Who adopts AI?
Evidence from Firms and Workers in Denmark

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Introduction

"Core AI":
machine learning, NLP etc

Other Advanced Tech:
robots, automated storage systems..

Introduction

Why does AI adoption matter?

- AI is transforming firm behaviour, labour markets, and productivity
- Yet we know little about **which firms adopt AI** and how.
- Key questions we plan to answer:
  - What are the characteristics of AI adopters?
  - Are there distinct patterns relative to other advanced technologies and across business areas?
  - Are existing AI exposure proxies valid?

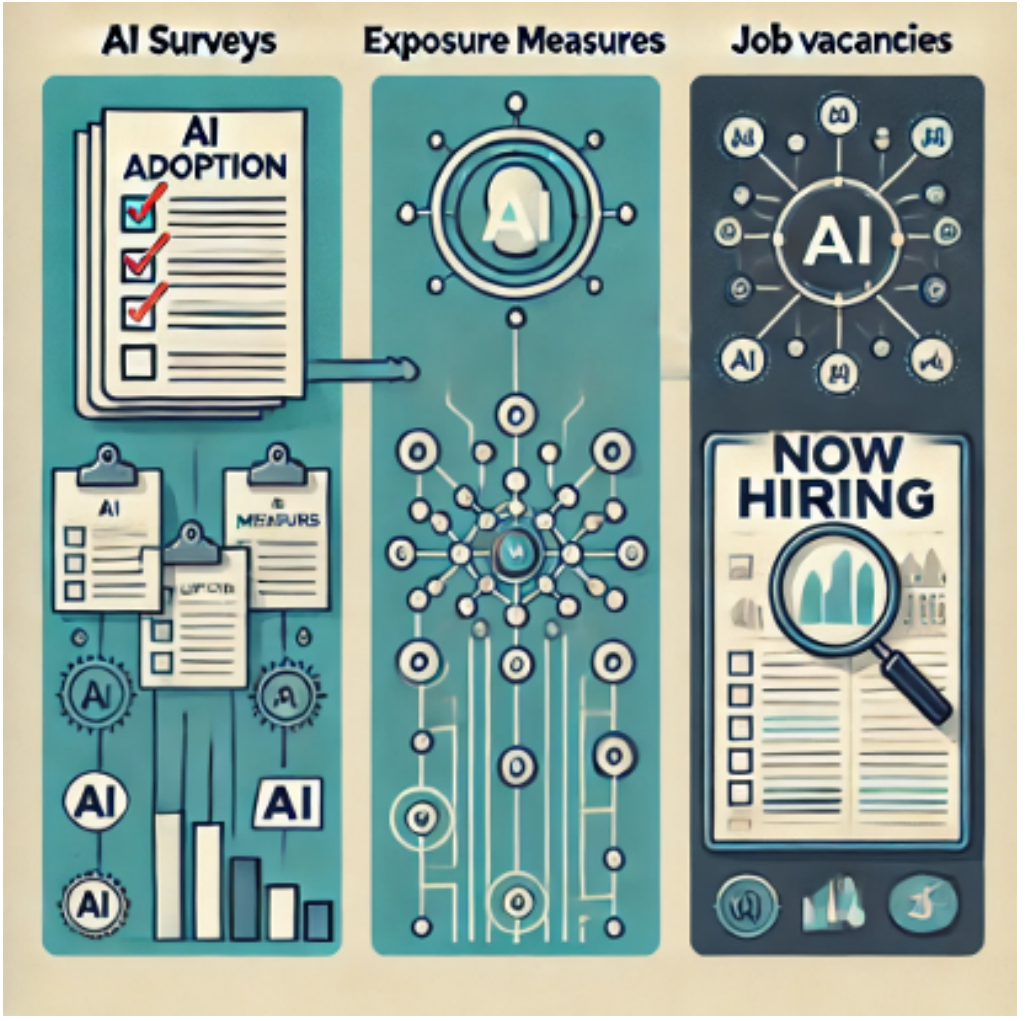
Accurately measuring AI's impact on:

- Firms' production processes and productivity
- Labour market outcomes and inequality

Introduction

How Can We Measure AI Adoption?

- **Job Vacancies (AI-related roles)**
  - \+ Indicates *demand for AI skills* in the labour market.
  - – *Focused on future intent*, not actual adoption.
- **AI Exposure Measures (Patents & Task Mapping)**
  - \+ *Broad, scalable*, and cross-sectoral.
  - – Captures *potential*, not firm-level implementation.
- **Surveys**
  - \+ Direct measurement of firm behaviour.
  - – Results vary due to *sampling* and *AI definition* differences.



Our Contribution

- **New firm/worker-level evidence on AI adoption:**
  - Unique data linking AI survey (2023–2024) with Danish employer-employee register data.
  - Covers ca. 2,500 firms per year, with panel dimension for about 500 firms.
  - About 2000 individuals in the worker-level survey
- **Distinguishing types of AI & Advanced Technologies**
  - Core AI: e.g. Machine Learning and Natural Language Processing
  - Other Advanced Tech.: e.g. Robotics, and Automated Guided Vehicles
- **Characteristics and predictors of AI adopters - extensive and intensive margin**

Validation of common AI exposure proxies:

- Compare survey-based adoption to exposure indices (task mapping and patents).

Brief Literature Review

AI Adoption – What We Know:

- Larger, more productive, and skill-intensive firms are more likely to adopt (e.g. Zolas et al. (2021); Rammer et al. (2022); McElheran et al. (2024)
- Most studies do not differentiate between AI *types*
- Few studies use firm-level adoption data (connected with worker-level info)

AI Exposure Proxies:

- Based on occupational/industry-level task measures (Webb (2019), Felten et al. (2021), Acemoglu & Restrepo (2022), Engberg et al. (2025))
- Rarely validated with actual firm-level adoption

Data

DST Survey on Digitization and AI

- **Two surveys:** Firm-level and worker-level run by Danmark Statistics.
- **Two rounds per survey:**
  - mid 2023 (referring to 2022)
  - end 2024
- **Sample**
  - Firms with >5 employees
  - All industries except agriculture
  - Stratified random sample as defined by DST standards
- **Response rates and sample sizes**
  - 2023 Employer Survey: 23.1% ($n = 2547$)
  - 2024 Employer Survey: 18.9% ($n = 1907$)
- **Register Data**
  - Detailed universal linked employer–employee data (2022)

Data

What's new?

Beyond Level of digitization and whether firm uses AI ...
What's novel about this survey?

