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The Challenges Facing Young Workers in an Ageing Society — Does AI Really Help

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Abstract. This study examines how artificial intelligence may reshape the effects of population aging on young workers' productivity and human-capital accumulation. Moving beyond the traditional view that aging primarily affects economic growth through labour-supply reductions, the paper considers the possibility that demographic change also weakens cross-age knowledge transmission and workplace learning. Drawing on Mincer's human-capital theory and on an adapted version of Acemoglu and Restrepo's task-based framework, the study conducts a theory-guided qualitative review of existing literature on aging, productivity, AI and young workers. The analysis distinguishes between augmentative AI, which supports workers in completing tasks, and automative AI, which substitutes for tasks previously performed by labour. The literature suggests that augmentative AI may partially offset aging-related productivity losses by transmitting codified expertise and accelerating learning among less-experienced workers. However, automative AI may reduce entry-level employment and learning-by-doing opportunities. The paper concludes that AI's impact on young workers in aging labour markets depends fundamentally on task allocation and its effects on human-capital formation.

Keywords: Labor Economy, Population Aging, AI, Intergenerational Impact

1. Introduction

Population ageing is becoming an important structural force shaping labour markets and economic growth. While traditional discussions emphasise declining labour supply, Maestas, Mullen and Powell show that ageing also affects productivity. Using variation in ageing across US states between 1980 and 2010, they find that a 10 per cent increase in the population aged 60 and over reduces GDP per capita growth by 5.5 per cent. Around two-thirds of this effect comes from slower GDP-per-worker growth, while the remaining only one-third reflects slower labour-supply growth [1]. They also find slower hourly wage growth across age groups, suggesting that ageing may generate negative productivity spillovers for younger workers through weaker experience transfer and team production.

Mincer's human-capital theory provides a mechanism for this effect. Young workers continue to accumulate human capital through experience, learning-by-doing, training and occupational mobility [2]. Experienced workers can therefore contribute to younger workers' development

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through the provision of knowledge, feedback and supervision. Their retirement or withdrawal from key roles may consequently weaken younger workers' learning and productivity growth.

AI may alter this process. Through real-time guidance, task standardisation and the codification of expertise, augmentative AI may partially substitute for knowledge traditionally obtained from experienced colleagues. However, AI may also automate entry-level tasks and reduce early-career employment. Brynjolfsson, Chandar and Chen argue that substitution at the "apprentice margin" and complementarity at the "expert margin" can help explain the declining employment among young workers alongside stronger employment outcomes for older workers [3].

This paper therefore examines how AI reshapes the effects of population ageing on young workers' productivity and human-capital accumulation. It combines human-capital theory with an adapted task-based framework and uses a qualitative review of existing literature to compare the effects of augmentative and automative AI on young workers.

2. Theoretical framework

2.1. Human capital accumulation and experience-based learning

Mincer argues that human capital continues to accumulate throughout working life through experience, training, job mobility and learning-by-doing. However, investment in human capital declines with age because the remaining period over which workers can receive returns becomes shorter, eventually contributing to retirement [2]. For younger workers, work experience is particularly important: post-school human capital develops through workplace learning, training and occupational mobility rather than formal education alone [2]. Human-capital formation should therefore be understood as an ongoing process embedded in workplace tasks and interactions, rather than as an individual stock fixed at graduation

Mincer did not explicitly model the intergenerational mentoring relationship between older and younger workers. Consequently, this study extends Mincer's theoretical framework by treating interactions with experienced colleagues as a channel through which human capital accumulation may occur after leaving school. The ageing process influences the accumulation of human capital among younger workers by affecting experience accumulating. Older workers not only possess their own experience-based human capital but also provide a learning environment for younger workers. The productivity of young workers is not formed in complete isolation, but is gradually accumulated through observation, imitation, feedback, supervision, training and task collaboration whilst working alongside experienced workers. Consequently, when population ageing leads to the retirement of highly experienced workers, a reduction in their working hours, their withdrawal from key positions, or an imbalance in the age structure within firms, the learning curve for young workers may flatten. This manifests as follows: whilst the employment rate among young people may not necessarily decline, growth in hourly wages slows.

