ECONOMIC IMPACTS OF AI

San Francisco Fed

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INTRODUCTION

- The AI revolution is unavoidable and it affects all domains of activity: the economy, public services, the organization of work, media, culture, …
- The emergence of generative AI, represents a unprecedented acceleration by simplifying the use of certain tools to the extreme, and by generating texts, images, sounds, at an extraordinarily high speed and with a stunning degree of realism

INTRODUCTION

- To reach 1 million users:
  - Netflix: Two and half years
  - Instagram: Two and half months
  - Chat GPT: five days

INTRODUCTION

- This revolution creates both, hopes and fears:
  - Hope: a growth upsurge
  - Fear: mass unemployment

INTRODUCTION

- 1st prior belief: AI should boost productivity growth
- 2nd prior belief: AI is detrimental to employment including to skilled employment

INTRODUCTION

- In this lecture I will question both of these prior beliefs

AI AND GROWTH

AI AND GROWTH

- AI should boost productivity growth as it automates not only the production of goods and services but also the production of ideas (Aghion, Jones and Jones)

AI AND GROWTH

AI :

- Helps find solution to complex problems
- Facilitates imitation and learning
- Can become self-improving

AI AND GROWTH

Automation baseline: The Zeira Model

- Aggregate GDP:

$$Y = AX_1^{\alpha_1} X_2^{\alpha_2} \ldots X_n^{\alpha_n},$$

where $\sum_{i=1}^{n} \alpha_i = 1$ and

$$X_{it} = \begin{cases} L_{it} & \text{if not automated} \\ K_{it} & \text{if automated} \end{cases} \qquad (1)$$

AI AND GROWTH

Automation baseline: The Zeira Model

- Aggregate production function reexpressed as:

$$Y = AK^{\alpha}L^{1-\alpha}$$

- Then:

$$g_y = \frac{g_A}{1-\alpha}$$

AI AND GROWTH

AI increases both, « α » and « g_A »:

- Automates production of goods and services (increases « α »)
- Automates production of ideas (increases « g_A »)

BRYNJOLFSSON ET AL. (2023)

- *« Generative AI at Work »,* Erik Brynjolfsson, Danielle Li, and Lindsey R. Raymond, 2023, NBER working paper

<u>Customer service sector</u>
- Domain with high AI adoption rate (22%)
- Helps firm in establishing long-lasting relationship with customers and thereby to build up reputation

BRYNJOLFSSON ET AL. (2023)

Focus

- Diffusion of a Generative AI system in a Fortune 500 company which advises SMEs on enterprise software
- The job mainly consists in answering SME managers' questions on how to install the software.

Measuring agents' productivity:

- Average duration of a chat
- Percentage of successful chats
- Customer's satisfaction

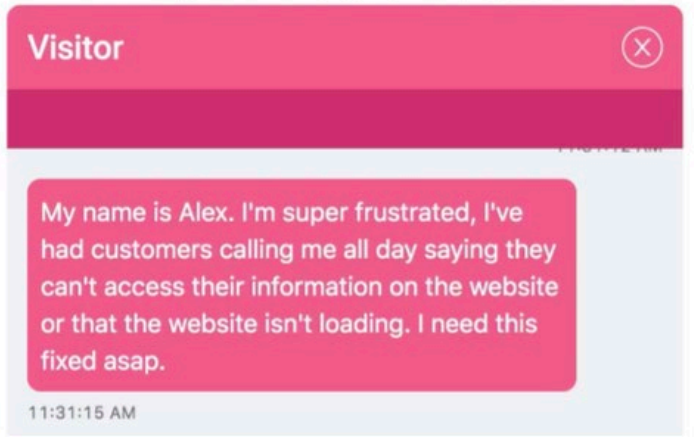
BRYNJOLFSSON ET AL. (2023)

AI Tool

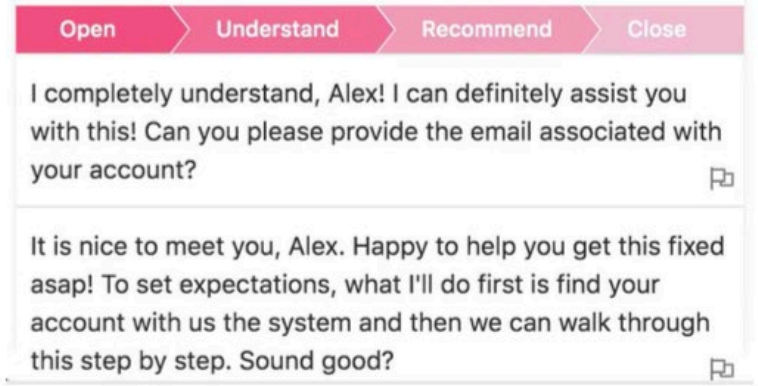
- Suggests responses which the agent may or may not endorse

FIGURE 1: SAMPLE AI OUTPUT

A. SAMPLE CUSTOMER ISSUE



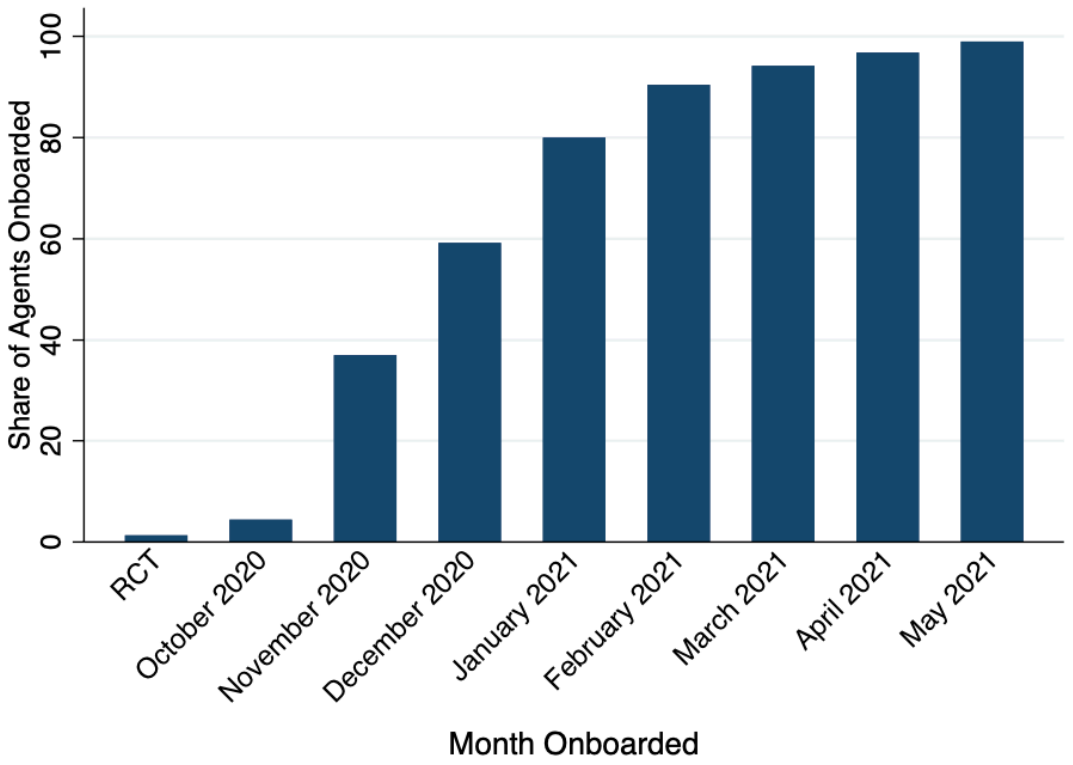
B. SAMPLE AI-GENERATED SUGGESTED RESPONSE



BRYNJOLFSSON ET AL. (2023)

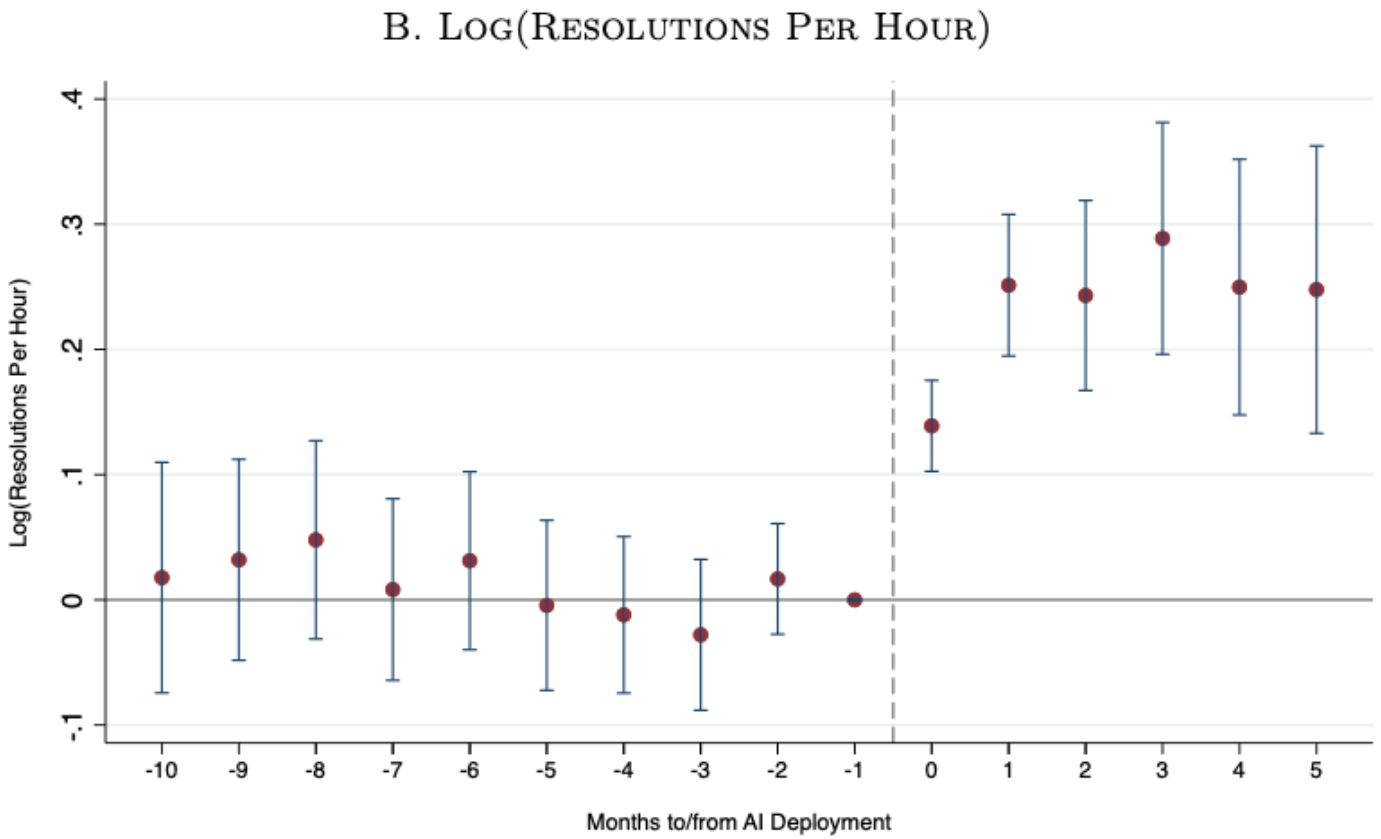
- Progressive diffusion following a first pilot program involving 50 agents, between November 2020 and February 2021.