11 DIFFERENT AI-RELATED APPLICATIONS

BUSINESS AREAS AND PURPOSE OF AI ADOPTION

BARRIERS TO ADOPTION

EXPERIMENTAL SETTING

Data

Definitions

Core AI

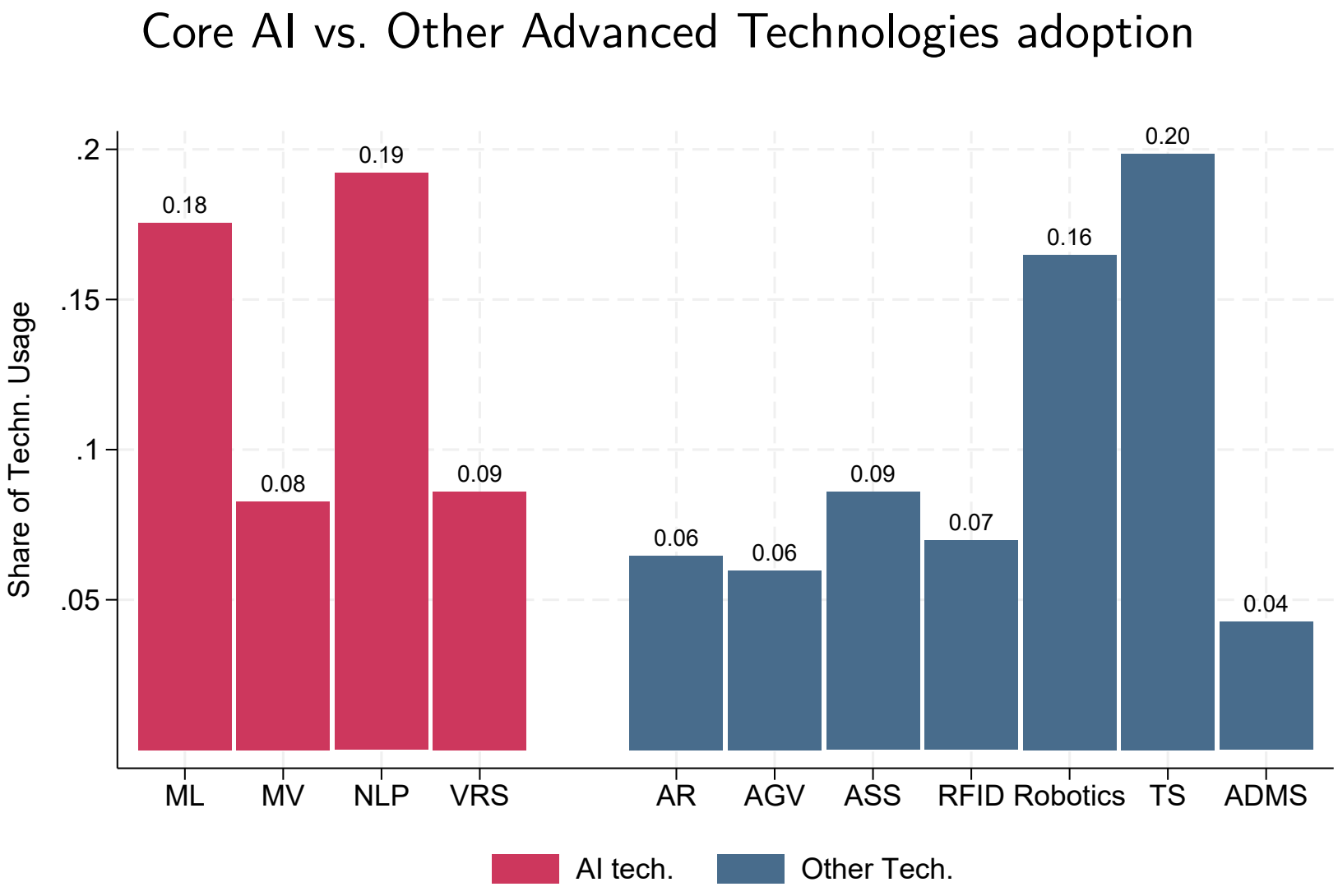
- Machine Learning (ML)
- Natural Language Processing (NLP)
- Machine Vision (MV)
- Voice Recognition Software (VRS)
- Generative AI (GenAI) (2024 round only)

Other Advanced Tech.

- Robotics (R)
- Automated Guided Vehicles (AGV)
- Automated Guided Vehicles (AGVs)
- Automated Storage Systems (ASS)
- Radio Frequency Identification (RFID)
- Touchscreens/Kiosks (TS)
- Augmented Reality (AR)
- Automated Decision-Making Systems (ADMS)