This study refers to this mechanism as the aging-induced knowledge-transfer channel. The argument does not imply that all older workers are necessarily more productive than younger workers. Rather, the relevant mechanism concerns the reduction of accumulated, task-specific knowledge that younger workers may otherwise access through workplace interaction.

2.2. Augmentation, automation and human-capital formation

Human-capital theory suggests that AI may influence cross-age productivity spillovers by complementing workers' skills and partially substituting for experience-based knowledge

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transmission [2]. Evidence from customer-service workers shows that generative AI increased productivity by about 15%, with the largest gains among less-experienced and lower-skilled employees; treated workers with two months' tenure could perform similarly to untreated workers with over six months' tenure [3]. Population ageing may also encourage technological adoption: ageing explains substantial cross-country variation in robot use, and a 10-percentage-point increase in ageing is associated with 1.6 additional robots per 1,000 workers.

To analyse how AI may alter this process, the study adapts the task-based framework developed by Acemoglu and Restrepo. The key insight of the task approach is that jobs should not be treated as indivisible units of labour. Instead, production consists of a collection of heterogeneous tasks, and technology affects workers by changing how those tasks are performed [4].

Acemoglu and Restrepo model production as an aggregation of tasks and define automation as an expansion in the range of tasks that machines can perform in place of labour. Their original framework emphasises substitution between machines and workers and distinguishes middle-aged and older workers according to comparative advantage in different types of tasks [4].

The present study retains the task-based structure but does not adopt this specific age-task specialisation assumption. Instead, it focuses on young workers and distinguishes between tasks that are performed without AI assistance and tasks that are augmented by AI.

This mechanism is consistent with the evidence reported by Brynjolfsson, Li and Raymond who find that generative-AI assistance increased customer-service productivity and that the gains were particularly large among less experienced and lower-skilled workers [3].

The task-based framework therefore provides a theoretical explanation for why AI may be particularly valuable to workers who have not yet accumulated substantial task-specific experience.

AI does not affect young workers uniformly. Brynjolfsson, Chandar and Chen find that employment among workers aged 22–25 declines in occupations with high exposure to automative AI, whereas highly augmentative occupations show no comparable decline and may even experience stronger employment growth. They argue that firms may reduce entry-level hiring because junior workers are costly to train and may later leave. This creates substitution at the "apprentice margin" while experienced workers remain complementary to AI at the "expert margin", helping explain why early-career employment falls while employment among older workers is more resilient [5]. This section will also use task-based model, separately analysis the different effects from Augmented AI(AI_{Aug})and Automative AI(AI_{Auto}).

The effect of AI, however, depends on how it changes the allocation of tasks. This study distinguishes between two mechanisms:

$$AI = AI_{Aug} \cup AI_{Auto} \tag{1}$$

Under augmentation, workers continue to perform a task while AI increases their efficiency, provides information or supports decision-making. AI may therefore both increase current task productivity and facilitate access to codified knowledge.

This process can be represented by defining an effective knowledge stock:

$$K^{eff} = K_E + wK_{AI}, \quad w > 0 \tag{2}$$

Where K_{AI} represents task-relevant knowledge delivered through AI. In an aging workforce, where K_E may be declining, AI-generated guidance may therefore partially compensate for reduced access to experienced co-workers.

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Under automation, however, AI performs the task rather than assisting the worker. This may generate a different human-capital effect when automated tasks are traditionally performed by entry-level workers. If young workers accumulate human capital partly through learning-by-doing:

$$H_Y = g(LBD_Y), \quad g > 0 \tag{3}$$

Where LBD_Y represents learning-by-doing opportunities, then automation of apprenticeship-type tasks may cause:

$$AI_{Auto} \uparrow \Rightarrow LBD_Y \downarrow \Rightarrow H_Y \downarrow \tag{4}$$

Consequently, automation may generate potential growth that lies between short-term productivity gains and long-term human capital accumulation. This gives rise to differing outcomes for young workers in the labour market. Previous reviews have utilised this distinction to explain the displacement of entry-level jobs and the 'apprentice margin'.