FIGURE 2: DEPLOYMENT TIMELINE



NOTES: This figure shows the share of agents deployed onto the AI system over the study period. Agents are deployed onto the AI system after a training session. The firm ran a small randomized control trial in August and September of 2020. All data are from the firm's internal software systems.

BRYNJOLFSSON ET AL. (2023) - RESULTS



- Significant productivity boost already one month after AI adoption (+14%)
- Further productivity increase thereafter (up to +25%)

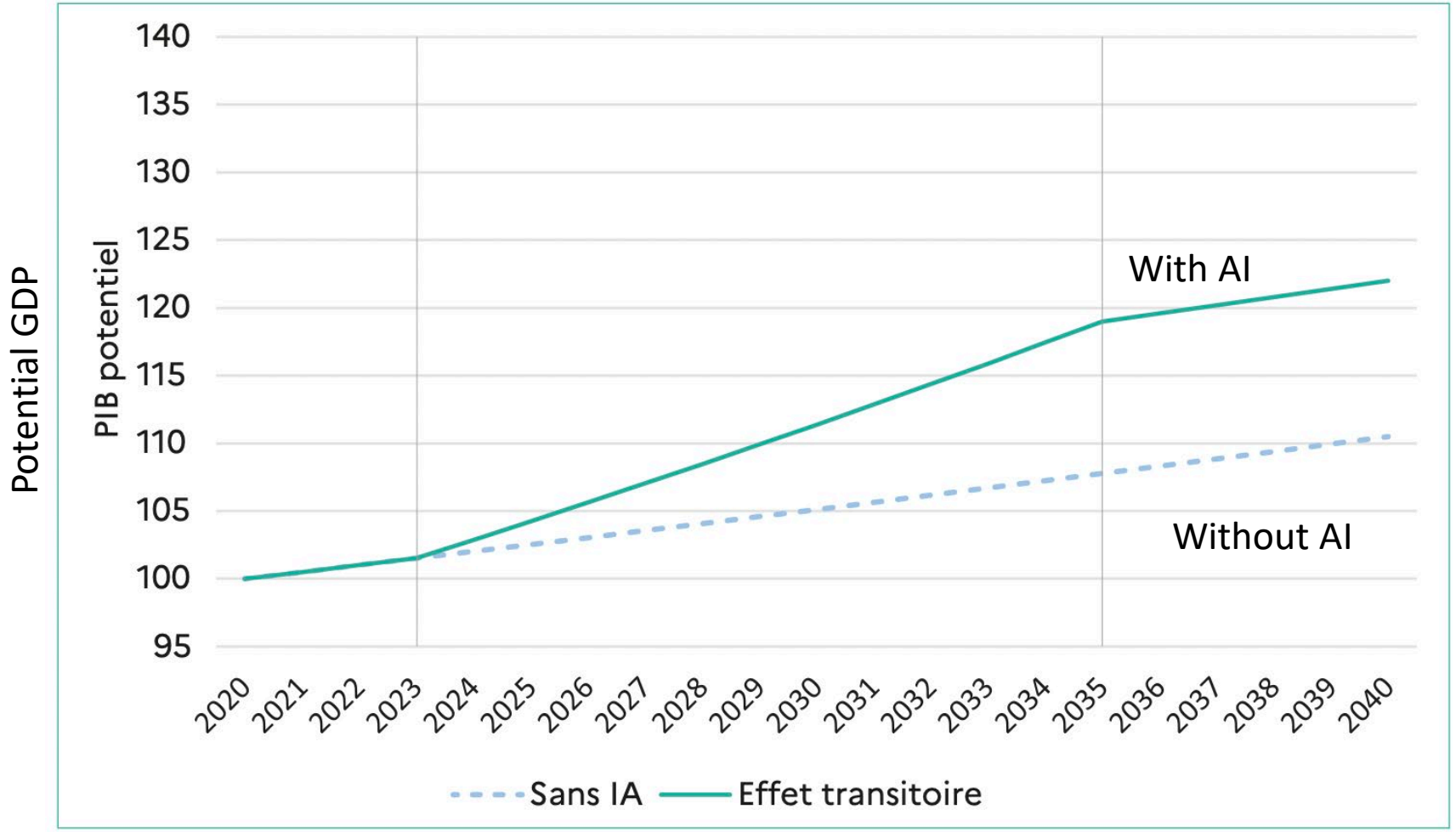
AI AND GROWTH

- From micro to macro
- Extrapolate from previous GPTs
- This benchmark may be too pessimistic or too optimistic

AI AND GROWTH

Expected transitory effect of AI adoption on growth

(Report of Ministry of Economics, Finance and Industrial and Digital Sovereignty)

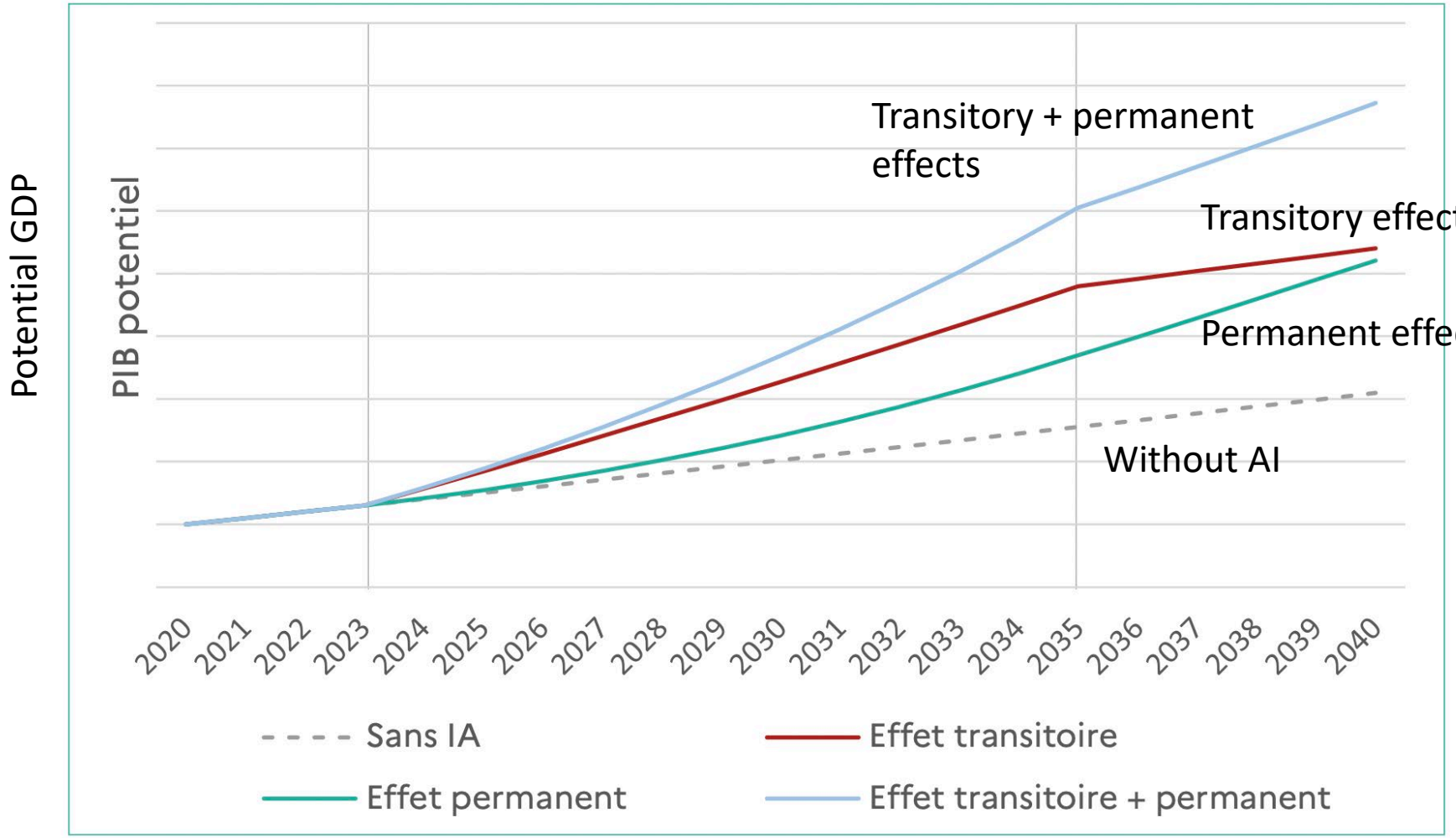


Graphique 2 : Effet transitoire attendu de l'adoption de l'IA sur la croissance.

AI AND GROWTH

Total expected effects of AI adoption on growth

(Report of Ministry of Economics, Finance and Industrial and Digital Sovereignty)