Data

AI Adoption in Denmark

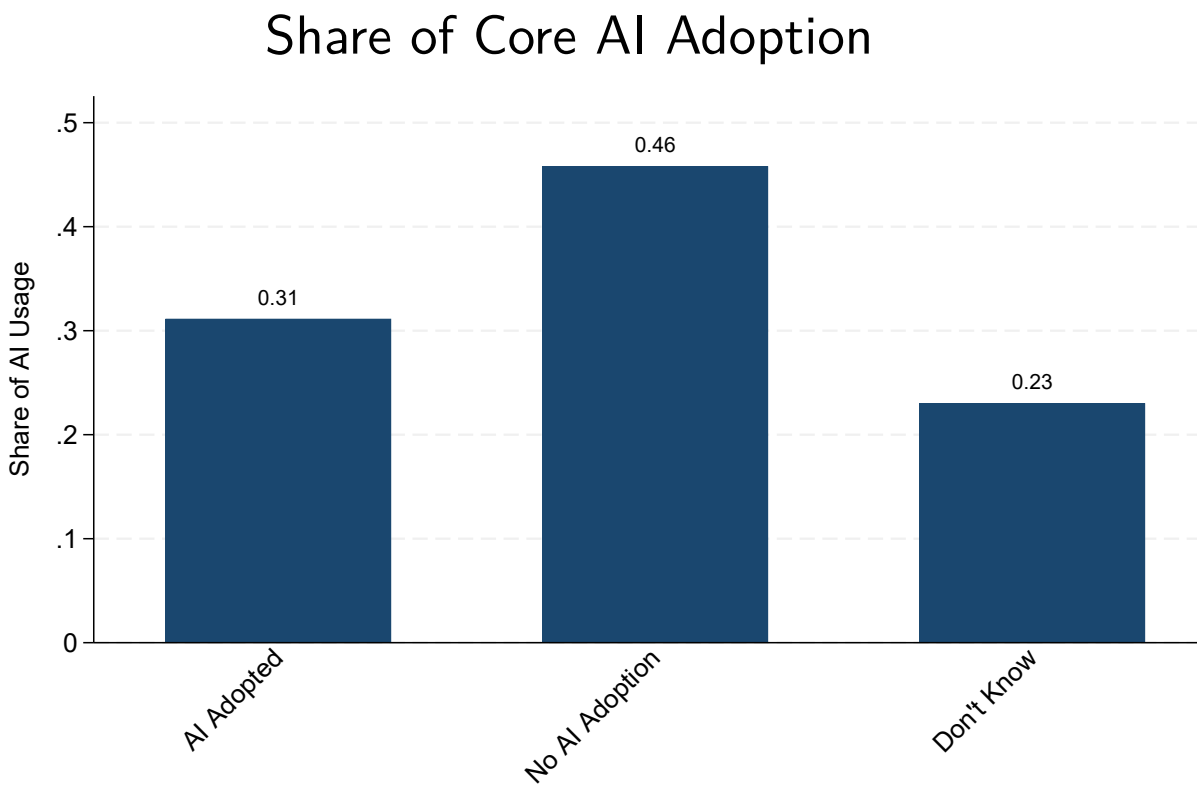


Data

AI Adoption in Denmark

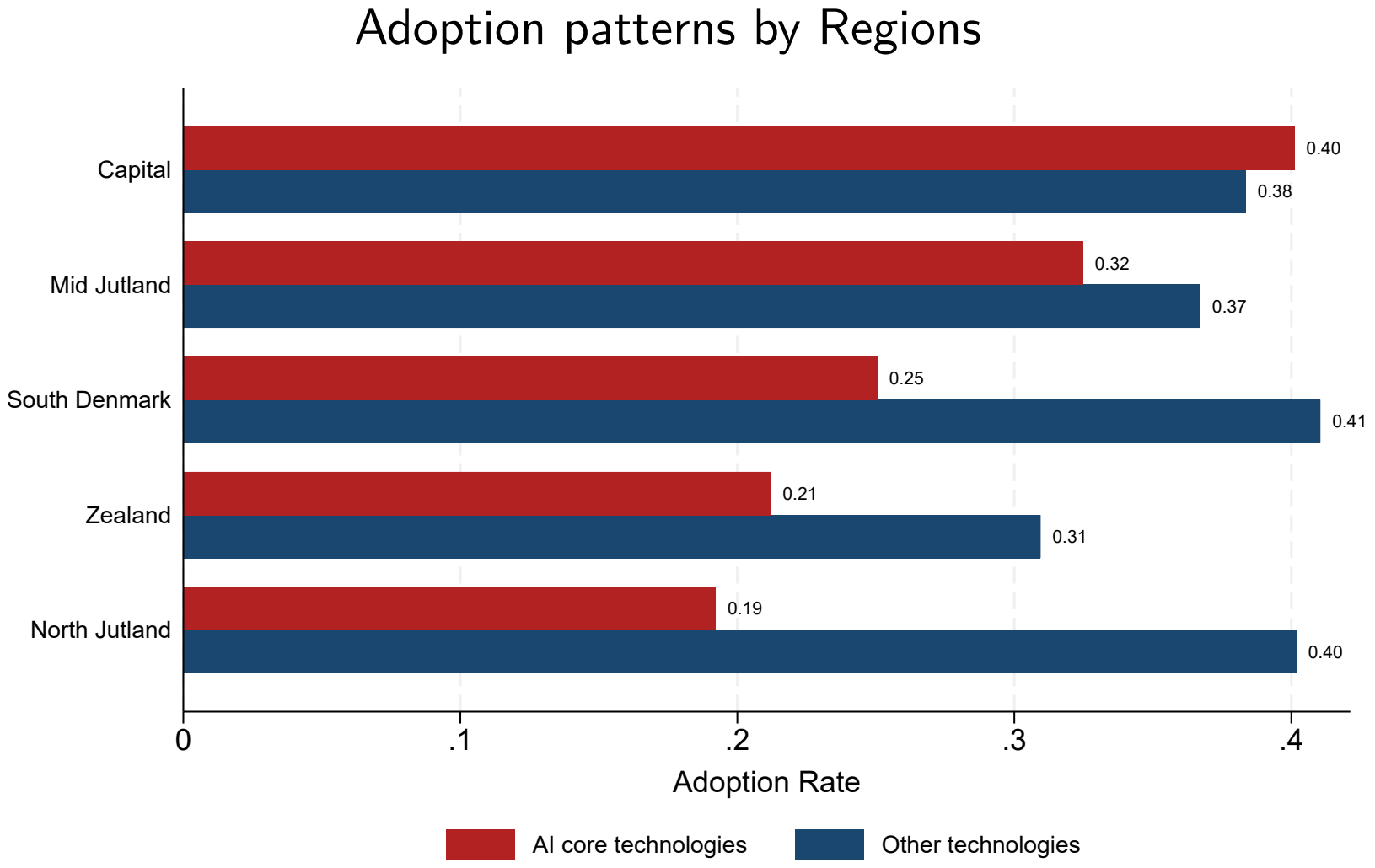
AI Adoption in Denmark:

- Eurostat (2024): 28%
- McKinsey (2024): 70%
- Our DST survey: 31-56%



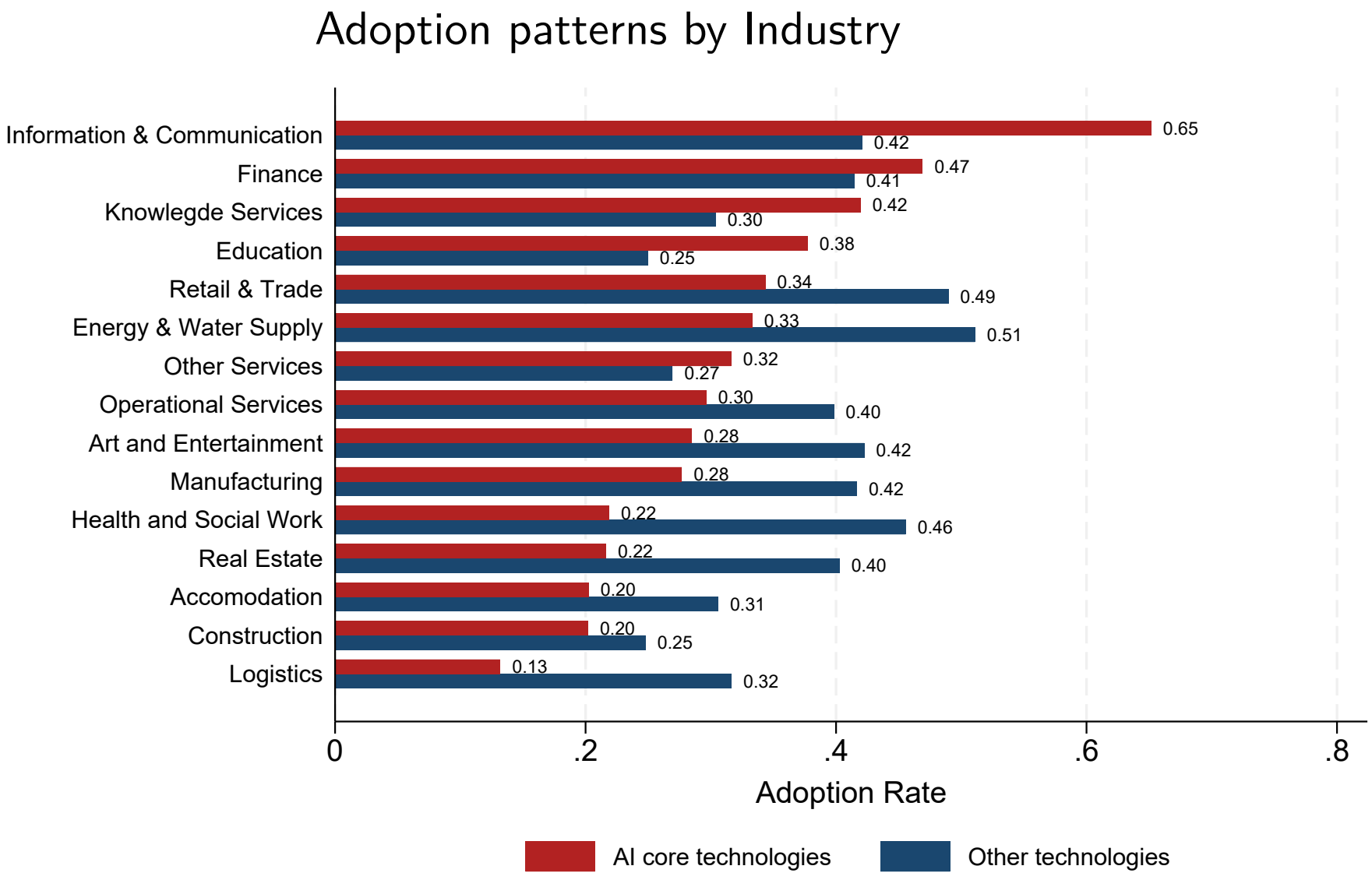
Descriptive Statistics

Adoption by Region



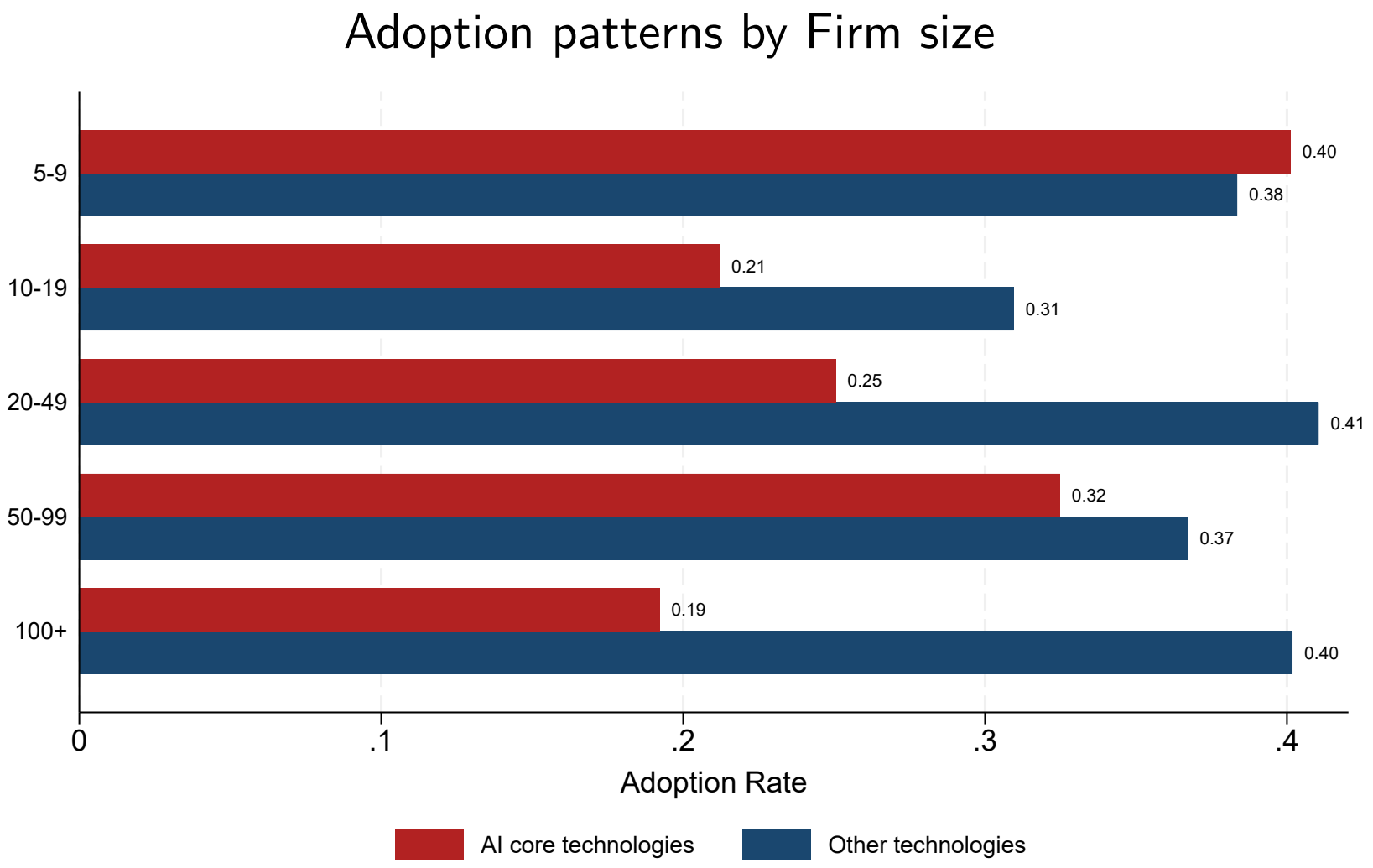
Descriptive Statistics

Adoption by Industry



Descriptive Statistics

Adoption by Firm Size



Descriptive Statistics

Firm Characteristics

Table: Firm Characteristics by Adoption Type

	Core AI		Other tech.		No AI		No Tech	
Variable	**Mean**	**St.dev**	**Mean**	**St.dev**	**Mean**	**St.dev**	**Mean**	**St.dev**
Firm characteristics:								
No. of Employees	144.12	363.20	132.66	329.23	52.85	92.69	43.44	73.60
Revenue (m)	769.77	9478.22	449.27	1950.96	140.19	536.44	103.04	311.19
Value Added (m)	176.32	783.88	134.27	562.84	43.55	91.49	34.87	77.97
Yearly Wage (th)	447.77	184.08	422.31	177.70	378.07	160.00	372.12	157.18
Hourly Wage	282.38	92.62	268.18	86.57	246.53	74.52	244.59	74.15
Firm Age	24.58	20.70	26.14	20.95	23.57	18.71	22.42	18.00
Exports (m)	411.17	6911.01	181.93	1504.21	37.51	186.27	23.76	131.10
Imports (m)	685.43	14967.95	380.03	11012.86	32.26	189.40	21.40	122.33
Physical capital stock	46.53	497.22	35.98	432.43	8.87	69.81	6.64	68.49
Foreign Ownership	0.22	0.42	0.21	0.41	0.13	0.33	0.11	0.31
No of Obs/Firms:	1396		1733		2374		1619	

Notes: AI includes: ML, NLP, MV, VRS, GenAI. Other advanced tech includes: R, AGV, ASS, RFID, TS, AR, ADMS. Financial values in million DKK; yearly wages in thousand DKK. Firm age and employment counts in levels. Population: non-agricultural private sector firms with 5 employees.

Descriptive Statistics

Workforce Composition

Table: Workforce Composition by Adoption Type

	Core AI		Other Tech.		No AI		No Tech	
Variable	**Mean**	**St.dev**	**Mean**	**St.dev**	**Mean**	**St.dev**	**Mean**	**St.dev**
Workforce composition:								
Female workers	0.37	0.23	0.36	0.24	0.34	0.26	0.34	0.27
Immigrant workers	0.14	0.17	0.13	0.17	0.13	0.18	0.13	0.19
Avg. age workers	41.95	6.29	42.63	6.53	42.82	7.21	42.64	7.27
Younger than 36	0.37	0.20	0.35	0.20	0.35	0.22	0.36	0.22
Between 36 and 54	0.41	0.14	0.41	0.13	0.39	0.15	0.39	0.16
Older than 55	0.22	0.15	0.24	0.15	0.26	0.17	0.25	0.18
No secondary educ.	0.13	0.14	0.16	0.15	0.20	0.16	0.20	0.17
Bachelor's or higher	0.46	0.28	0.38	0.27	0.29	0.26	0.29	0.26
Master's or higher	0.20	0.21	0.14	0.18	0.09	0.15	0.09	0.15
STEM educated	0.25	0.24	0.25	0.23	0.25	0.24	0.26	0.25
University STEM ed.	0.14	0.18	0.11	0.16	0.07	0.13	0.07	0.13
White collar	0.75	0.31	0.68	0.33	0.59	0.35	0.58	0.36
Blue collar	0.25	0.31	0.32	0.33	0.41	0.35	0.42	0.36
Managers	0.07	0.08	0.07	0.08	0.07	0.08	0.06	0.08
No of Obs/Firms:	1396		1733		2374		1619	

Notes: AI includes: ML, NLP, MV, VRS. Other advanced tech includes: R, AGV, ASS, RFID, TS, AR, ADMS. All variables except average age are employment shares at the firm level. Population: non-agricultural private sector firms with 5 employees.

Empirical Strategy: What Predicts AI Adoption?

Main specification:

$$\Pr(AI_i = 1) = \Lambda\left(Z_i'\delta + X_i'\beta + \theta_s + \mu_r + \varepsilon_i\right)$$

- AI_i: Indicator for AI adoption in firm i
- $\Lambda(\cdot)$: Logistic function
- Z_i: Firm characteristics (e.g. size, value added, export & import status etc)
- X_i: Worker characteristics (e.g. skill composition, demographics, wage structure etc)
- θ_s, μ_r: Sector and region fixed effects

Outcomes:

- *Extensive margin:* Any AI adoption, Software AI, Hardware AI (binary logit)
- *Intensive margin:* Number of AI technologies adopted (Neg.Binomial)

What Predicts AI Adoption?

Extensive Margin – Firm Characteristics

	Core AI		Other Tech.		GenAI	
Firm characteristics:						
Ln(employment)	0.347***	0.359***	0.388***	0.411***	0.460***	0.793***
	(0.062)	(0.085)	(0.060)	(0.084)	(0.102)	(0.146)
Ln(value added)	1.503	-0.606	-0.484	0.692	1.939	1.191
	(1.817)	(1.973)	(1.368)	(1.974)	(2.028)	(3.561)
Ln(capital intensity)	-0.012	0.004	0.023*	0.010	-0.007	-0.010
	(0.013)	(0.014)	(0.013)	(0.014)	(0.019)	(0.020)
Ln(intangibles per worker)	0.008	-0.005	-0.005	0.002	-0.045	0.016
	(0.021)	(0.026)	(0.020)	(0.024)	(0.032)	(0.037)
Ln(hourly wage)	0.104	0.073	0.697**	-0.118	-0.033	-0.968
	(0.375)	(0.477)	(0.342)	(0.433)	(0.511)	(0.658)
Ln(firm age)	-0.044	0.014	-0.130	0.120	-0.306**	-0.111
	(0.095)	(0.173)	(0.089)	(0.158)	(0.140)	(0.233)
Foreign owned	0.026	-0.050	0.175	0.225	-0.456*	-0.229
	(0.158)	(0.191)	(0.158)	(0.181)	(0.262)	(0.307)
Exporting	0.022	0.071	-0.048	0.109	0.171	0.105
	(0.162)	(0.199)	(0.146)	(0.166)	(0.229)	(0.275)
Importing	-0.008	0.069	0.280*	0.569***	0.447**	0.519*
	(0.167)	(0.226)	(0.149)	(0.193)	(0.219)	(0.276)
Digitalization	0.107***	0.117***	0.065***	0.072***	0.115***	0.113***
	(0.014)	(0.019)	(0.013)	(0.016)	(0.020)	(0.027)
Sector & region FE	✓		✓		✓	
Firm Effects		✓		✓		✓
No of Obs/Firms:	3000	1854	3000	1854	1506	920

Logit model. Robust standard errors in parentheses. Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

What Predicts AI Adoption?