Based on this framework, the study develops three theoretical propositions:

Proposition 1. Population aging may reduce young workers' productivity by weakening access to experience-based knowledge and intergenerational human-capital transmission.

Proposition 2. Augmentative AI may mitigate this productivity loss by increasing the efficiency of AI-compatible tasks and partially substituting for the knowledge-transfer role of experienced workers.

Proposition 3. Automative AI may instead weaken young workers' long-term human-capital accumulation when it replaces entry-level tasks that provide learning-by-doing and apprenticeship opportunities.

AI is more likely to mitigate aging-related productivity losses when it complements young workers and supports knowledge acquisition, but it may reinforce longer-term human-capital problems when it substitutes for the tasks through which experience is accumulated.

3. Methodology

3.1. Organization of literature

This study adopts a theory-guided qualitative literature review rather than conducting an original econometric analysis. The purpose is not to estimate a new causal effect of AI on young workers, but to synthesise existing empirical evidence through a common theoretical framework. The analysis combines Mincer's human-capital theory with a modified version of Acemoglu and Restrepo's task-based framework to examine how artificial intelligence may reshape the effects of population aging on young workers' productivity, learning and employment opportunities.

The literature is organised into three related strands. The first examines population aging and productivity, with particular attention to evidence of cross-age productivity spillovers. The second considers post-school human-capital accumulation, learning-by-doing and experience transmission. The third examines the labour-market effects of AI and automation, distinguishing between technologies that augment workers and technologies that automate tasks. Studies are compared according to their research setting, type of technology, worker experience level, outcome variable and proposed mechanism.

The studies are synthesised according to the mechanisms implied by the theoretical framework. Under the augmentation mechanism, AI raises the productivity of tasks that remain performed by

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workers and may facilitate the codification and transmission of expertise. This mechanism is therefore expected to partially compensate for the decline in access to experienced co-workers associated with population aging. Under the automation mechanism, however, AI removes tasks from workers. Where these tasks traditionally function as entry-level or apprenticeship tasks, automation may reduce opportunities for learning-by-doing and slow subsequent human-capital accumulation. The analysis therefore evaluates whether the existing literature is more consistent with AI mitigating challenges or reinforcing the challenges faced by young workers in an aging labour market.

3.2. Analytical strategy

The reviewed studies are compared along several dimensions: the type of technological change considered, the experience or age profile of affected workers, the labour-market outcome examined, and the mechanism proposed by the authors.

The first analytical category is the augmentation mechanism. Evidence is classified as augmentative when workers continue to perform the task but AI increases task efficiency, improves access to information or accelerates learning. Such findings are interpreted through the AI-augmented task model and the effective-knowledge mechanism described above.

The second category is the automation mechanism. Evidence is classified as automative when technology reduces or removes tasks previously performed by workers. Particular attention is paid to entry-level tasks because these may simultaneously represent productive activities for firms and learning opportunities for young workers.

The analysis then evaluates how these two mechanisms interact with the demographic context. Existing studies do not directly establish that generative AI offsets population aging. Instead, the study asks whether their findings are consistent with the theoretical mechanisms developed in this paper. Evidence that AI improves the productivity and learning of inexperienced workers would support the plausibility of an augmentation channel, whereas evidence that automation reduces entry-level opportunities would support the possibility of a negative learning-by-doing channel.

Accordingly, the review does not treat the three theoretical propositions as hypotheses that can be statistically accepted or rejected. They instead function as analytical propositions used to organise and interpret the existing evidence.