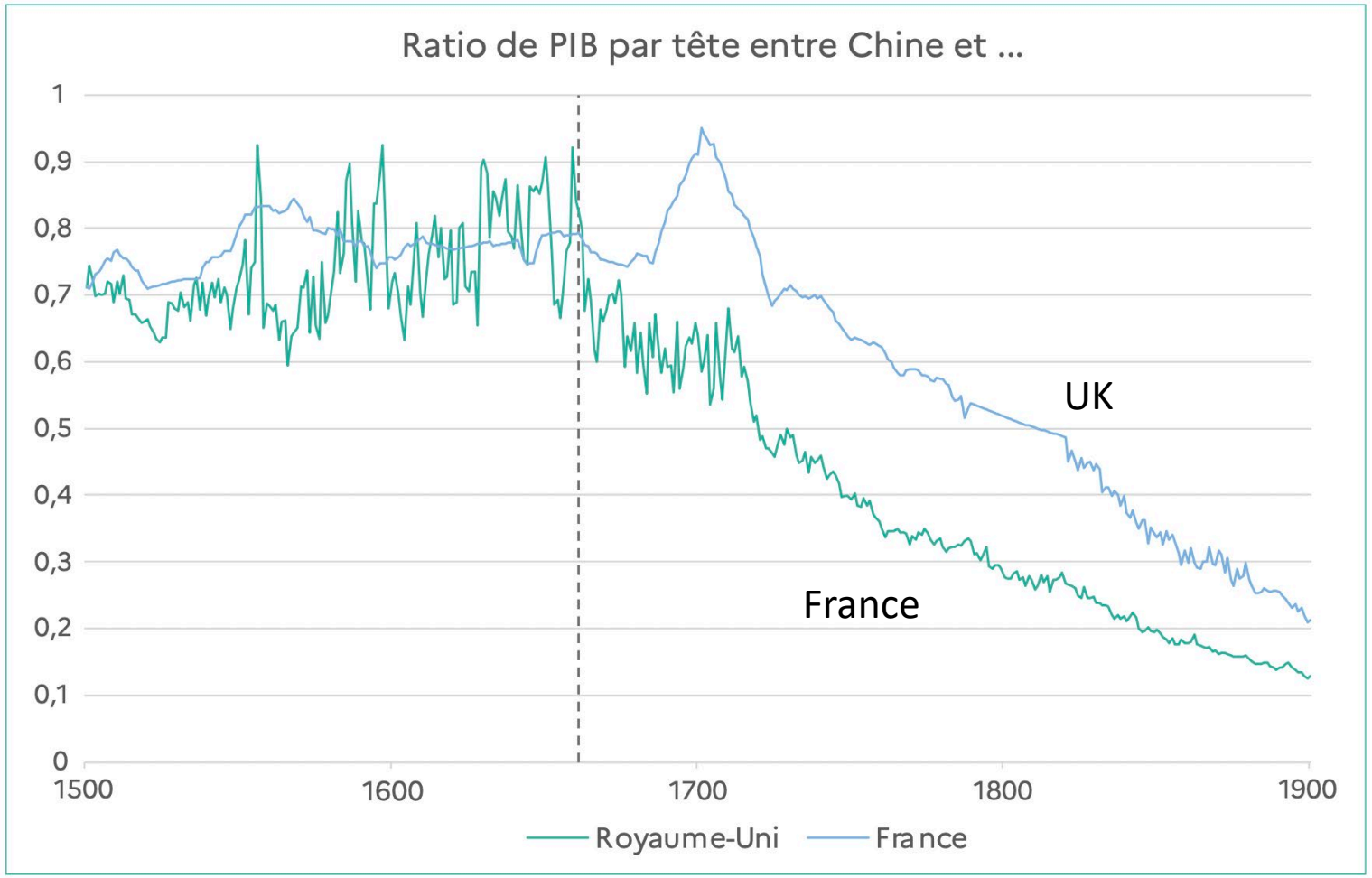


Graphique 3 : Effets totaux attendus de l'adoption de l'IA sur la croissance.

AI AND GROWTH

China's GDP per capita relative to UK and France

(Report of Ministry of Economics, Finance and Industrial and Digital Sovereignty)

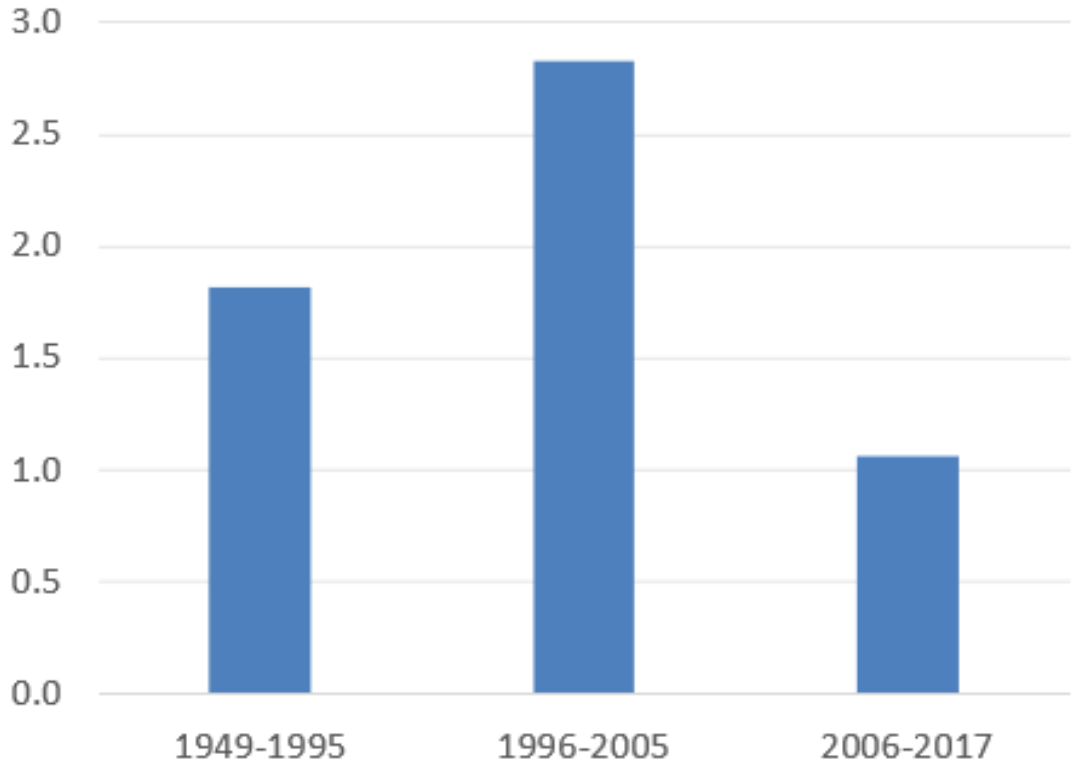


Graphique 4 : Comparaison du PIB par tête de la Chine à ceux du Royaume-Uni et de la France

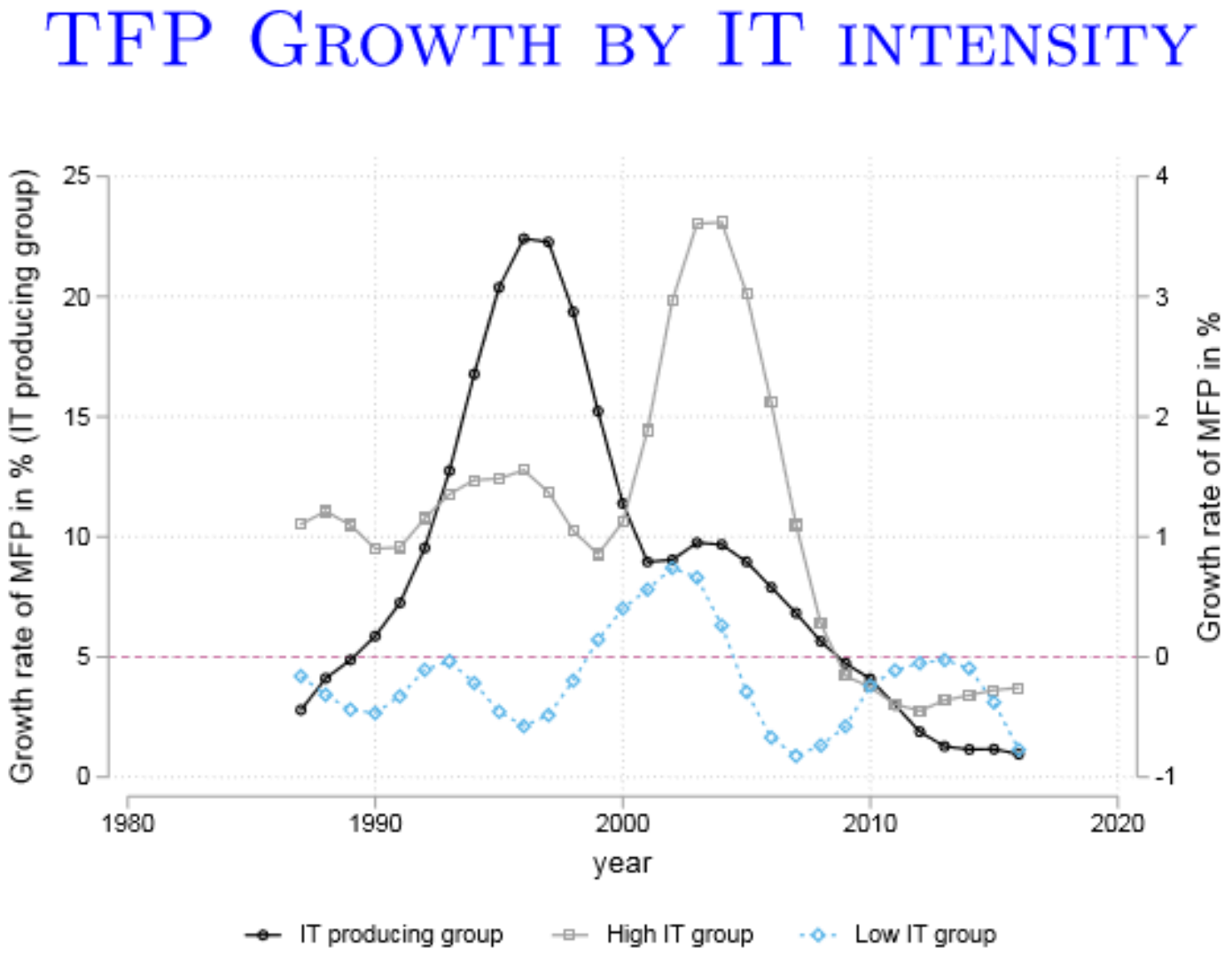
Source : Commission IA à partir des données du Maddison Project Database 2020.

BUT

Rise and Decline in TFP Growth

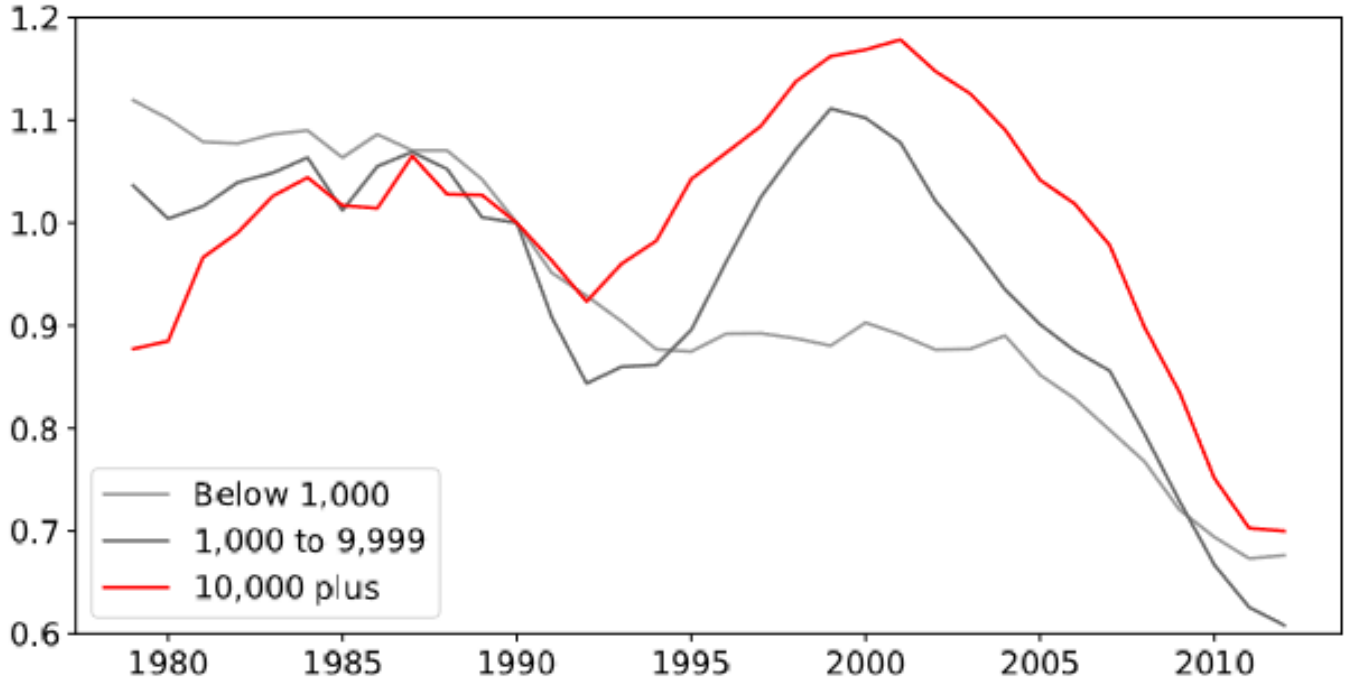


BUT


TFP Growth by IT intensity
Growth rate of MFP in % (IT producing group)
Growth rate of MFP in %
25
20
15
10
5
0
4
3
2
1
0
-1
1980
1990
2000
2010
2020
year
IT producing group
High IT group
Low IT group

BUT

Rise and decline in employment-weighted plant entry rate



Source: U.S. Census Bureau's *Business Dynamics Statistics*. Job creation by birth over total employment by firm size bins. 5-year centered moving average.