Extensive Margin – Workforce Composition

	Core AI		Other tech.		GenAI	
Workforce characteristics (shares):						
Females	-0.839**	-0.316	0.357	0.142	-1.319**	-0.653
	(0.371)	(0.451)	(0.339)	(0.438)	(0.568)	(0.773)
Immigrants	0.466	0.850	0.080	0.638	-2.244***	-3.321***
	(0.426)	(0.561)	(0.394)	(0.528)	(0.575)	(0.745)
Age $<$ 36	0.769	0.134	0.302	0.134	0.485	1.387
	(0.468)	(0.634)	(0.423)	(0.578)	(0.664)	(0.905)
Age $>$ 55	0.069	-0.020	0.079	0.525	-0.703	0.203
	(0.579)	(0.678)	(0.477)	(0.588)	(0.784)	(0.945)
STEM, no university	-0.802*	-0.834*	-0.151	-0.356	-1.739**	-0.861
	(0.452)	(0.504)	(0.400)	(0.435)	(0.691)	(0.725)
University, no STEM	1.180**	0.292	-0.034	-0.553	3.409***	3.013***
	(0.468)	(0.577)	(0.449)	(0.561)	(0.685)	(0.904)
STEM university	0.560	1.228**	0.294	-0.197	1.361*	0.004
	(0.448)	(0.518)	(0.453)	(0.505)	(0.761)	(0.790)
Managers	-1.149*	-1.243	0.334	-0.133	1.118	5.862***
	(0.673)	(0.869)	(0.644)	(0.801)	(1.258)	(1.554)
White collar	0.470	0.781**	-0.379	0.136	-0.417	0.467
	(0.317)	(0.369)	(0.300)	(0.340)	(0.433)	(0.494)
Sector & region FE	✓		✓		✓	
Firm Effects		✓		✓		✓
No of Obs/Firms:	3000	1854	3000	1854	1506	920

Logit model. Robust standard errors in parentheses. Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

What Predicts AI Adoption?

Extensive Margin - Key Drivers

- **Bigger, more digitalized firms** adopt earlier—across all tech types.
- **Importing firms** adopt more Tech/GenAI, reflecting global exposure and better management.
- **Core AI and GenAI are highly skill-biased**: adopters have more university-educated, managerial, and white-collar workers.
- **Gender and immigrant shares proxy task structure:** firms with more female or immigrant workers adopt less, mainly due to differences in *occupational composition*.
- **GenAI is the most polarized**: adopted by large, knowledge-intensive firms; much lower adoption in low-skilled and immigrant-heavy workplaces.

What Predicts AI Adoption?

Intensive Margin

	All firms				
Firm characteristics:					
Ln(employment)	0.480***	0.432***	0.465***	0.417***	0.486***
	(0.074)	(0.073)	(0.074)	(0.073)	(0.079)
Ln(value added)	-0.057	0.011	-0.004	-0.002	-0.038
	(0.065)	(0.064)	(0.065)	(0.064)	(0.071)
Firm age	-0.006***	-0.001	-0.001	-0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Foreign owned	0.282***	0.211**	0.182*	0.151	0.123
	(0.093)	(0.093)	(0.094)	(0.092)	(0.095)
Ln(hourly wage)	0.797***	0.135	0.373*	0.416*	0.409*
	(0.165)	(0.219)	(0.227)	(0.223)	(0.244)
Exporting	0.334***	0.272***	0.124	0.072	0.050
	(0.090)	(0.090)	(0.096)	(0.095)	(0.103)
Importing	0.349***	0.275***	0.183*	0.117	0.152
	(0.102)	(0.102)	(0.105)	(0.104)	(0.114)
Capital intensity	0.004	0.005	0.000	-0.001	-0.010
	(0.012)	(0.012)	(0.013)	(0.012)	(0.014)
Intagibles per worker	0.601	-0.320	-0.580	-1.547	-1.644
	(3.842)	(3.861)	(3.833)	(3.781)	(3.848)
...	...	...	...	...	...
Region FE			✓	✓	✓
Sector FE			✓	✓	✓
Firm FE					✓
No of Obs/Firms:	3000	3000	3000	3000	2629

Negative Binomial model. Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

What Predicts AI Adoption?

Intensive Margin

	All firms				
...	...	...	...	...	...
Workforce characteristics (shares):					
Females		-0.033	-0.067	-0.019	-0.032
		(0.210)	(0.220)	(0.217)	(0.241)
Immigrants		0.591***	0.543**	0.674***	0.321
		(0.222)	(0.234)	(0.233)	(0.271)
Age<36		0.020	0.187	0.241	0.255
		(0.293)	(0.302)	(0.298)	(0.340)
Age>55		-0.498	-0.507	-0.271	-0.072
		(0.367)	(0.371)	(0.368)	(0.411)
No edu		0.239	0.126	0.209	0.460
		(0.350)	(0.358)	(0.356)	(0.396)
Bc or Higher		0.828***	0.791***	0.615**	0.837**
		(0.280)	(0.302)	(0.299)	(0.337)
STEM uni edu		0.385	0.276	0.287	0.139
		(0.304)	(0.314)	(0.308)	(0.347)
White collar		0.431**	0.326*	0.288	0.330
		(0.170)	(0.187)	(0.185)	(0.204)
Managers		0.316	0.168	0.100	0.322
		(0.456)	(0.457)	(0.450)	(0.505)
Digitalization				0.091***	0.096***
				(0.009)	(0.010)
Region FE			✓	✓	✓
Sector FE			✓	✓	✓
Firm FE					✓
No of Obs/Firms:	3000	3000	3000	3000	2629

Negative Binomial model. Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Main findings so far

SUmmary of Findings:

1. **Who adopts AI?** — Larger, high-skill, and digitilized firms more likely to adopt
2. **Not all Tech. is the same** — differ in firm characteristics and workforce composition
3. Adoption varies by **business areas** and by **sectors**

   Business Area Sectors
4. Systematic **joint adoption** among various AI technologies

   AI Matrix
5. **Existing proxies can mislead** — Some exposure indices may be weak predictors of firm-level adoption

Next Steps and Outlook

Next Steps within this Project:

- Leverage the panel structure: Track firm adoption dynamics across 2023 and 2024
- Link pre-survey administrative data to assess baseline firm trajectories
- Incorporate worker-level AI use from employee survey (2024 round)
- Theoretical model to conceptualise hard vs software AI adoption

Future Outlook:

- Analyse the effects of heterogeneous AI adoption on:
  - Employment and wages
  - trade (in services) and onshoring
- Exploit experimental modules within the firm and worker surveys
  1. AI is good / bad for jobs
  2. info on (non) regulation

Thank you!

Questions and feedback welcome.

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AI Adoption by Business Areas and AI Application

	HR	Finance	Marketing	CRM	Supply-Chain	Production
Augmented_Reality	0.058**	0.056**	0.094***	0.030	0.042**	0.039
	(0.025)	(0.028)	(0.028)	(0.022)	(0.016)	(0.026)
Autom._Guid._Vehic	-0.039	-0.063**	-0.102***	-0.057**	-0.014	-0.033
	(0.029)	(0.031)	(0.033)	(0.025)	(0.018)	(0.029)
Autom._Storage_Syst.	0.014	0.003	-0.000	0.031	0.046***	0.012
	(0.024)	(0.027)	(0.027)	(0.021)	(0.015)	(0.026)
Machine_Learning	0.055***	0.130***	0.111***	0.087***	0.055***	0.103***
	(0.020)	(0.021)	(0.021)	(0.017)	(0.014)	(0.019)
Machine_Vision	-0.012	-0.022	-0.011	-0.004	0.012	0.066***
	(0.023)	(0.026)	(0.026)	(0.019)	(0.015)	(0.022)
Natural_Lang._Proc	0.121***	0.067***	0.206***	0.105***	0.059***	0.110***
	(0.018)	(0.021)	(0.019)	(0.016)	(0.014)	(0.019)
...	...	...	...	...	...	...
Region FE	✓	✓	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓	✓	✓
No of Obs/Firms:	2134	2134	2134	2134	2134	2134

Notes: These are marginal effects. Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

..by Firm Business Areas CONT.

