The Labor Market Impacts of AI Technology:
A Case Study of Korea

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1. The emergence of AI technology in Business **KDI**

➢ The Emergence of AI Technology in Business

▪ AI models surpass average human level and even reach expert-level performance in many fields

▪ Increasing number of firms adopt and utilize AI technology

➢ Dual Aspects of the impact of AI technology on the labor market

▪ Job automation and increased production efficiency

▪ Employment reduction and job replacement

➢ This presentation is based on **Dr. Joseph Han's** "AI-driven Labor Market Changes and Implications for Policy Directions", KDI Report 2023-03.

2. AI-driven Automation and "Jobs at Risk"

- Frey and Osborne(2013, 2017) anticipates *47 percent* of US employment is susceptible to computerization (the probability for complete computerization is over 70%) and at risk in the next 10 to 20 years.
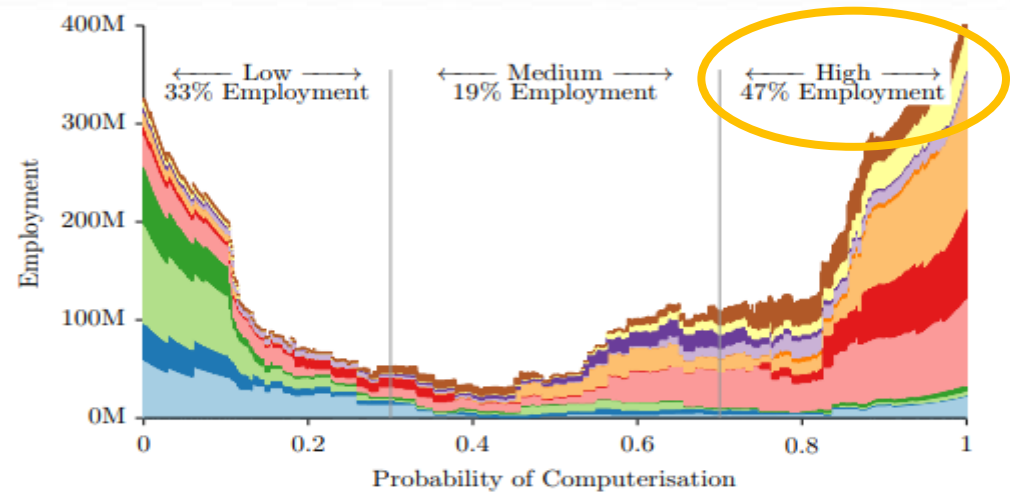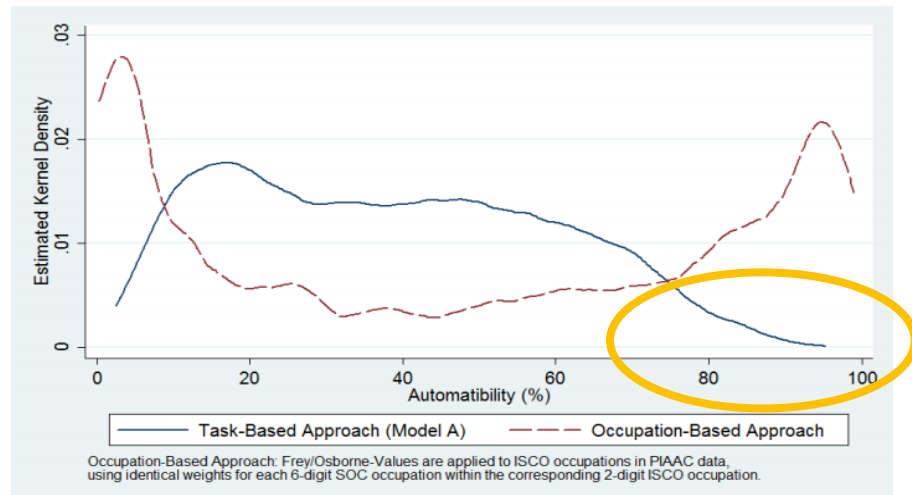

- Arntz, Gregory & Zierhan(2016) shows that, when the variation of tasks within occupations or task-based approaches are taken into account, estimates of jobs at risk are lower.