CONCLUSION SO FAR

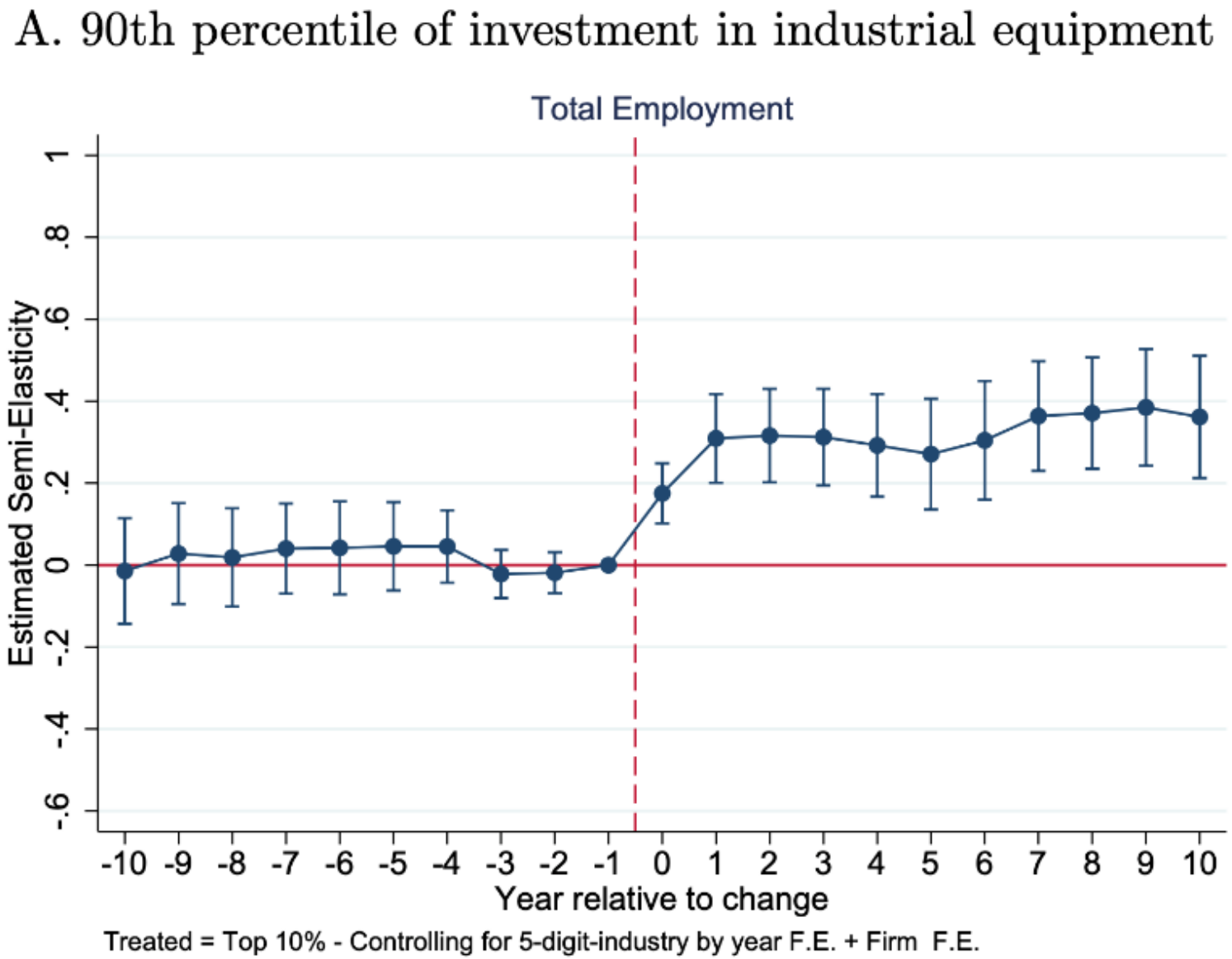
- AI has a high growth potential
- But inappropriate competition policy may hamper it
  - In particular the Cloud is dominated by three superstar firms: Amazon, Google, Microsoft
  - Only one big actor (GPU) on the market for graphic processes

AI AND EMPLOYMENT

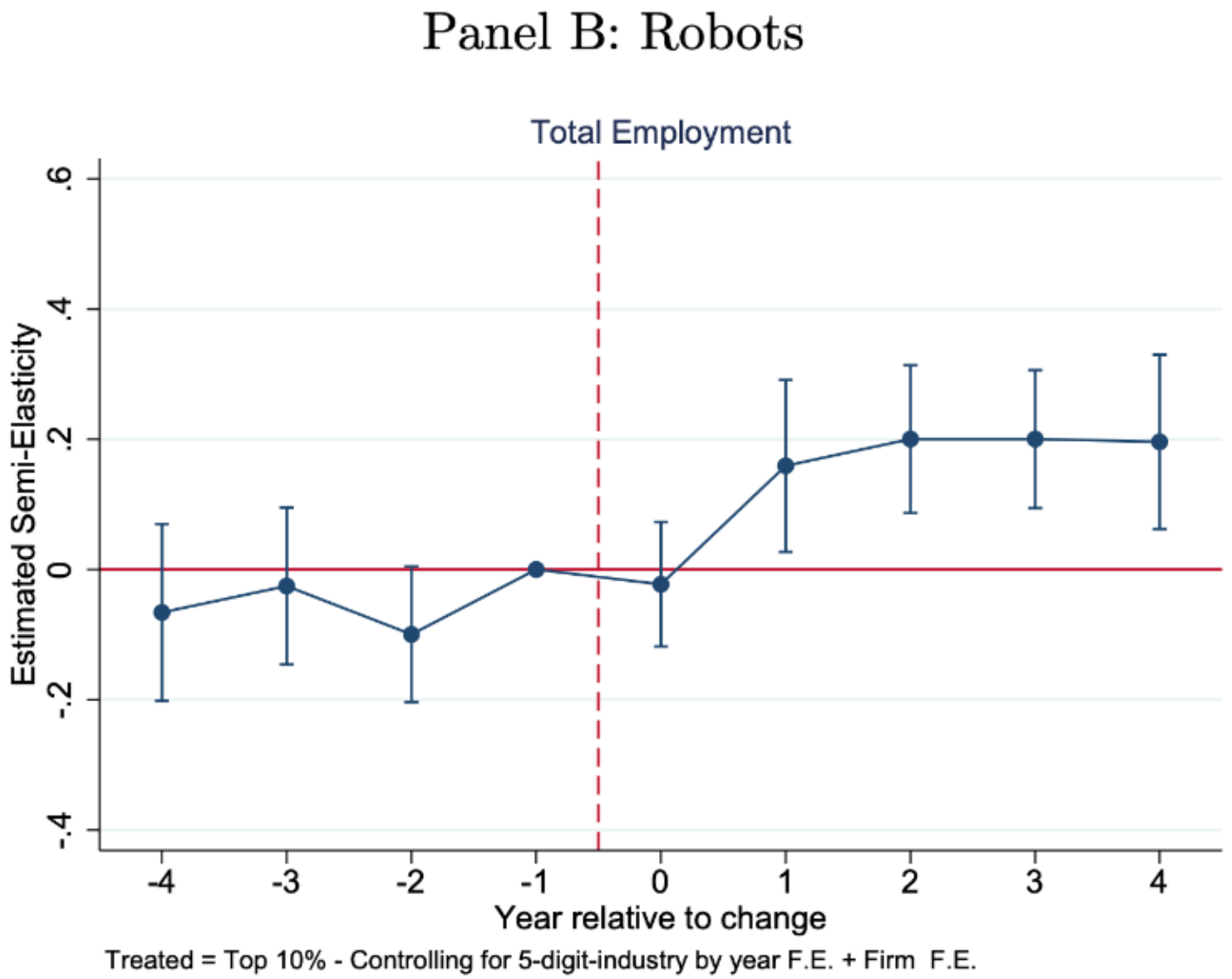
AI AND EMPLOYMENT

Current research with Simon Bunel, Xavier Jaravel et Alexandra Roulet using French firm-level data