	HR	Finance	Marketing	CRM	Supply-Chain	Production
...	...	...	...	...	...	...
Radio_Frequency_Ident.	0.007	0.015	-0.012	0.024	0.005	0.022
	(0.023)	(0.025)	(0.026)	(0.020)	(0.015)	(0.024)
Robotics	-0.000	0.069***	-0.008	-0.004	0.017	0.043**
	(0.019)	(0.021)	(0.021)	(0.017)	(0.014)	(0.020)
Touchscreens_Kiosks	0.051***	0.034*	0.055***	0.045***	0.047***	0.048**
	(0.018)	(0.020)	(0.020)	(0.016)	(0.013)	(0.019)
Voice_Recogn._SW	0.001	0.006	0.033	0.051***	-0.012	0.004
	(0.023)	(0.026)	(0.026)	(0.019)	(0.016)	(0.024)
Autom._Decision − Making_Syst.	0.167***	0.134***	0.090***	0.091***	0.044**	-0.019
	(0.026)	(0.031)	(0.034)	(0.023)	(0.018)	(0.032)
Region FE	✓	✓	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓	✓	✓
No of Obs/Firms:	2134	2134	2134	2134	2134	2134

Notes: These are marginal effects. Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

AI Adoption by Firm Business Areas - incl. all controls

	HR	Finance	Marketing	CRM	Supply-Chain	Production
Augmented_Reality	0.054*	0.081***	0.092***	0.038	0.045**	0.021
	(0.028)	(0.031)	(0.031)	(0.023)	(0.019)	(0.029)
Autom._Guided_Vehicles	-0.043	-0.056	-0.048	-0.039	-0.006	-0.012
	(0.032)	(0.035)	(0.035)	(0.027)	(0.021)	(0.032)
Autom._Storage_Systems	0.016	-0.002	-0.025	0.019	0.055***	0.024
	(0.027)	(0.029)	(0.030)	(0.023)	(0.018)	(0.028)
Machine_Learning	0.044*	0.130***	0.082***	0.062***	0.055***	0.084***
	(0.022)	(0.023)	(0.024)	(0.019)	(0.017)	(0.022)
Machine_Vision	-0.011	-0.042	-0.029	-0.010	0.001	0.069***
	(0.025)	(0.028)	(0.028)	(0.021)	(0.018)	(0.024)
Natural_Lang._Processing	0.095***	0.072***	0.185***	0.089***	0.054***	0.107***
	(0.021)	(0.023)	(0.021)	(0.018)	(0.016)	(0.021)
Radio_Freq._Ident.	-0.013	0.015	-0.008	0.012	0.000	0.026
	(0.026)	(0.028)	(0.028)	(0.022)	(0.018)	(0.026)
Robotics	-0.021	0.081***	-0.008	-0.011	0.015	0.030
	(0.022)	(0.023)	(0.024)	(0.019)	(0.016)	(0.022)
...	...	...	...	...	...	...
Region FE	✓	✓	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓	✓	✓
No of Obs/Firms:	1708	1708	1708	1708	1708	1708

Notes: These are marginal effects. Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

..by Firm Business Areas - all controls CONT.)

	HR	Finance	Marketing	CRM	Supply-Chain	Production
...	...	...	...	...	...	...
$Touchscreens\_Kiosks$	0.044**	0.034	0.054**	0.044**	0.050***	0.046**
	(0.021)	(0.023)	(0.023)	(0.018)	(0.015)	(0.021)
$Voice\_Recognition\_SW$	0.017	0.000	0.043	0.054***	-0.009	-0.010
	(0.026)	(0.029)	(0.029)	(0.021)	(0.019)	(0.027)
$Autom.\_Decision-Making\_Syst.$	0.142***	0.115***	0.080**	0.070***	0.029	-0.047
	(0.030)	(0.036)	(0.036)	(0.025)	(0.022)	(0.035)
$Ln(employment)$	0.029	0.009	0.040*	0.043***	-0.002	-0.003
	(0.020)	(0.021)	(0.021)	(0.016)	(0.015)	(0.020)
$Ln(valueadded)$	-0.001	0.000	-0.022	-0.022	0.011	0.008
	(0.018)	(0.019)	(0.019)	(0.014)	(0.014)	(0.018)
$Firm\_age$	0.000	0.000	-0.001	0.000	0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
$Foreign\_owned$	0.015	-0.071**	-0.085***	0.002	-0.018	0.011
	(0.024)	(0.028)	(0.027)	(0.021)	(0.018)	(0.025)
$Ln(hourlywage)$	0.094	0.127*	0.030	0.012	-0.012	-0.138**
	(0.060)	(0.065)	(0.065)	(0.052)	(0.048)	(0.063)
...	...	...	...	...	...	...
Region FE	✓	✓	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓	✓	✓
No of Obs/Firms:	1708	1708	1708	1708	1708	1708

Notes: These are marginal effects. Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

(..by Firm Business Areas - full controls CONT.)

	HR	Finance	Marketing	CRM	Supply-Chain	Production
...	...	...	...	...	...	...
Exporting	0.010	-0.015	-0.008	0.003	0.005	0.039
	(0.027)	(0.028)	(0.028)	(0.023)	(0.021)	(0.026)
Importing	-0.018	-0.052	0.026	0.002	-0.006	0.003
	(0.030)	(0.032)	(0.033)	(0.027)	(0.025)	(0.031)
Capital_intensity	-0.015	-0.017*	-0.004	-0.054	0.001	-0.011*
	(0.010)	(0.009)	(0.005)	(0.045)	(0.002)	(0.006)
intangible_assets_k	0.001	-0.014	-0.001	0.007	0.002	0.018
	(0.005)	(0.014)	(0.006)	(0.005)	(0.003)	(0.014)
share_female_cvrnr	0.160**	0.135**	0.051	-0.043	0.030	0.002
	(0.062)	(0.066)	(0.067)	(0.055)	(0.048)	(0.064)
share_immig_cvrnr	0.085	-0.050	0.009	-0.035	-0.065	-0.160**
	(0.065)	(0.072)	(0.073)	(0.058)	(0.055)	(0.070)
age_less36	0.014	0.139	0.087	0.132*	0.089	-0.035
	(0.085)	(0.091)	(0.089)	(0.072)	(0.065)	(0.084)
age_55_more	-0.010	-0.007	0.034	-0.021	0.038	-0.061
	(0.111)	(0.117)	(0.115)	(0.099)	(0.086)	(0.107)
...	...	...	...	...	...	...
Region FE	✓	✓	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓	✓	✓
No of Obs/Firms:	1708	1708	1708	1708	1708	1708

Notes: These are marginal effects. Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

(..by Firm Business Areas - full controls CONT.)