  - 14% of the occupations are at high risks
  - 50% of them are at medium level risks

Figure 2. Distribution of Automatibility in the US (Task-Based vs. Occupation-Based Approach)

Occupation-Based Approach: Frey/Osborne-Values are applied to ISCO occupations in PIAAC data, using identical weights for each 6-digit SOC occupation within the corresponding 2-digit ISCO occupation.

# 2. AI-driven Automation and "Jobs at Risk"

➢ Arntz, Gregory & Zierhan(2016) estimates that the share of workers at high risk in OECD countries largely lower.

Figure 3. **Share of Workers with High Automatibility by OECD Countries**

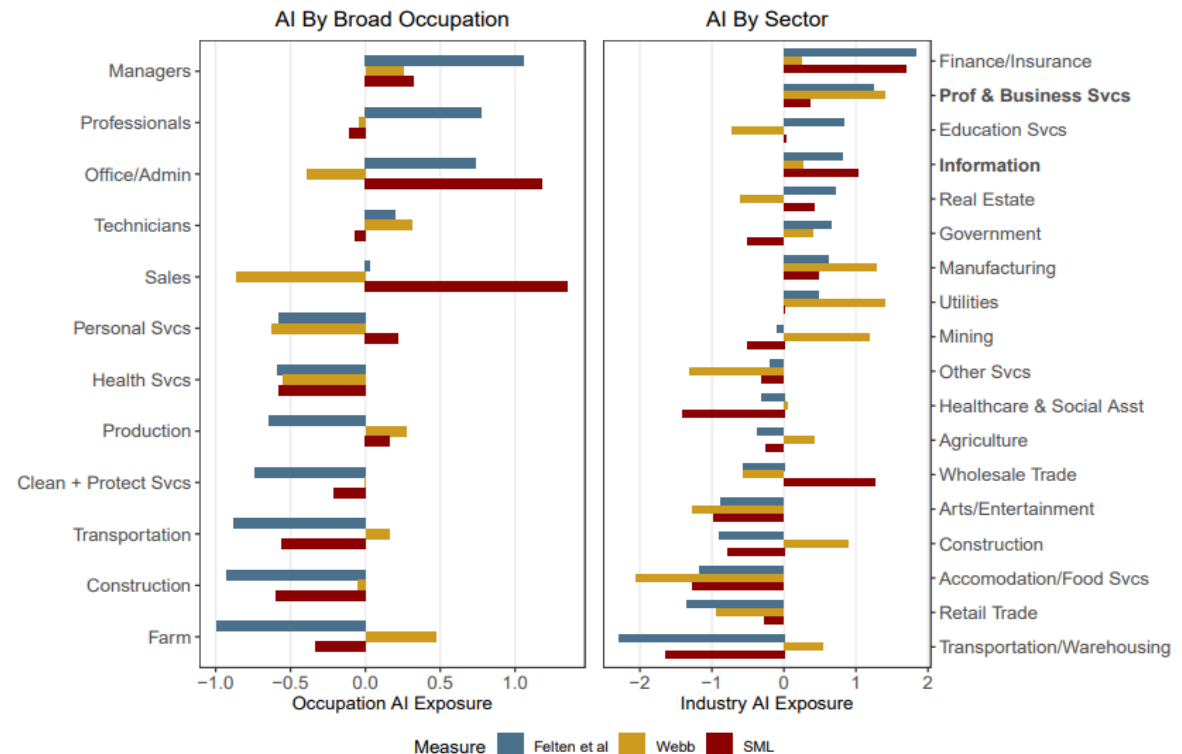Share of Workers at High Risk (>70%) in Percent
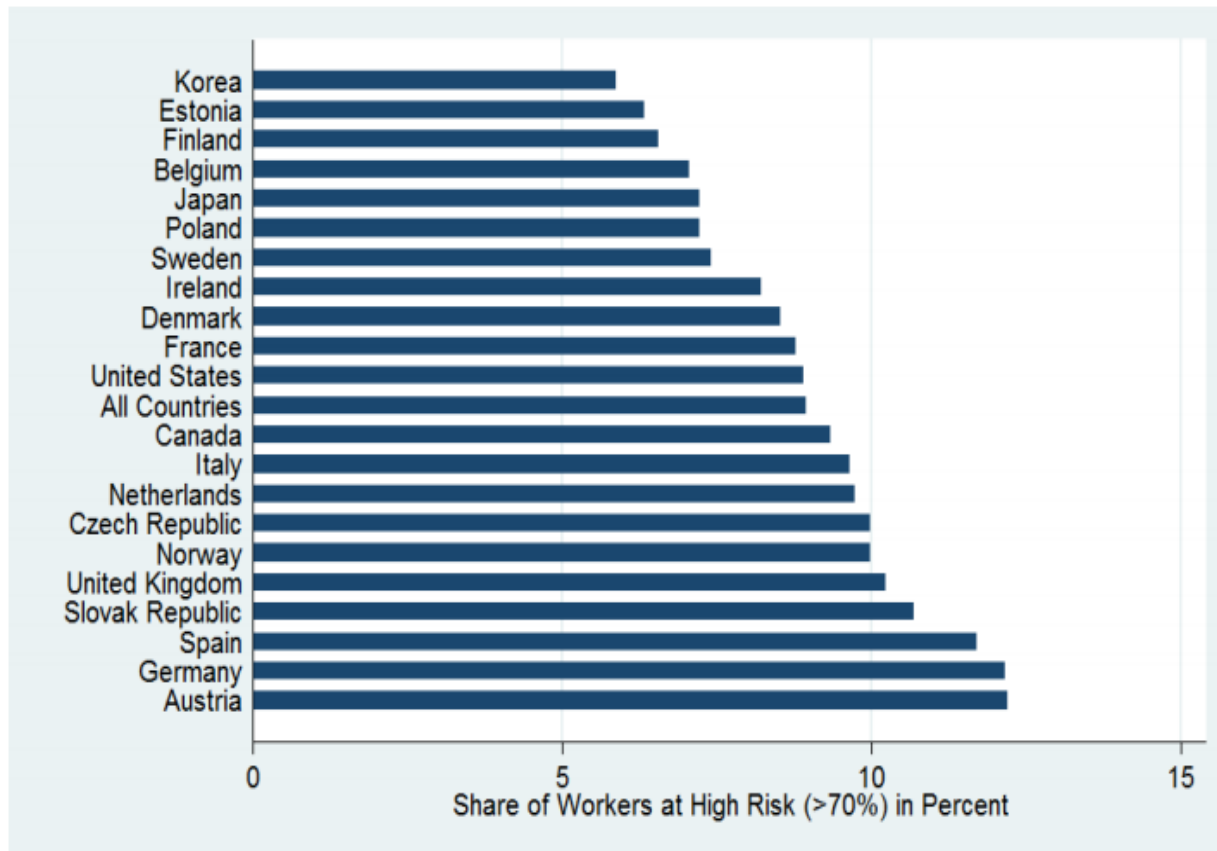
2. AI-driven Automation and "Jobs at Risk"