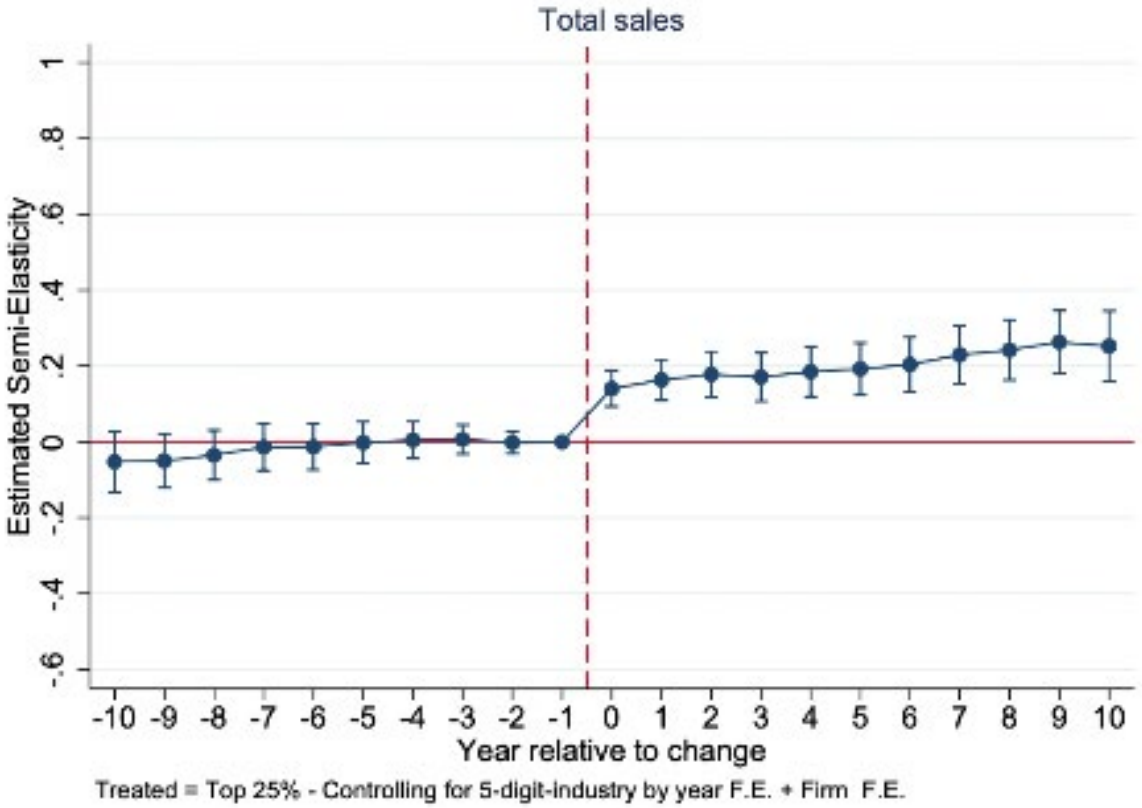
AUTOMATION AND EMPLOYMENT

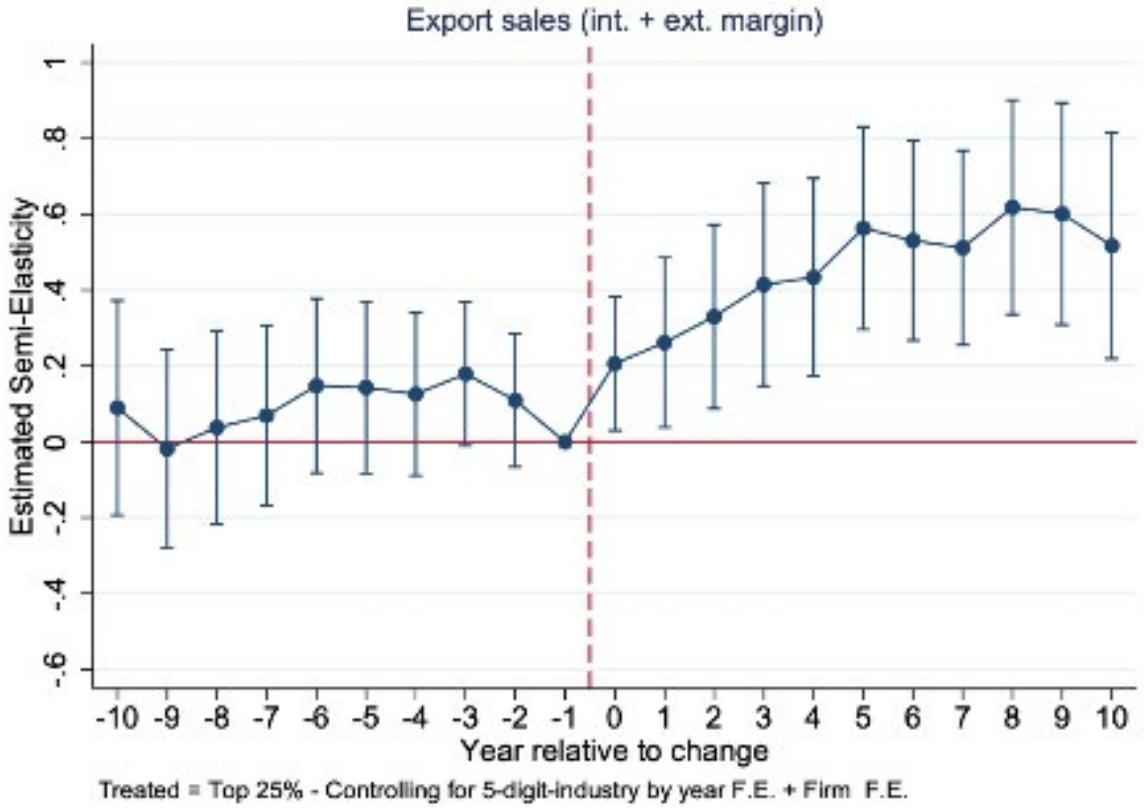


ROBOTS AND EMPLOYMENT

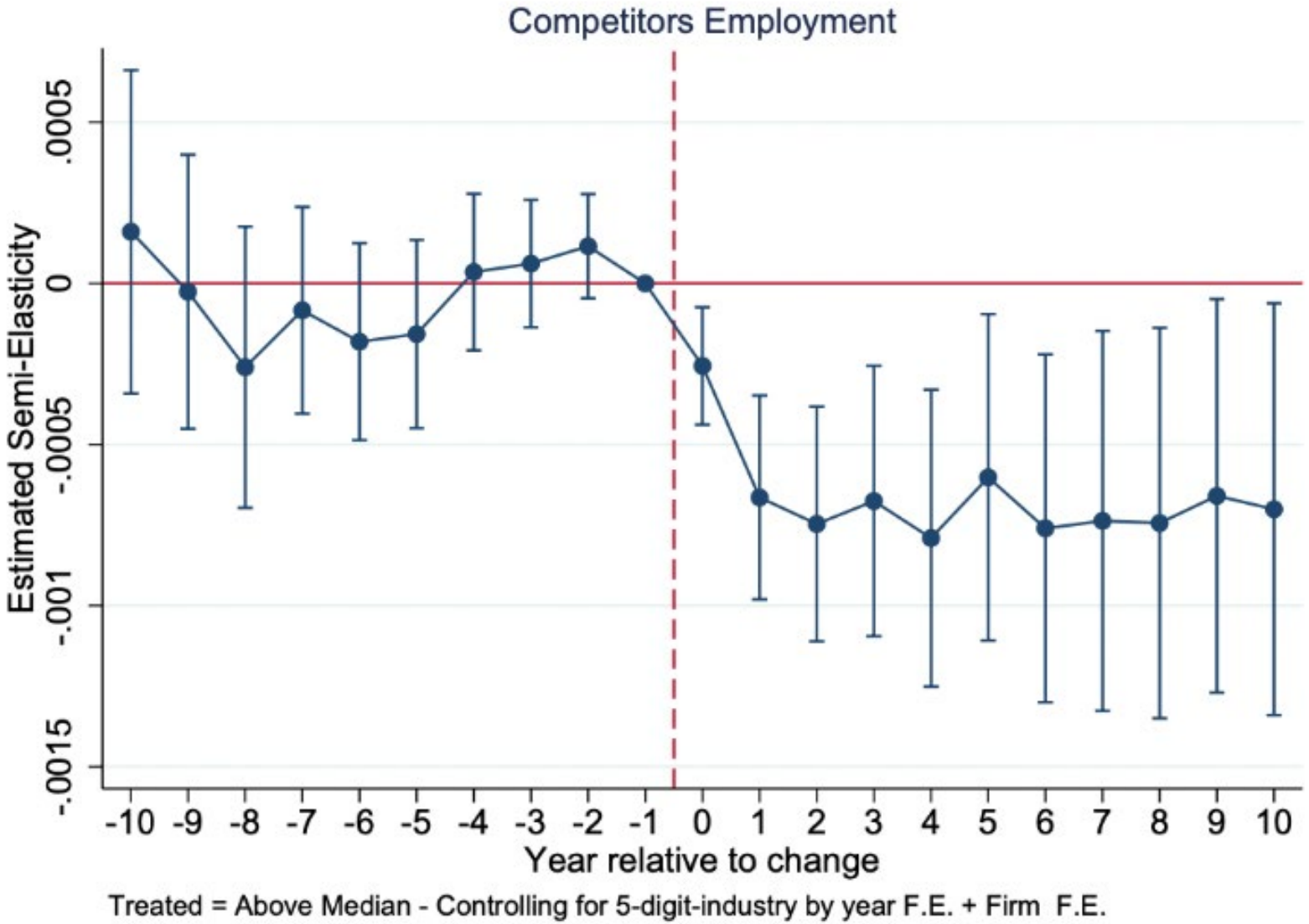


AUTOMATION AND EMPLOYMENT





AUTOMATION AND EMPLOYMENT



AUTOMATION AND EMPLOYMENT

Two effects: eviction vs. productivity

- Automation displaces tasks from labor to capital, thereby destroying jobs: ***eviction effect***
- Automation increases productivity on existing tasks, which increases quality-price ratio, thereby increasing sales, exports sales, thereby creating jobs: ***productivity effect***

AI AND EMPLOYMENT

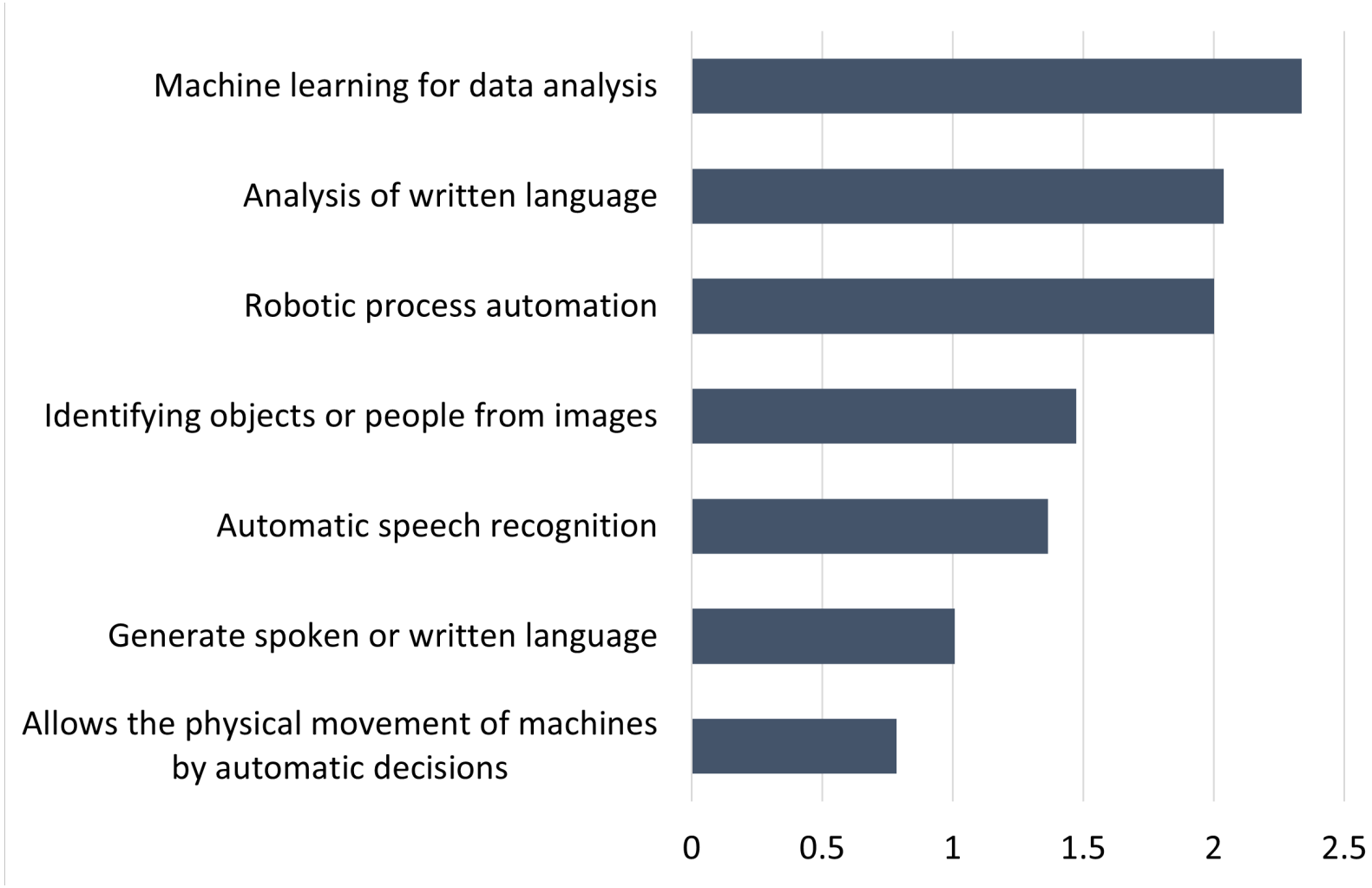
Is this different for AI ?