	HR	Finance	Marketing	CRM	Supply-Chain	Production
...	...	...	...	...	...	...
no_secondary_educ	-0.043	-0.211*	-0.113	-0.173*	-0.010	0.024
	(0.106)	(0.114)	(0.116)	(0.096)	(0.081)	(0.115)
bachelor_or_higher	-0.093	-0.062	-0.104	-0.129*	0.005	0.230***
	(0.081)	(0.086)	(0.086)	(0.070)	(0.065)	(0.079)
stem_education_univ	-0.019	-0.260***	-0.043	-0.017	0.015	-0.068
	(0.085)	(0.093)	(0.089)	(0.072)	(0.067)	(0.079)
white_collar_share	0.019	-0.006	0.082	0.022	-0.021	-0.063
	(0.055)	(0.059)	(0.058)	(0.048)	(0.041)	(0.057)
managers_share	0.083	-0.159	0.082	0.154	0.060	0.089
	(0.122)	(0.139)	(0.132)	(0.100)	(0.094)	(0.123)
digitalization	0.012***	0.012***	0.023***	0.013***	0.007***	0.016***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
Region FE	✓	✓	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓	✓	✓
No of Obs/Firms:	1708	1708	1708	1708	1708	1708

Notes: These are marginal effects. Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

back

AI Adoption by Sectors

	Manufacturing	**+ FE**	**Transort**	**+ FE**	**KIBS**	**+ FE**	**Other**	**+ FE**
$Ln(employment)$	0.028	0.055	0.034	0.054	0.114***	0.114***	-0.152**	-0.088
	(0.049)	(0.051)	(0.040)	(0.042)	(0.030)	(0.034)	(0.077)	(0.096)
$Ln(valueadded)$	0.075	0.078	0.057	0.032	-0.017	-0.010	0.156**	0.116
	(0.047)	(0.049)	(0.037)	(0.040)	(0.025)	(0.030)	(0.073)	(0.094)
$Firm\_age$	-0.001	-0.002	-0.001	-0.001*	-0.001	-0.000	0.004*	0.006**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
$Foreign\_owned$	0.057	0.041	0.055	0.085*	-0.053	-0.035	-0.076	-0.131
	(0.047)	(0.049)	(0.043)	(0.044)	(0.047)	(0.049)	(0.092)	(0.103)
$Ln(hourlywage)$	-0.144	-0.079	-0.069	-0.096	0.075	0.053	-0.038	0.068
	(0.124)	(0.133)	(0.114)	(0.114)	(0.088)	(0.102)	(0.184)	(0.232)
$Exporting$	0.087**	0.077**	-0.074*	-0.083*	0.015	0.004	0.031	0.021
	(0.037)	(0.038)	(0.045)	(0.047)	(0.036)	(0.040)	(0.073)	(0.081)
$Importing$	0.043	0.050	0.132**	0.092*	0.077**	0.075*	0.008	0.055
	(0.040)	(0.042)	(0.051)	(0.056)	(0.037)	(0.041)	(0.069)	(0.080)
$Capital\_intensity$	0.031	0.023	0.000	-0.003	0.005	-0.003	0.060	0.057
	(0.047)	(0.049)	(0.004)	(0.004)	(0.011)	(0.016)	(0.090)	(0.118)
$Intagibles\_per\_worker$	1.877	6.146	-4.245	-10.952*	-0.936	-0.858	27.360	19.436
	(4.438)	(6.048)	(3.087)	(5.753)	(1.104)	(1.277)	(21.736)	(29.081)
$share\_female\_cvrnr$	0.154	0.102	0.040	-0.004	-0.087	-0.041	0.166	0.249*
	(0.107)	(0.114)	(0.106)	(0.112)	(0.086)	(0.103)	(0.123)	(0.147)
...	...	...	...	...	...	...	...	...
Region FE	✓	✓	✓	✓	✓	✓	✓	✓
No of Obs/Firms:	1010	934	792	722	749	623	270	214

Notes: These are margins. Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

AI Adoption by Sectors CONT.

	Manufacturing	+ FE	Transort	+ FE	KIBS	+ FE	Other	+ FE
...	...	...	...	...	...	...	...	...
share_immig_cvrnr	-0.068	-0.190	0.346**	0.263*	0.211*	0.186	-0.025	0.035
	(0.119)	(0.133)	(0.142)	(0.159)	(0.113)	(0.138)	(0.147)	(0.165)
age_less36	0.095	0.098	0.200	0.134	0.078	0.033	0.170	0.217
	(0.145)	(0.157)	(0.145)	(0.159)	(0.114)	(0.134)	(0.196)	(0.243)
age_55_more	0.256	0.312*	0.165	0.073	-0.021	-0.018	-0.048	-0.113
	(0.157)	(0.164)	(0.154)	(0.168)	(0.140)	(0.163)	(0.249)	(0.293)
no_secondary_educ	0.197	0.203	0.007	0.269*	-0.058	-0.072	-0.195	0.050
	(0.133)	(0.138)	(0.148)	(0.159)	(0.240)	(0.275)	(0.222)	(0.255)
bachelor_or_higher	0.239	0.323	0.185	0.234	0.054	-0.035	0.135	0.135
	(0.205)	(0.235)	(0.158)	(0.167)	(0.105)	(0.123)	(0.203)	(0.244)
stem_education_univ	0.256	-0.033	0.531**	0.602**	-0.154*	-0.124	-0.357	0.124
	(0.259)	(0.290)	(0.247)	(0.268)	(0.092)	(0.108)	(0.715)	(0.853)
white_collar_share	-0.034	0.023	-0.078	-0.049	0.168	0.253*	0.019	-0.006
	(0.084)	(0.089)	(0.083)	(0.089)	(0.120)	(0.150)	(0.105)	(0.116)
managers_share	0.117	0.192	0.069	0.273	-0.011	-0.146	0.393	0.158
	(0.224)	(0.240)	(0.215)	(0.220)	(0.165)	(0.191)	(0.402)	(0.470)
digitalization	0.014***	0.014***	0.013***	0.014***	0.018***	0.017***	0.008	0.008
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.007)
Region FE	✓	✓	✓	✓	✓	✓	✓	✓
No of Obs/Firms:	1010	934	792	722	749	623	270	214

Notes: These are margins. Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

back

Adoption of individual AI technologies

	AR	AGV	ASS	ML	MV	NLP	RF	Robot	TS	VRS	ADS	Generative_AI
Ln(employment)	0.227	0.059	0.182	0.529***	0.408***	0.301***	0.421***	0.442***	0.595***	0.470***	0.007	0.497***
	(0.158)	(0.174)	(0.144)	(0.105)	(0.126)	(0.103)	(0.142)	(0.107)	(0.105)	(0.129)	(0.193)	(0.159)
Ln(valueadded)	0.049	0.197	0.169	-0.028	-0.062	-0.001	0.006	0.069	-0.183**	-0.237**	0.229	0.135
	(0.142)	(0.161)	(0.132)	(0.092)	(0.111)	(0.091)	(0.129)	(0.096)	(0.093)	(0.112)	(0.174)	(0.146)
Firm_age	0.001	0.007	0.004	0.000	-0.001	-0.001	0.001	0.001	-0.003	-0.003	0.006	-0.010**
	(0.005)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.005)	(0.004)
Foreign_owned	0.186	0.339*	0.102	0.058	-0.062	0.035	0.114	0.006	0.240**	0.112	0.148	-0.311*
	(0.180)	(0.174)	(0.149)	(0.128)	(0.152)	(0.128)	(0.157)	(0.123)	(0.120)	(0.169)	(0.215)	(0.188)
Ln(hourlywage)	-0.104	-0.138	0.104	0.100	0.729*	0.391	0.513	0.266	0.927***	0.767**	0.466	0.005
	(0.473)	(0.485)	(0.406)	(0.311)	(0.373)	(0.304)	(0.411)	(0.310)	(0.304)	(0.378)	(0.535)	(0.434)
Exporting	0.241	0.005	-0.174	0.220	0.315*	0.141	0.133	0.227*	-0.077	-0.155	-0.048	-0.021
	(0.212)	(0.207)	(0.176)	(0.137)	(0.178)	(0.134)	(0.184)	(0.134)	(0.133)	(0.174)	(0.241)	(0.169)
Importing	0.163	-0.091	-0.009	-0.029	-0.059	0.050	0.233	0.266*	0.131	-0.161	-0.038	0.490***
	(0.243)	(0.221)	(0.196)	(0.151)	(0.196)	(0.146)	(0.203)	(0.153)	(0.143)	(0.182)	(0.257)	(0.166)
Capital_intensity	-0.471	-0.108	0.022	0.011	0.015	0.017	-0.091	-0.020	0.019	0.036	-0.110	-0.018
	(0.400)	(0.110)	(0.038)	(0.032)	(0.042)	(0.032)	(0.085)	(0.040)	(0.036)	(0.043)	(0.129)	(0.027)
Intagibles_per_worker	0.374	1.609	2.225	5.126	-6.692	3.754	9.428*	4.160	-4.986	-8.714	-2.539	-5.351
	(7.414)	(7.691)	(6.587)	(5.282)	(8.447)	(4.941)	(5.699)	(5.244)	(6.682)	(11.732)	(10.384)	(6.085)
share_female_cvrnr	-0.338	-0.172	-0.659*	-0.585*	0.175	-0.068	0.060	0.703**	0.753***	-0.671*	-0.087	-0.290
	(0.471)	(0.439)	(0.377)	(0.310)	(0.389)	(0.297)	(0.413)	(0.294)	(0.287)	(0.408)	(0.553)	(0.392)
...	...	...	...	...	...	...	...	...	...	...	...	...
Region FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
No of Obs/Firms:	2915	2915	2915	2915	2915	2915	2915	2915	2915	2915	2915	1506