➤ Acemoglu, Autor, Hazell, and Restrepo(2022) shows and compares the results of estimation by different methodologies. Although the share of the jobs under AI-exposure vary across occupation jobs, sectors, and wage levels, the general trends are evident.
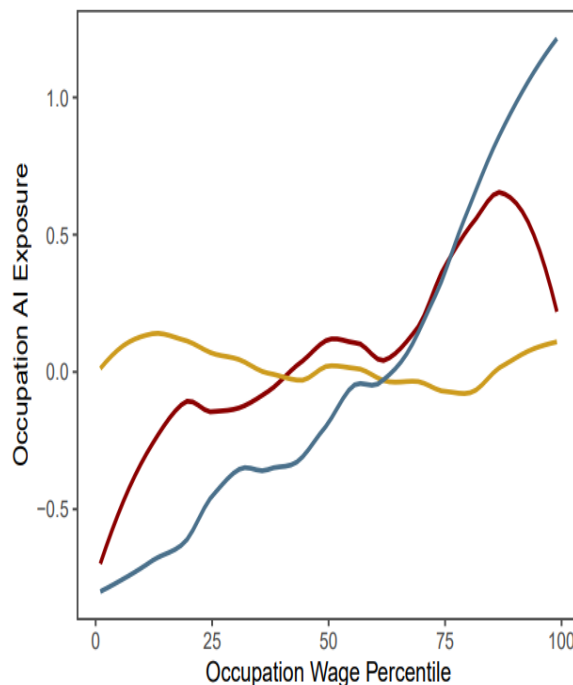
3. AI-exposure by Jobs in Korea