AI AND EMPLOYMENT

- « Enquête annuelle de l'Insee » = ICT French firm-level annual survey
- Specific questions on AI adoption in 2019 and 2021 surveys
- Random survey covering 9000 representative firms with more than 50 employees
- Event studies comparing between firms that adopt « some » AI between 2018 and 2020, and similar firms that do not adopt AI at all before 2020
- 321 firms in treatment group: adopt AI before 2020
- 897 firms in control group: do not adopt AI before 2020

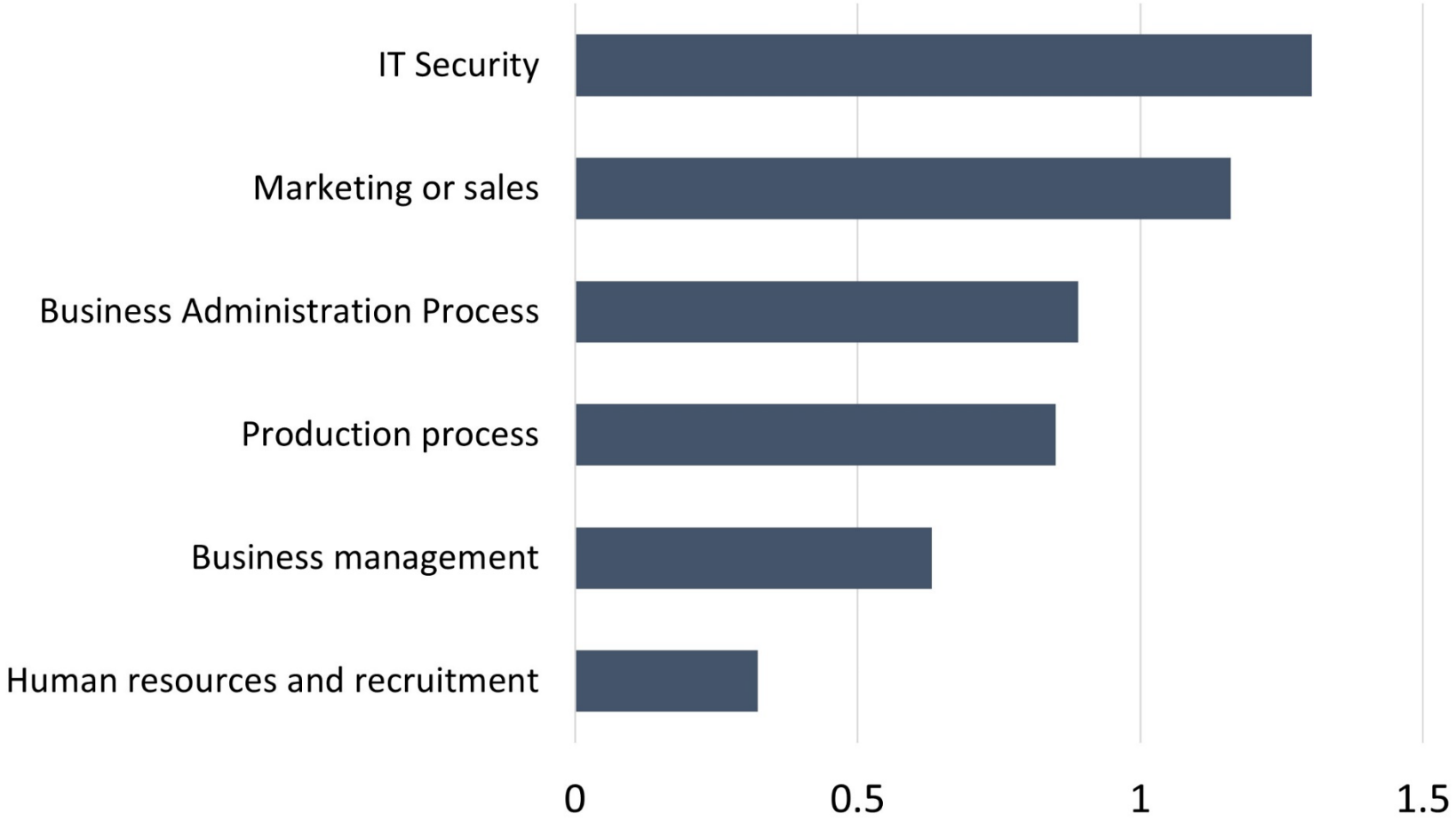
AI AND EMPLOYMENT

1 – Which AI technologies do firms use?



AI AND EMPLOYMENT

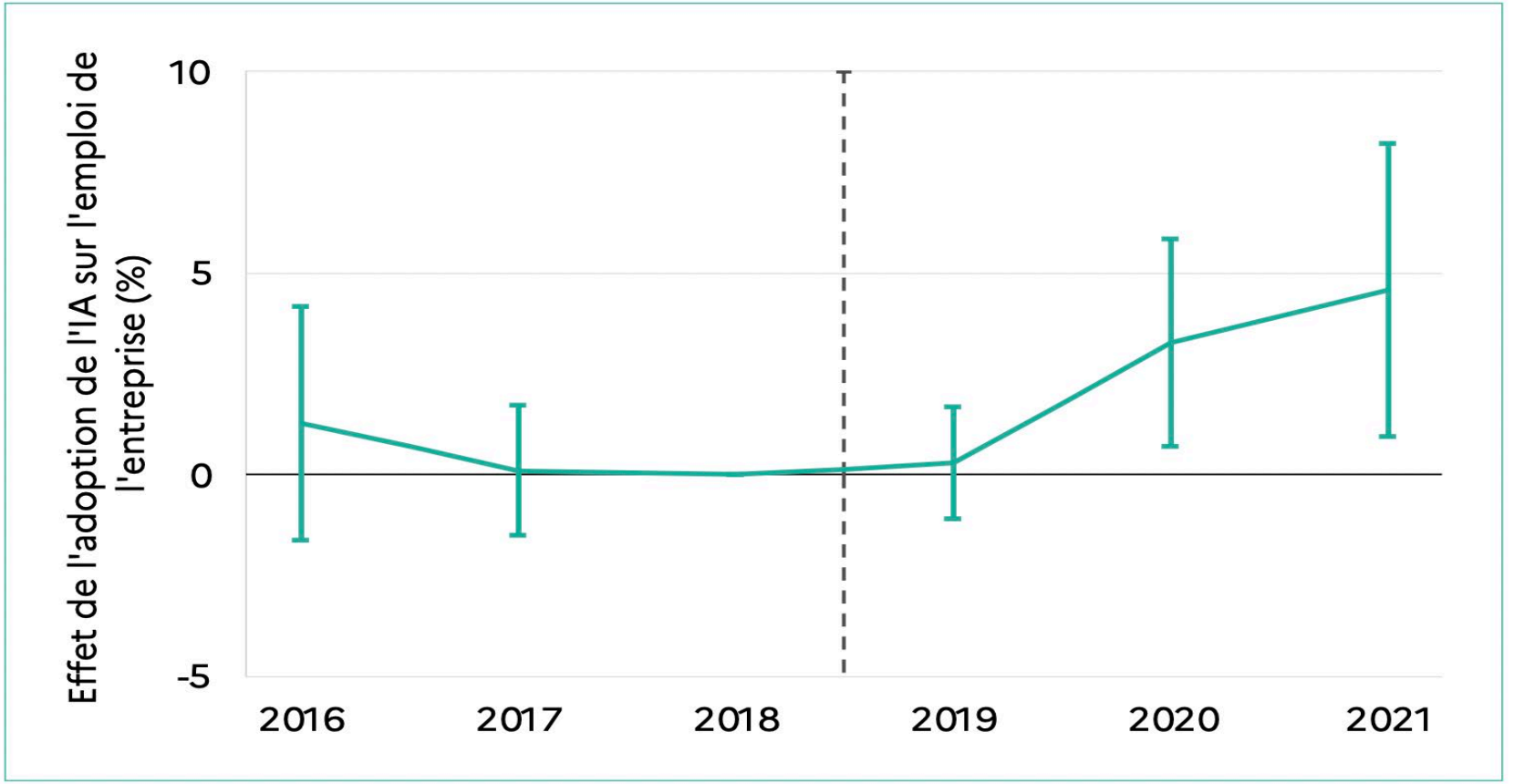
Why do firms resort to AI?