4. Literature review and discussion

4.1. Population aging and the productivity challenge for young workers

The economic consequences of population aging extend beyond the direct reduction in labour supply. Maestas, Mullen and Powell show that population aging significantly reduces economic growth, with approximately two-thirds of the decline in GDP per capita associated with slower growth in labour productivity rather than slower employment growth. Their analysis also finds that labour compensation and wages decline as populations age, suggesting that demographic change can affect the productivity of workers who remain employed rather than merely reducing the number of workers in the labour market [1].

This finding is particularly relevant to younger workers. The effect of aging on younger workers cannot be explained simply by the biological aging of younger workers themselves. Instead, it raises the possibility that productivity is partly determined by the composition of the workplace and interactions between workers with different levels of experience. This interpretation receives

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additional support from Herkenhoff et al., who develop and estimate a model in which both worker productivity and human-capital accumulation depend on the human capital of co-workers. They find that workers with lower levels of human capital catch up when they are matched with more knowledgeable colleagues. Consequently, limited access to knowledgeable co-workers can reduce both individual human-capital accumulation and aggregate output [6].

In general, these studies support the plausibility of the aging-induced knowledge-transfer channel developed in the theoretical framework. Population aging may reduce the availability of experienced workers through retirement or reduced labour-force participation, thereby weakening opportunities for younger workers to obtain task-specific knowledge, feedback and workplace experience. Importantly, neither Maestas et al. nor Herkenhoff et al. directly demonstrates that population aging reduces mentoring between older and younger workers. The mechanism should therefore be interpreted as a theoretically plausible explanation consistent with the evidence, rather than as an already established causal channel.

4.2. Augmentative AI as a potential knowledge-transfer mechanism

If part of the productivity cost of aging arises from reduced access to experience-based knowledge, generative AI may provide a partial technological substitute for some forms of workplace learning. The strongest evidence for this possibility comes from Brynjolfsson, Li and Raymond. Studying the staggered introduction of a generative-AI assistant among customer-support agents, they find an average productivity increase of approximately 15%, with substantially larger gains among less-experienced and lower-skilled workers. More importantly for the present argument, they find evidence of durable learning: workers who had greater exposure to AI recommendations retained productivity gains even during temporary AI outages, while lower-skilled workers' communication patterns became more similar to those of higher-skilled workers [3] .

These results suggest that AI may do more than increase the speed at which existing skills are applied. Generative AI can potentially codify patterns associated with high-performing workers and transmit them to less-experienced workers through real-time recommendations. Within the task-based framework developed above, this corresponds to the augmentation mechanism: workers continue to perform the relevant tasks, but AI increases task efficiency while simultaneously lowering the cost of accessing task-specific knowledge.

Evidence from Noy and Zhang reinforces this interpretation. In a randomized experiment involving 453 college-educated professionals completing writing tasks, access to ChatGPT reduced completion time by approximately 40% and increased output quality by 18%. The productivity distribution also became more compressed because weaker performers benefited disproportionately from AI assistance.

Nevertheless, these findings should not be interpreted as evidence that AI can fully replace experienced workers. The tasks studied by Brynjolfsson, Li and Raymond and by Noy and Zhang are relatively amenable to codification through language models. Tacit judgement, organisational knowledge, interpersonal mentoring and context-specific decision-making may be considerably more difficult to reproduce. AI should therefore be understood as a partial substitute for particular dimensions of knowledge transmission, rather than as a complete replacement for experienced colleagues.

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4.3. Automative AI and the erosion of learning-by-doing

This distinction is particularly important for young workers because entry-level tasks may serve two functions simultaneously: they contribute to current production, but they also provide opportunities through which inexperienced workers acquire human capital.

Mincer's human-capital framework treats training, labour-market experience, job choice and mobility as forms of investment through which productive capacities continue to develop after formal education. Consequently, eliminating tasks performed by early-career workers may affect more than current employment. If those tasks provide learning-by-doing opportunities, their automation may also reduce the accumulation of experience required for later career progression [2].