➢ **KDI survey for the severity of AI-exposure of jobs and occupations**

▪ How do experts evaluate "jobs at risks" in Korea in 2023 and in 2030?

Job Automation	Experts' Evaluation for 2023	Experts' Anticipation for 2030
P > 0.7	38.8%	98.9%
P > 0.8	20.5%	97.5%
P > 0.9	7.5%	89.8%

▪ How do GPT-4 evaluate "jobs at risks" in Korea in 2023 and in 2030?

Job Automation	GPT-4's Evaluation for 2023	GPT-4's Anticipation for 2030	GPT-4's Anticipation for 2040
P > 0.7	51.0%	93.6%	99.4%
P > 0.8	27.3%	71.1%	98.4%
P > 0.9	9.0%	34.5%	90.6%

Joseph Han's "AI-driven Labor Market Changes and Implications for Policy Directions", KDI Report 2023-03

3. AI-exposure by Wages in Korea

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➢ **AI exposure and "Job Risks" by Wage levels**

[그림 3-8] 임금과 자동화 가능성(2023년)

AI exposure

Wages
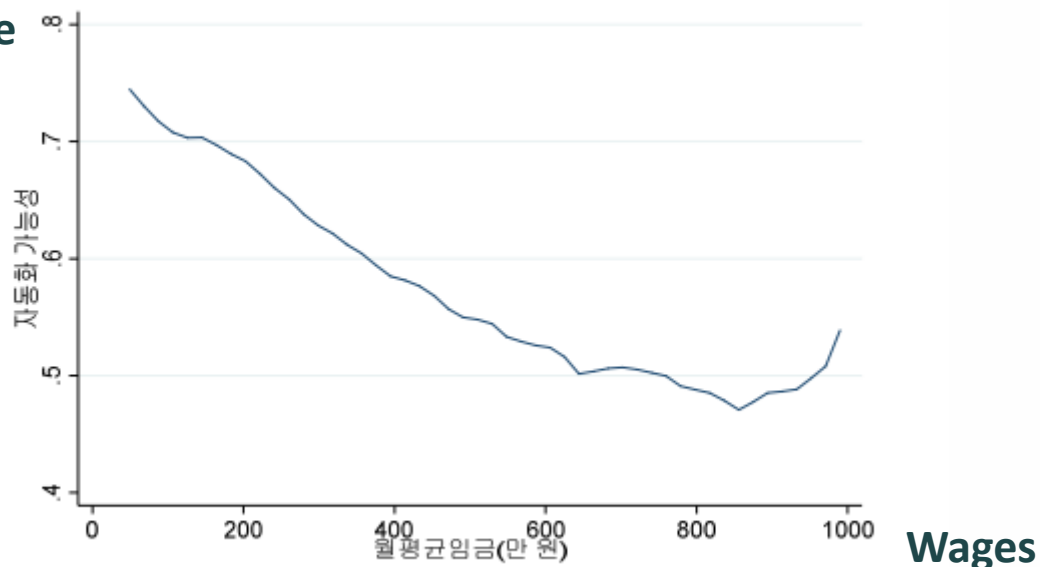
자료: 일자리 수준 자동화 가능성 추산치와 지역별 고용조사 연계자료(2023년 4월 기준).

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4. Korean Firms' AI Utilization and Adoption

➤ **Trends of Korean Firms' Adoption of Cloud Computing, Big-Data and AI**

➤ There are large gaps between firms with different sizes.