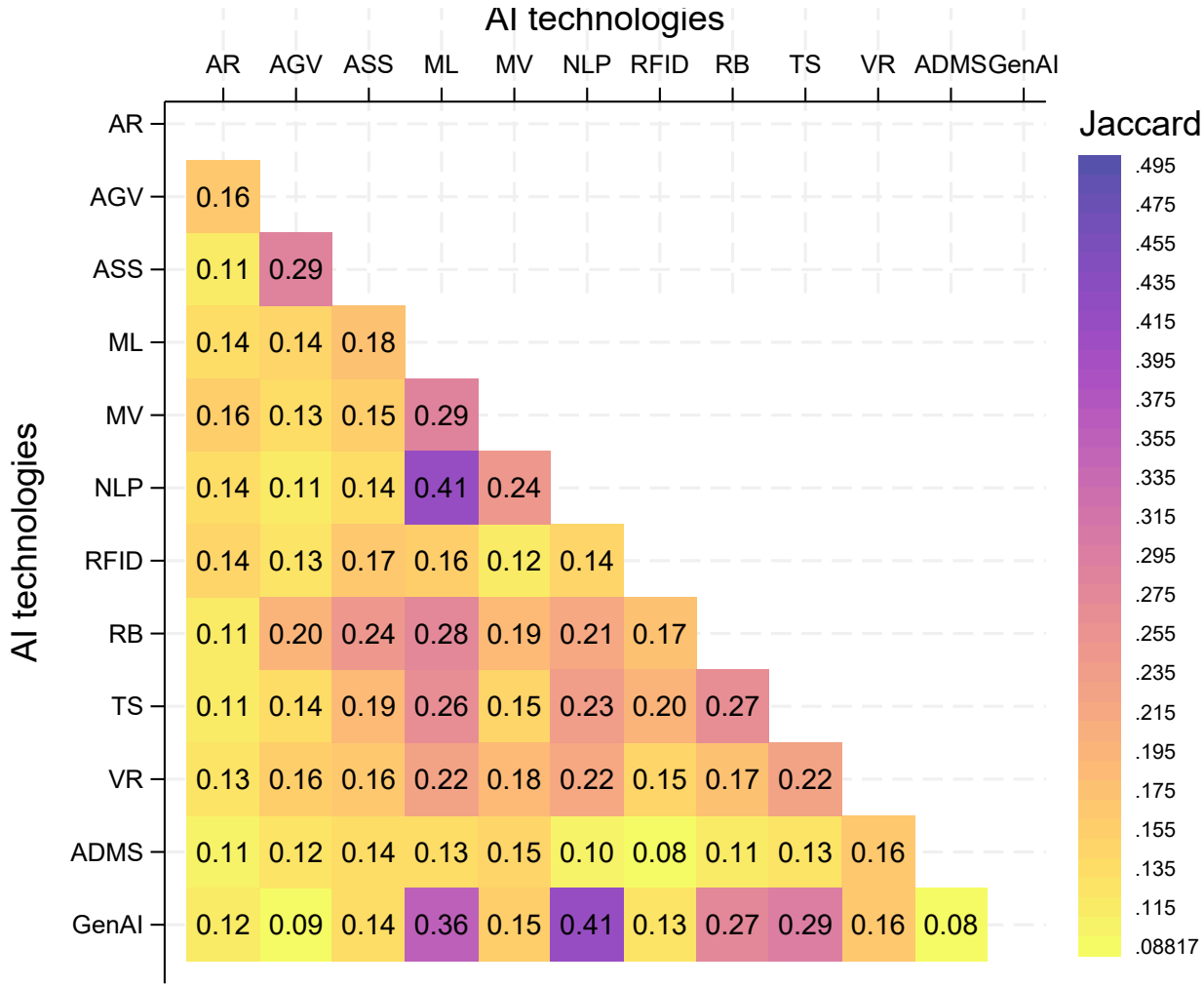
Notes: Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Adoption of individual AI technologies CONT.

	AR	AGV	ASS	ML	MV	NLP	RF	Robot	TS	VRS	ADS	Generative_AI
...	...	...	...	...	...	...	...	...	...	...	...	...
share_immig_cvrnr	0.158	1.245***	1.214***	-0.059	0.924**	0.449	1.220***	0.155	-0.098	0.548	1.107**	-1.287***
	(0.494)	(0.450)	(0.395)	(0.344)	(0.397)	(0.326)	(0.417)	(0.334)	(0.324)	(0.408)	(0.530)	(0.439)
age_less36	0.086	-0.424	-0.372	0.556	-0.051	1.010**	-0.074	0.002	0.380	0.374	-0.278	0.144
	(0.650)	(0.636)	(0.545)	(0.425)	(0.534)	(0.412)	(0.593)	(0.426)	(0.411)	(0.536)	(0.732)	(0.528)
age_55_more	-1.055	-0.436	-0.628	-0.567	-0.847	-0.040	0.431	0.840	-0.195	0.096	-2.192**	-0.337
	(0.866)	(0.775)	(0.676)	(0.553)	(0.699)	(0.535)	(0.720)	(0.511)	(0.517)	(0.696)	(1.032)	(0.630)
no_secondary_educ	-0.031	-0.075	1.061*	-0.985*	0.579	0.682	-0.070	-0.211	0.783*	0.151	0.153	-0.629
	(0.888)	(0.736)	(0.608)	(0.589)	(0.707)	(0.533)	(0.693)	(0.514)	(0.468)	(0.670)	(0.947)	(0.579)
bachelor_or_higher	1.164*	0.028	0.633	0.724*	0.686	1.020**	-0.010	0.617	-0.082	0.227	-0.117	3.142***
	(0.643)	(0.656)	(0.562)	(0.412)	(0.536)	(0.403)	(0.608)	(0.424)	(0.426)	(0.539)	(0.748)	(0.589)
stem_education_univ	0.067	0.862	-0.009	-0.022	0.315	-0.033	1.797***	-0.369	1.090**	-0.317	0.217	-2.119***
	(0.597)	(0.660)	(0.620)	(0.410)	(0.513)	(0.401)	(0.592)	(0.445)	(0.443)	(0.554)	(0.723)	(0.648)
white_collar_share	0.381	-0.086	0.414	0.834***	0.282	0.558**	-0.189	-0.005	-0.116	0.414	0.270	-0.023
	(0.421)	(0.371)	(0.306)	(0.273)	(0.342)	(0.262)	(0.347)	(0.253)	(0.240)	(0.342)	(0.476)	(0.307)
managers_share	-0.464	-0.232	0.190	-0.307	-0.324	0.534	0.438	0.125	-0.156	0.276	0.971	1.901**
	(0.982)	(1.013)	(0.850)	(0.644)	(0.839)	(0.615)	(0.874)	(0.643)	(0.665)	(0.829)	(1.045)	(0.896)
digitalization	0.067***	0.050***	0.071***	0.087***	0.091***	0.094***	0.048***	0.045***	0.056***	0.057***	0.097***	0.111***
	(0.020)	(0.018)	(0.016)	(0.013)	(0.017)	(0.013)	(0.016)	(0.012)	(0.012)	(0.017)	(0.024)	(0.015)
Region FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
No of Obs/Firms:	2915	2915	2915	2915	2915	2915	2915	2915	2915	2915	2915	1506

Notes: Asterisks: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Jaccard Similarity Matrix of AI applications



back