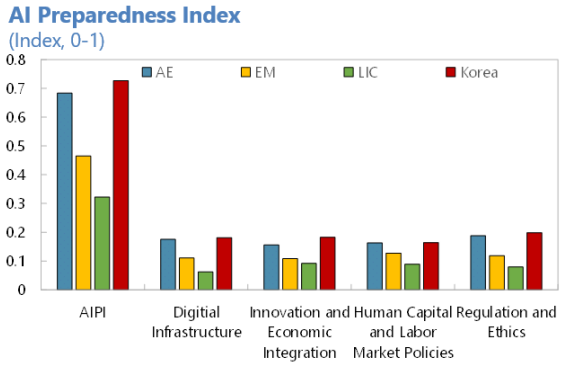


Sources: Haver, CEIC and IMF staff calculations.

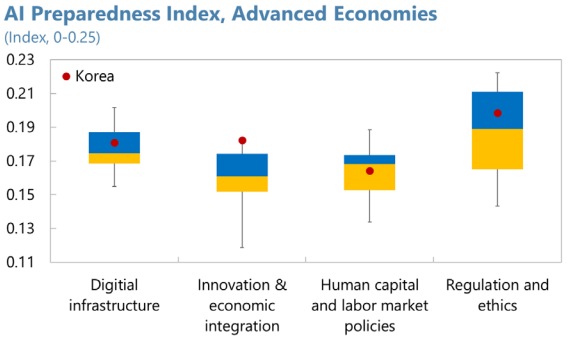
E. AI Preparedness

27. Korea is well-prepared for AI adoption, surpassing the average of advanced economies. A country's level of preparedness plays a pivotal role when it comes to maximizing AI's benefits while managing downside risks. The AI preparedness index (AIPI) is employed to compare Korea's preparedness in AI adoption against its peers. Developed by Cazzaniga et al. (2024), the AIPI is drawn from the literature on cross-country determinants of technology diffusion. It comprises a selected set of macro-structural indicators that are essential for AI adoption, which are organized under four dimensions: (1) digital infrastructure, (2) innovation and economic integration, (3) human capital and labor market policies, and (4) regulation and ethics. Korea excels both in the aggregate index and three of the four dimensions when compared to the median of AEs (Figure 19).

Figure 19. AI Preparedness Index



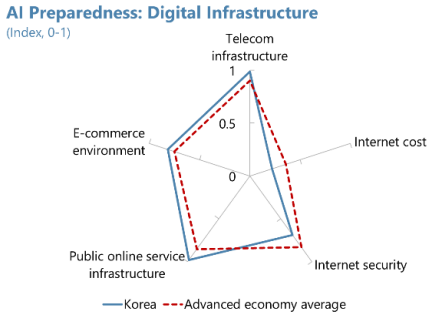
Source: Cazzaniga and others. 2024. "Gen-AI: Artificial Intelligence and the Future of Work." IMF Staff Discussion Note SDN2024/001.



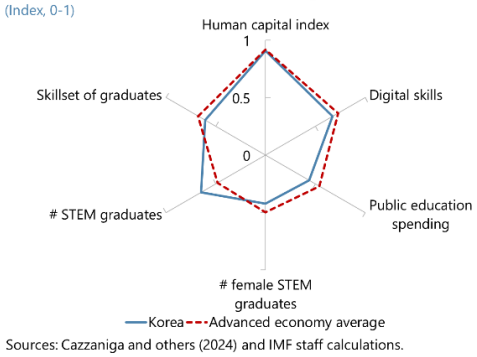
Sources: Cazzaniga and others. 2024. "Gen-AI: Artificial Intelligence and the Future of Work." IMF Staff Discussion Note SDN2024/001. The boxplot displays the 5th, 25th, 50th (median), 75th, and 95th percentiles of values of the four dimensions of the AIPI for advanced economies, with Korea's data highlighted by red dots.

28. Korea excels in innovation and digital capabilities, with room for improvements on human capital and labor market policies. Korea ranks third globally in "Innovation and Integration", demonstrating its leadership in AI-related scientific research, substantial R&D investment supporting technological advancement, and strong integration into the global economy through trade, investment, and collaboration. Korea's preparedness in "Regulation and Ethics" exceeds the AE median, reflecting a higher level of government effectiveness. Korea's preparedness in "Digital infrastructure" is comparable to the AE median. Sub-indicators values in this dimension highlight Korea's outstanding telecom infrastructure, a mature e-commerce environment, and robust public online services, which all strongly facilitate AI integration into economic activity. However, there is still room for improvement in the affordability and security of internet access (Figure 20, top chart).[8] The country's overall preparedness in "Human Capital and Labor Market Policies" is slightly below the AE median. Looking into the human capital sub-indicators, although Korea has a highly educated workforce, there is scope to increase public education spending and strengthen digital skills of the population (Figure 20, bottom left chart). In labor market policies, the two areas where Korea has the most room for improvement are (1) enhancing social protection, which could help address AI displacement effects and (2) increasing labor market flexibility, which would allow firms to better adapt to AI-driven changes (Figure 20, bottom right chart).

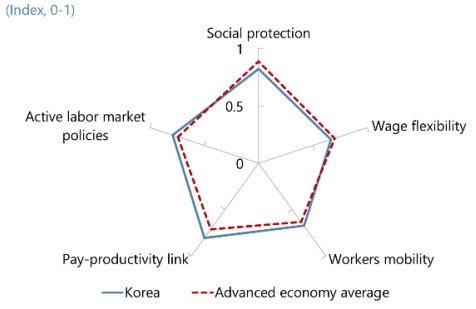
Figure 20. Sub-Categories in the AI Preparedness Index



Source: Cazzaniga and others (2024) and IMF staff calculations.