➤ While 20% of the large firms in Korea have adopted AI, less then 5% of the small and medium sized companies have adopted it.
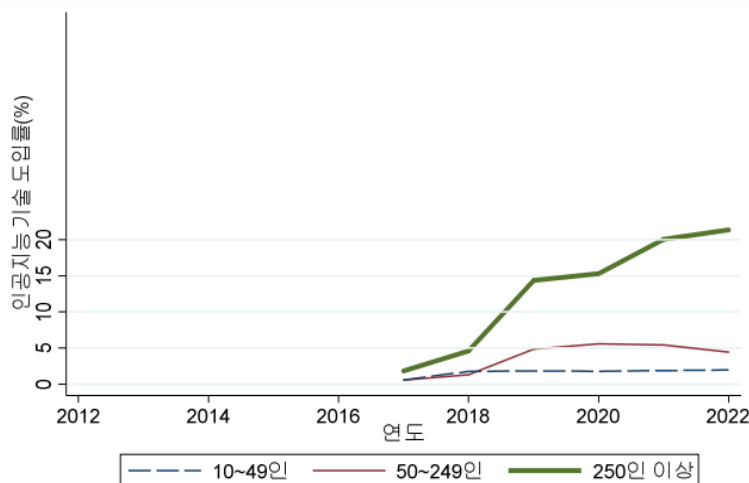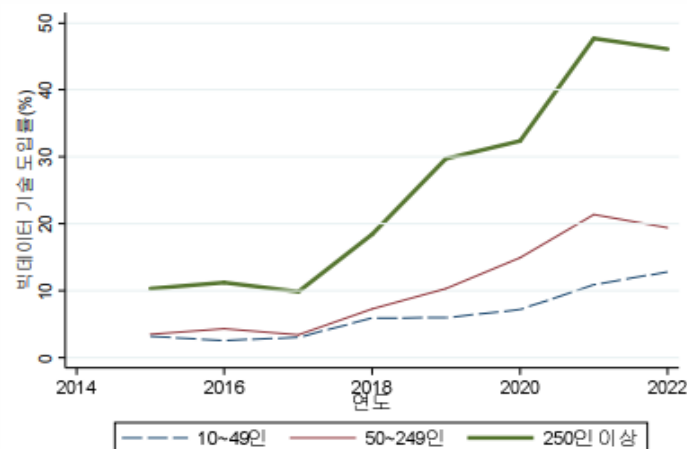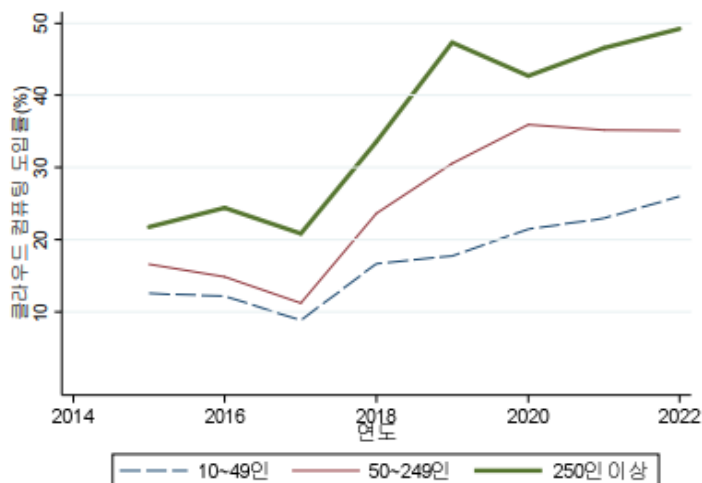
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4. Korean Firms' AI Utilization and Adoption

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➢ **Current Status of Korean Firms' Adoption of AI by Sectors and Firms' Size**

(단위: %)