AI AND EMPLOYMENT

Effect of adopting AI on total employ within companies in France

(Report of Ministry of Economics, Finance and Industrial and Digital Sovereignty)

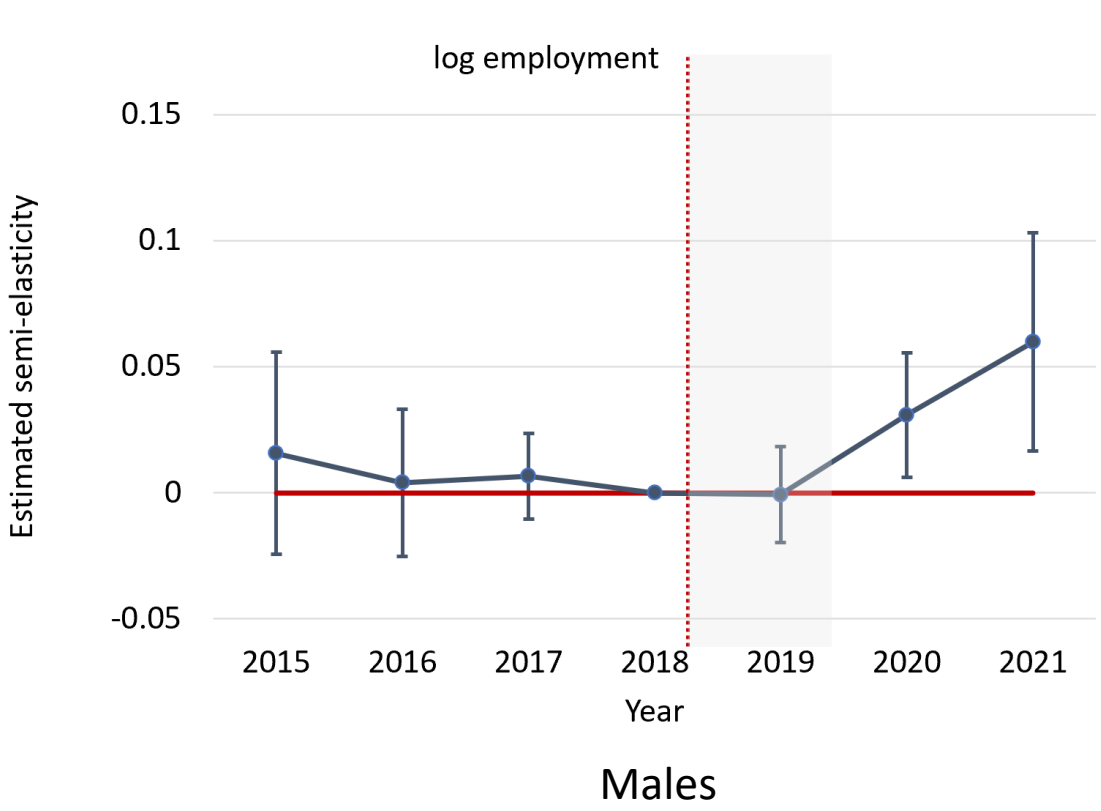


Graphique 5 : Effet de l'adoption de l'IA sur l'emploi total au sein des entreprises en France

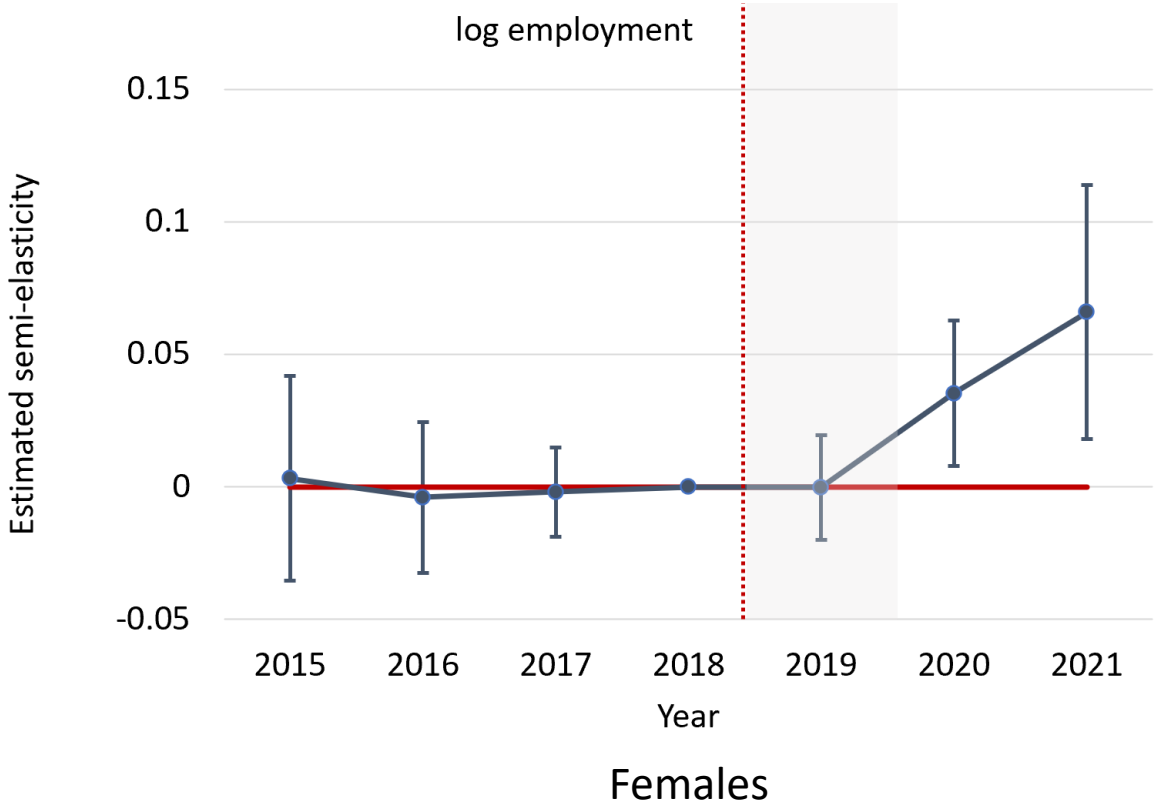
Source : Commission IA.

Lecture : Les entreprises adoptant l'IA augmentent leur emploi davantage que celles ne l'adoptant pas, alors qu'elles évoluaient de façon similaire dans les 3 années précédentes.

AI AND EMPLOYMENT



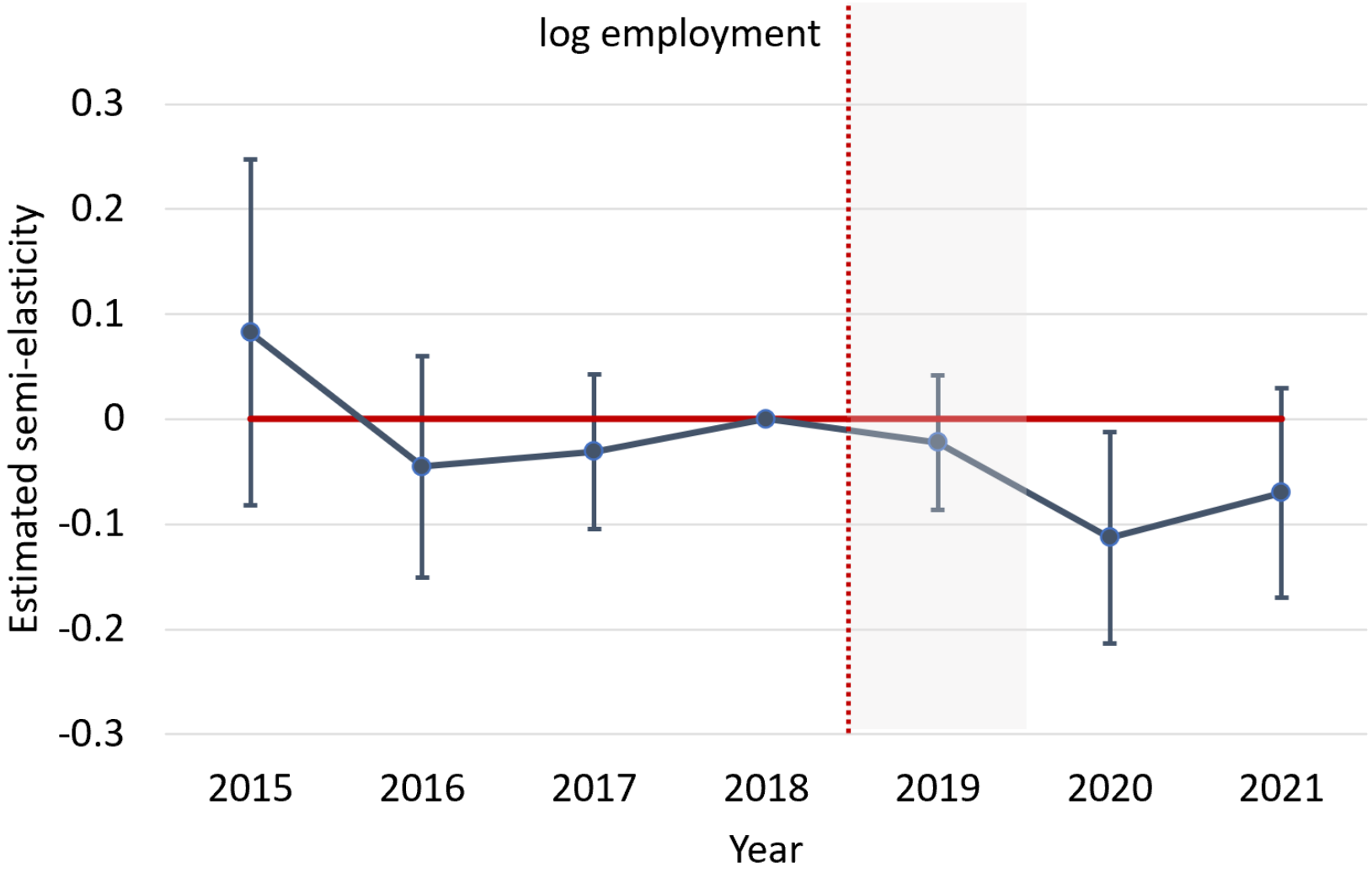
Males



Females

AI AND EMPLOYMENT

• Effect on employment in “administrative and commercial intermediate professions” (executive secretary, administrative service, legal service, sales, etc.)



AI AND EMPLOYMENT: THE « TASKS » APPROACH (ILO)

- *Generative AI and jobs: A global analysis of potential effects on job quantity and quality,* Paweł Gmyrek, Janine Berg, David Bescond, ILO Working Paper 96, 2023

Idea :