Sources: Cazzaniga and others (2024) and IMF staff calculations.



Sources: Cazzaniga and others (2024) and IMF staff calculations.

[8] The affordability of internet in the AIPI is measured by internet cost as percent of Gross National Income per capita, for which Korea is higher than the AE median level. That said, this indicator does not fully capture the affordability, especially in terms of the intensity of internet usage, which may be better measured by internet cost as percent of per gigabyte data used, although the availability cross-country data is limited on this front.

29. Active and ongoing policy efforts are being made to promote AI adoption while managing potential risks. Through a series of national initiatives and the establishment of a national AI committee, the authorities have outlined key directions for the country's AI strategy, including expanding AI infrastructure, incentivizing private investment, promoting broader adoption, and implementing risk management measures. To strengthen human capital, the government has introduced new initiatives to train and transition professionals into AI-related fields. Beyond developing domestic talents, the government is also addressing the growing demand for AI expertise by attracting foreign professionals. Additionally, legislative proposals are in progress to introduce an AI Basic Law, which will regulate the development and deployment of AI technologies (Box 1). Going forward, broad-based AI adoption should be supported by labor market reforms aimed at enhancing flexibility. In addition to funding targeted training and reskilling programs (including sector-based training and apprenticeships), fiscal policy can also play a vital role in strengthening the social safety net (through expanding unemployment insurance to more non-regular workers and the self-employed and enhancing access and generosity of social assistance programs), which would help prepare the society, especially vulnerable groups, for the AI transition.[9]

Box 1. AI-Related Policies and Regulation Initiatives in Korea

In Korea, efforts are underway to develop the AI industry and promote its use, alongside implementing regulations to minimize potential negative side effects, including establishing ethical standards and ensuring the trustworthiness of AI technology.

The establishment of the National AI Committee and the announcement of key policy directions for the National AI Strategy mark significant steps forward. These directions include: (1) establishing a National AI Computing Center and expanding AI infrastructure, (2) encouraging private investment in AI development through policy-backed financial support, (3) promoting AI adoption across a wide range of sectors, and (4) managing AI-associated risks by enacting the AI Basic Law. Other important focus going forward include nurturing AI startups and talent, advancing core technologies and innovation, establishing a foundation for sustainable AI development, and developing legal principles for AI responsibility and rights.

The government is also making efforts to strengthen human capital, particularly through initiatives aimed at training and transitioning AI professionals, such as the K-Digital Training (KDT) program. KDT is a vocational training initiative that brings together educational institutions, companies, and universities to offer project-based, real-world training. In addition, in the 'Dynamic Economy Roadmap' announced in July 2024, the government outlined plans to meet the growing demand for AI professionals by fostering domestic talents and attracting foreign experts, including expanding specialized universities in high-tech fields, accrediting in-house graduate programs, exploring special visa options and ways expedite the permanent residency and naturalization processes.

The parliament is introducing legislative proposals to enact the AI Basic Law, which will regulate AI development and usage. The key elements of these proposals include the establishment of an AI Committee, the promotion of AI technology and data utilization, and the formulation of AI ethical principles to ensure reliability and safety in the development and use of AI.

[9] See IMF Staff Discussion Note SDN/2024/002, *Broadening the Gains from Generative AI: The Role of Fiscal Policies*.

F. Conclusion

30. The adoption of Artificial Intelligence (AI) holds the potential of significant output and productivity gains. Korea is at the global forefront in AI adoption, with increasingly more companies and workers actively exploring the use of AI. Adoption rates are higher among larger and younger firms with stronger technological capacities. Under a scenario where AI complements job functions and increases overall productivity, AI adoption could significantly boost productivity and output, by about 3 percent and 13 percent over the next decades, largely offsetting the estimated negative impact of population aging on output. Moreover, as a top semiconductor producer, Korea is set to benefit from the global AI-boom. It is projected that global AI demand will lead to the doubling of Korean chips exports by 2030. However, productivity and output enhancements are not universal. Firm-level analysis suggests that such effects are significant only in large and mature Korean firms, which could further exacerbate the already-large productivity gaps between large firms and SMEs. Increasing investment in AI innovation and integration, while advancing adequate regulatory frameworks, would help to fully harness AI's potential benefits.

31. Targeted policies are needed to fully harness AI's potential while ensuring a more widespread sharing of its benefits. Overall, Korea is well positioned in AI preparedness, with leading innovation capacities and advanced digital infrastructure. But there is room for further improvements, especially in human capital and labor market policies. While AI may bring productivity gains, it could also pose challenges to the labor market. Staff estimates that about half of jobs are highly exposed to AI. While some may benefit from AI adoption, others could be replaced by it. Women, young, high-skill and high-income groups are more likely to be adversely affected by AI, while at the same time, may benefit more from AI adoption. High labor market duality poses significant challenges for workers to switch jobs, especially for elderly groups. The authorities have taken proactive steps to advance AI development and adoption, expand the AI talent pool, and establish regulations to manage associated risks. Moving forward, enhancing labor market flexibility, strengthening the social safety net, and implementing targeted training and reskilling programs, will also be essential in ensuring a more resilient economy capable of adapting to technological shifts while at the same time sharing the benefits of AI adoption across society.

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