	Companies (emp. > 10)	Companies (10~49)	Companies (50~249)	Companies (250+)
Total	2.7	1.9	4.4	21.4
Agriculture, Fishery, Mining	1.6	1.3	7.3	0.0
Manufacture	1.7	1.1	2.5	25.1
Electricity, Gas, Water Management	0.6	0.0	0.0	45.6
Construction	0.3	0.1	0.6	6.5
Retail and Wholesale	2.2	1.5	5.6	40.7
Logistics and Storage	1.4	0.4	2.9	13.1
Hotels and Restaurants	0.9	0.4	3.1	34.9
ICT	20.9	18.9	27.5	49.7
Banking and Insurance	15.5	6.7	14.6	66.2
Real estate industry	1.0	0.9	1.0	2.0
Professional Services	2.2	1.9	3.8	10.1
Facility Management and Support Services	0.5	0.0	0.9	3.9
Education	8.4	8.1	6.3	36.2
Health and Social Security	1.8	1.1	4.4	21.4
Art, Sports, Leisure	1.0	0.0	3.0	40.2
Personal Services	0.2	0.0	2.4	29.2

4. Korean Firms' AI Utilization and Adoption

> **KDI survey : The Share of Korean Firms using AI**(columns 1 & 2) **and those planning to adopt** (columns 3 & 4)

	Med. Companies Utilizing AI (50 < E <249)	Large Companies Utilizing AI (250+)	Med. Companies Planning to adopt AI	Large Companies Planning to adopt AI(250+)
Agriculture, Fishery	0.0	0.0	0.0	0.0
Mining	0.0	0.0	0.0	0.0
Manufacture	2.2	2.3	6.2	19.9
Electricity, Gas, Water Manag.	0.0	-	0.0	-
Construction	0.0	0.0	0.0	0.0
Retail and Wholesale	0.0	5.1	15.6	10.0
Logistics and Storage	0.0	5.6	5.1	5.4
Hotels and Restaurants	0.0	2.2	0.0	4.5
ICT	0.0	0.0	0.0	25.1
Banking and Insurance	15.1	21.0	15.1	5.3
Real estate industry	0.0	0.0	0.0	39.9
Professional Services	0.0	0.0	0.0	13.4
Facility and Support Services	0.0	4.5	11.9	13.6
Education	0.0	1.5	0.0	3.8
Health and Social Security	-	0.0	-	0.0
Art, Sports, Leisure	0.0	0.0	0.0	0.0
Personal Services	0.0	-	0.0	-

5. The Labor Market Impact of AI in Korea

➢ The Effect of AI Adoption on **Total Employment**

종속변수: 로그 임금근로자 수	(1) 1년 후	(2) 2년 후	(3) 3년 후	(4) 1년 후	(5) 2년 후	(6) 3년 후
	OLS			IV		
인공지능 도입	0.058*** (0.014)	0.046*** (0.017)	0.030 (0.020)	-0.083 (0.258)	-0.131 (0.280)	-0.387 (0.288)
기업 고정효과	Y	Y	Y	Y	Y	Y
연도 고정효과	Y	Y	Y	Y	Y	Y
N	91685	75735	61428	91685	75735	61428

주: 1) *p<0.1, **p<0.05, ***p<0.01.
2) 괄호 안은 표준오차이며, 기업 단위에서 군집됨.

➢ The Effect of AI Adoption on **Permanent Workers**

종속변수: 로그 상용근로자 수	(1) 1년 후	(2) 2년 후	(3) 3년 후	(4) 1년 후	(5) 2년 후	(6) 3년 후
	OLS			IV		
기술 도입	0.040*** (0.015)	0.023 (0.016)	0.004 (0.020)	-0.030 (0.243)	-0.165 (0.264)	-0.398 (0.275)
기업 고정효과	Y	Y	Y	Y	Y	Y
연도 고정효과	Y	Y	Y	Y	Y	Y
N	91685	75735	61428	91685	75735	61428

주: 1) *p<0.1, **p<0.05, ***p<0.01.
2) 괄호 안은 표준오차이며, 기업 단위에서 군집됨.
자료: 통계청, 「기업활동조사」, 2013~21.

- AI adoption has not had a significant negative impact on employment and wages, at least in the short term.

- Its effect on employment may appear with time-lag.