Recent evidence from Brynjolfsson, Chandar and Chen is consistent with this concern. Their 2025 study found declining employment among workers aged 22–25 in occupations with high automative AI exposure, whereas occupations characterised by more augmentative AI use did not exhibit the same pattern. The revised 2026 analysis strengthens this pattern: employment among 22–25-year-olds in highly AI-exposed occupations stood about 19% below the level implied by employment growth among less-exposed peers, with the adjustment occurring mainly through reduced hiring rather than through increased separations. The declines were concentrated in occupations where AI use tended to automate human tasks, while employment was flat or increasing where AI primarily complemented workers [5].

This creates a potential intertemporal trade-off. Automating junior tasks may increase current organisational efficiency while simultaneously reducing the opportunities through which future experienced workers are created. However, the existing evidence does not directly measure subsequent human-capital accumulation. The claim that reduced entry-level hiring weakens future learning-by-doing is therefore a theoretical interpretation of the employment evidence, rather than a causal result established by Brynjolfsson, Chandar and Chen.

4.4. Synthesis: can AI mitigate aging-induced productivity spillovers

The literature therefore does not support a simple conclusion that AI either solves or worsens the economic consequences of population aging. Instead, the likely effect depends on how AI reallocates tasks and how those tasks contribute to human-capital formation.

On the one hand, the combination of Maestas, Mullen and Powell and Herkenhoff et al.suggests that demographic change may reduce productivity partly because workers benefit from the knowledge and human capital of their co-workers. Brynjolfsson, Li and Raymond and Noy and Zhang [7] then demonstrate that generative AI can disproportionately improve the performance of less-experienced or initially lower-performing workers. Together, these findings make the augmentation mechanism theoretically plausible: in the context where aging reduces access to experienced human capital, AI may partly compensate by codifying expertise, providing real-time guidance and accelerating learning.

On the other hand, the evidence from Brynjolfsson, Chandar and Chen indicates that the same technology may generate a different outcome when it automates the tasks traditionally allocated to young workers. In this case, AI may reduce not only current demand for entry-level labour but also the task opportunities through which workers acquire experience. The resulting effect may therefore involve a trade-off between current productivity and the future stock of human capital.

This conditional interpretation is also consistent with Acemoglu and Restrepo's task-based approach. Their central insight is that technological change should be interpreted as a shift in task allocation between labor and technology rather than a uniform shock to entire occupations. They

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additionally show that demographic aging itself can encourage automation by increasing the relative scarcity and cost of particular types of labour [4].

The main conclusion of the literature synthesis is therefore that AI is most likely to mitigate aging-related productivity spillovers when it complements young workers and preserves opportunities for human-capital accumulation. Where it instead substitutes for apprenticeship-type tasks, short-run productivity improvements may coexist with weaker entry-level employment and slower long-run accumulation of experience. The economic role of AI in an aging labour market is consequently determined not simply by the amount of AI adoption, but by the form of human–AI task allocation that adoption creates.

5. Conclusion

This study examines how AI may reshape the effects of population aging on young workers' productivity and human-capital accumulation. Rather than affecting only labour supply, aging may also weaken the workplace processes through which younger workers acquire experience-based knowledge, creating cross-age productivity spillovers.

The literature suggests that AI's effect depends on how it changes task allocation. When AI is augmentative, it can increase productivity, accelerate learning and transmit codified expertise, particularly to less-experienced workers. In an aging workforce, this may partially compensate for declining access to experienced co-workers and mitigate some aging-related productivity losses. However, automative AI may generate the opposite effect by replacing entry-level tasks through which young workers gain experience. This may reduce both early-career employment opportunities and learning-by-doing, creating a trade-off between short-run organisational productivity and long-run human-capital accumulation.

Therefore, AI should be understood neither as a simple solution to population aging nor as an inevitable threat to young workers. Its impact depends fundamentally on task allocation and whether technology complements or substitutes for human-capital formation. Since this study only synthesises existing literature and does not produce original causal estimates, future empirical research should directly examine how AI adoption in aging workplaces affects young workers' learning trajectories, task opportunities, and productivity growth.

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