- When they are compared to permanent workers, part-time workers were more vulnerable to the labor-saving effect of AI technology

- Firms investing in automation tend to maintain their current workers while hiring fewer new employees.

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5. The Labor Market Impact of AI in Korea

➢ The Effect of AI Adoption on **Male** Permanent Workers' Wage

	Wage (Permanent)	Wage (Permanent)	LogWage (Permanent)	LogWage Permanent
	OLS	IV	OLS	IV
인공지능 영향률	-0.012 (0.023)	0.065** (0.031)	-0.145** (0.069)	0.029 (0.058)
연령	0.113*** (0.002)	0.113*** (0.002)	-0.009** (0.004)	-0.009** (0.004)

- At the regional level, AI adoption did not have statistically significant effect on employment, both male and female works.

➢ The Effect of AI Adoption on **Female** permanent Workers' Wage

	Wage (Permanent)	Wage (Permanent)	LogWage (Permanent)	LogWage Permanent
	OLS	IV	OLS	IV
인공지능 영향률	0.012 (0.014)	0.058*** (0.017)	-0.126*** (0.036)	-0.227*** (0.083)
최종학력: 고교	0.008*** (0.002)	0.008*** (0.002)	0.128*** (0.005)	0.128*** (0.005)

- In contrast, AI adoption had significant negative impact on wages of employees both male and female.

- However, its negative effect was more pronounced for female workers than male works.

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5. The Labor Market Impact of AI in Korea

> ➤ The Effect of AI Adoption on **Males by Age**

	Wage (Perm.)	Wage (Permanent)	LogWage (Permanent)	LogWage Permanent
	OLS	IV	OLS	IV
인공지능 영향률 x 15~29세	-0.269*** (0.041)	-0.328*** (0.056)	0.039 (0.079)	0.430*** (0.148)
x 30~44세	-0.127*** (0.031)	-0.172*** (0.046)	-0.390*** (0.118)	-0.400*** (0.138)
x 45~59세	0.193*** (0.029)	0.285*** (0.050)	0.025 (0.065)	0.246*** (0.061)
x 60~74세	0.106** (0.044)	0.229*** (0.056)	0.029 (0.099)	0.346*** (0.106)

> ➤ The Effect of AI Adoption on **Females by Age**

	Wage (Perm.)	Wage (Permanent)	LogWage (Permanent)	LogWage Permanent
	OLS	IV	OLS	IV
인공지능 영향률 x 15~29세	-0.288*** (0.047)	-0.532*** (0.096)	-0.654*** (0.062)	-0.990*** (0.165)
x 30~44세	0.124** (0.051)	0.112** (0.052)	-0.055 (0.113)	-0.160 (0.162)
x 45~59세	0.049 (0.050)	0.122* (0.071)	-0.008 (0.060)	0.189* (0.109)
x 60~74세	0.035 (0.056)	0.165* (0.090)	0.433*** (0.113)	0.842*** (0.238)

- The effect of AI adoption on workers of different ages varied.

- Both male and female young employees were more vulnerable to the automation.

- AI adoption had positive effect on the employment and wages of the middle-aged.

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6. Conclusion and Implications

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➢ The net effect of AI adoption on labor market tends to change over time; in general, it is expected to shift from positive to negative.

  ▪ The safety zone or bottleneck abilities that are believed to be shield from the emerging technology will eventually shrink and disappear.

➢ In Korea, large firms and certain sectors adopt AI more actively while medium-sized firms are still reluctant to invest in and use the emerging technology.

➢ The effect of AI adoption on labor market is increasingly prevalent, but the impacts are different depending on the types of employment, wages, genders, ages, and education levels.

  ▪ Female works, part-time workers are vulnerable to AI's labor-saving effect

  ▪ Firms may have strong tendency toward refraining from **employing new and young, part-time workers** while using the resource to invest in the new technology and maintaining managerial level, mid-career, and permanent workers.

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6. Conclusion and Implications

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> ## Policy Implications

- Social safety nets in the labor market to support during the adjustment period

- Training and education system to alleviate the disruptions

- Human-centric worker policy

7. AI Regulation - Harms and Risks of AI

Harms of AI		Risks of AI		
Harms	Key Issues	Data Collection & Processing	Robustness, Safety of the System	Ethical Use
Social Harm	Privacy infringement	●	○	◎
	Unfair competition	●	○	◎
	Behavioral manipulation	◎	○	●
Economic Harm	Excessive/biased automation	○	◎	●
	Loss of human judgement	○	◎	●
	Excessive monitoring	◎	○	●
Political Harm	Social media bias	●	○	◎
	Data and information control	●	○	◎
	Erosion of political discourse	◎	○	●

Note: ●>◎>○ indicates the relevance between the categories of harms and key risks of AI system.

Source: Jungwook Kim et al. (2024) "Research on AI Regulations to Enhance Competitiveness in the Era of AI".

7. Pillars of AI Regulation: Data, Safety, Ethics

AI Regulatory Frameworks	Data	Safety	Ethics	Other
	Data Privacy, Data Quality	System Robustness, Security	Fairness, Non-discrimination, Transparency	Other
OECD AI Principles	—	Robustness, safety	Human-Centered Values, Fairness, Transparency, Accountability	Inclusive Growth, Well-being Sustainable Development
EU Ethics Guidelines For Trustworthy AI	Privacy and Data Governance	Technical Robustness and Safety	Human agency & Oversight, Transparency, Diversity, Non-discrimination, Fairness	Social and Environmental Well-being
EU AI Act (High-Risk AI System)	Data Governance	Safety, Accuracy, Robustness and Cybersecurity	Transparency, Explainability	Technical Documentation, Record-keeping, Human Oversight
US Blueprint for an AI Bill of Rights	Data privacy	Safe and Effective Systems	Algorithmic Discrimination, Protections	Notice and Explanation, Human Alternatives
US NIST Framework for AI Risk Management	Data Quality	Validity, Reliability, Safe, Security, Resilience	Accountability, Transparency, Privacy-Enhanced, Fair–with Harmful Bias Managed	—
UK AI Regulation (pro-innovation approach)	—	Safety, Security, Robustness	Transparency, Explainability, Fairness, Accountability	Governance, Contestability, Redress
Canada's Directive on Automated Decision-Making	Quality Assurance	Security	Algorithmic Impact Assessment, Transparency	Recourse, Reporting
China's Ethical Norms for the Next Generation AI	Data Quality	Security, Reliability, Predictability	Transparency, Accountability, Fairness, Justice, Privacy	Human Welfare
Korea's Guidelines for AI Ethics	Data Management	Prohibition of Harm, Safety	Human Rights Protection, Privacy Protection, Public Interest, Diversity, Accountability, Transparency	Solidarity

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Source: Jungwook Kim et al. (2024) "Research on AI Regulations to Enhance Competitiveness in the Era of AI".

7. Socioeconomic Impacts of AI

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Issues Indirectly Related to AI Technology and Systems			
Economic Impact	**Legal and Regulatory Impact**	**Social Impact**	**Environmental Impact**
• Market Monopoly and Unfair Competition • Job Displacement and Economic Inequality • Innovation and Industrial Transformation	• Conflicts with Existing Laws and Regulations • Intellectual Property and Personal Rights • Ownership of AI-Generated Content	• AI Inclusivity, Accessibility, and Literacy • Deepening Education and Technology Gaps • Psychological Impact and Mental Health • AI-Driven Crime and Spread of Fake News	• Resource Concentration, including Energy • Intensification of Climate Change and Environmental Pollution • Climate Change Mitigation through Innovation

- ***Technology-specific Issues** – need to* focus on technology-specific issues; requires new regulatory approaches based on continued data-gathering, technical adjustment, research.

- ***Broader Societal Impacts** – need to* address indirect issues arising from the broader societal impacts of AI, necessitating adaptations to/ improving the existing frameworks.

- ***Need of holistic approach to AI Regulation** –* shows the interconnection between technology-specific issues and broader societal impacts, while considering diverse regulatory approaches for each.

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Source: Jungwook Kim et al. (2024) "Research on AI Regulations to Enhance Competitiveness in the Era of AI".

Thank you

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