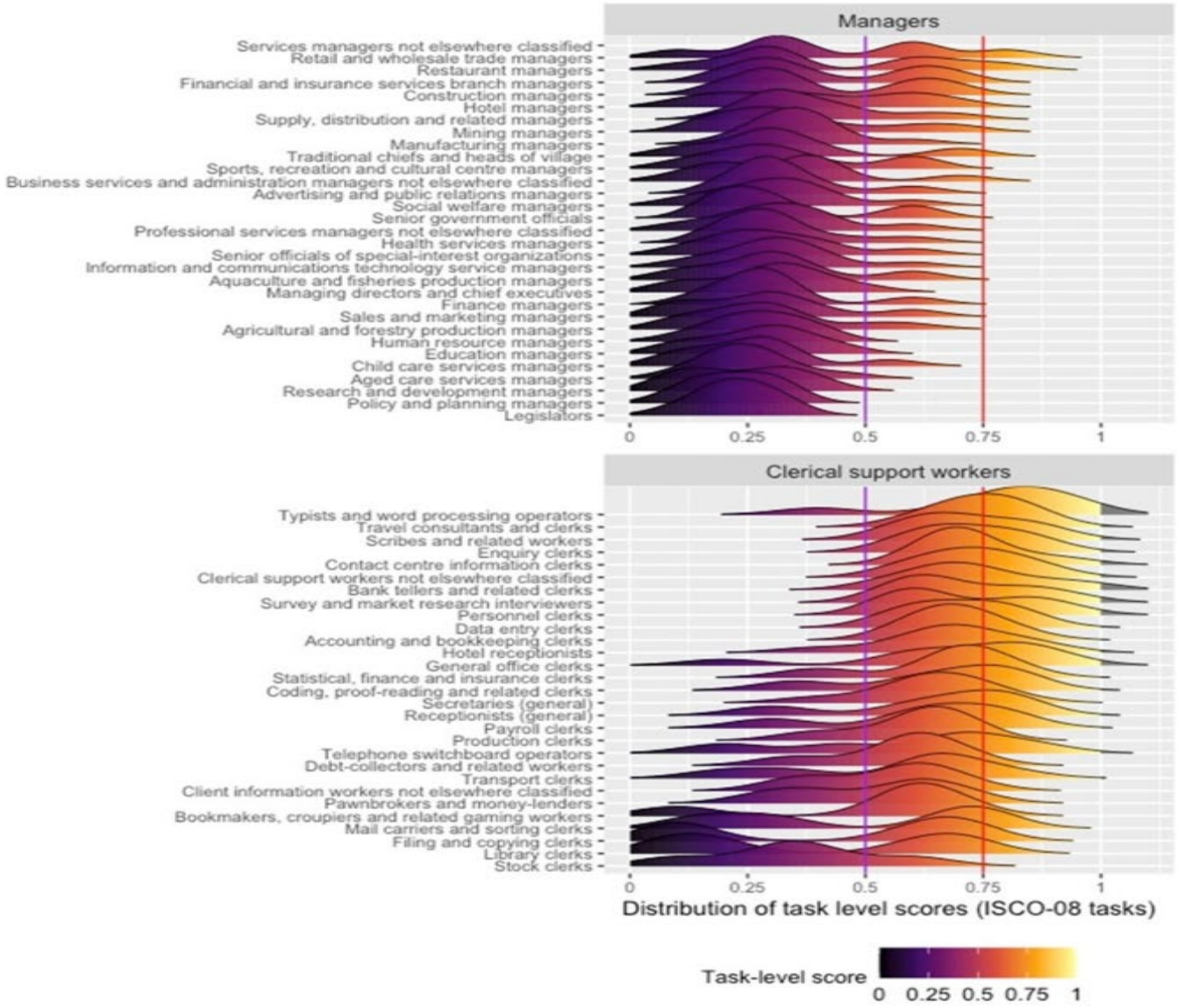
- Analyze the exposure of various tasks and jobs to *generative AI*, more precisely to *Generative Pre-Trained Transformers* (GPTs)

REPLACEMENT SCORE

- For each task :
  - Score less than 0.5 : small replacement risk
  - Score between 0.5 and 0.75 : medium replacement risk
  - Score above 0.75 : high replacement risk

AI AND EMPLOYMENT: THE « TASKS » APPROACH (ILO)

► **Figure 3. Box plot of task-level scores by ISCO 4d, grouped by ISCO 1d**



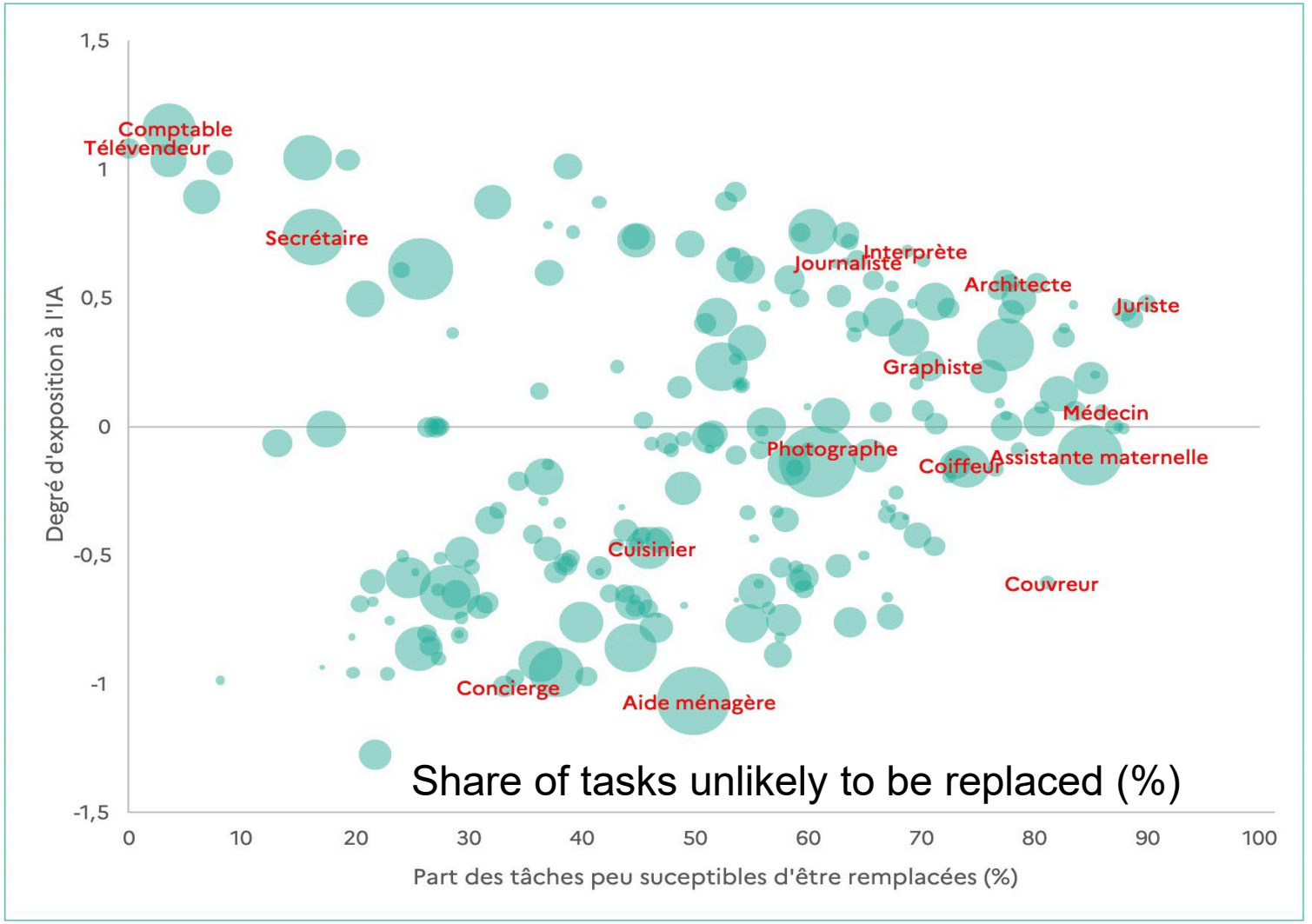
- Managers
- Clerks

AI AND EMPLOYMENT: THE « TASKS » APPROACH IN FRANCE

Expected effect of AI on professions in France

(Report of Ministry of Economics, Finance and Industrial and Digital Sovereignty)

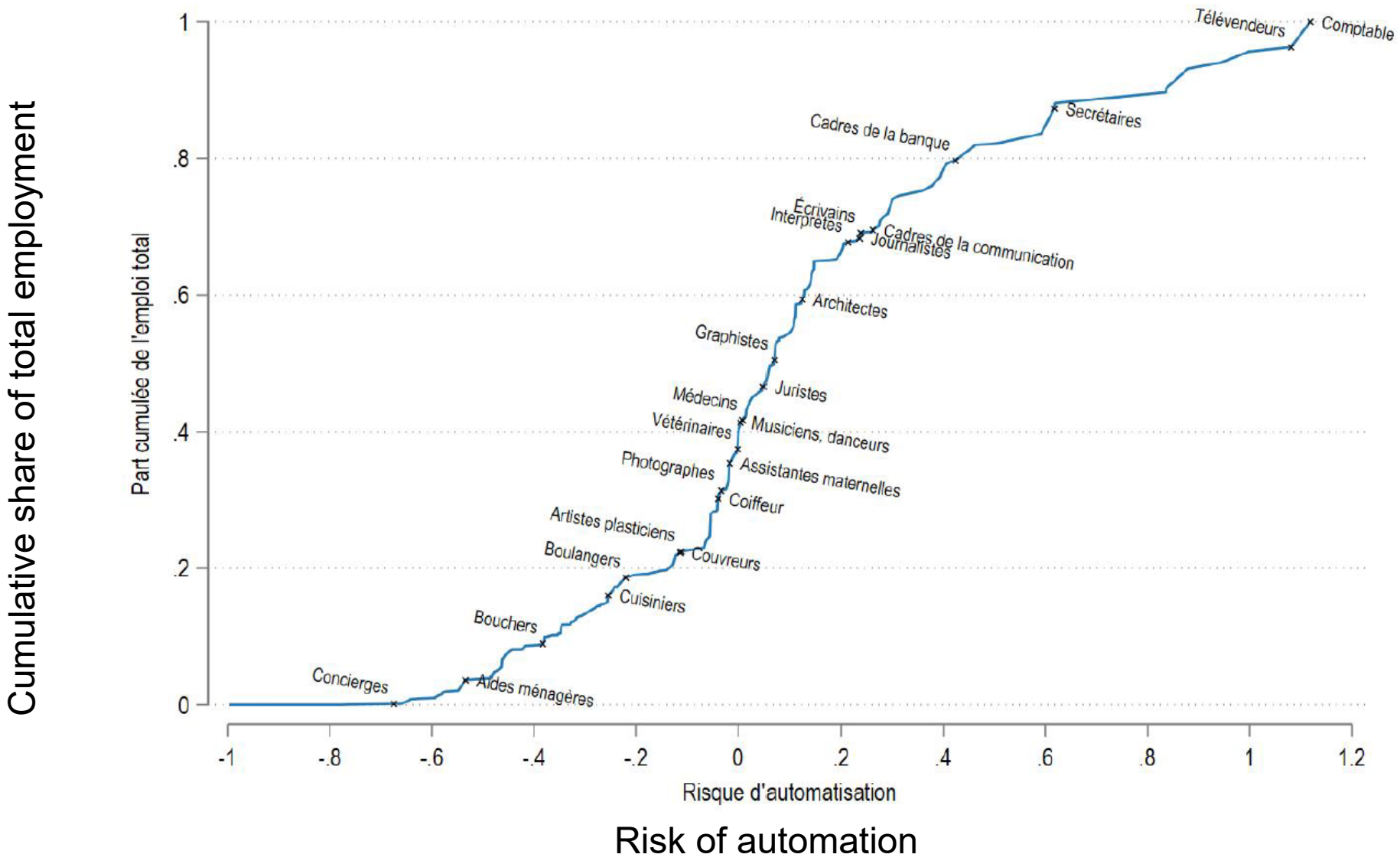
Degree of exposure to AI (%)



Graphique 7 : Effet attendu de l'IA sur les métiers en France.

Source : Bergeaud (2024)

AI AND EMPLOYMENT



CONCLUSION

- No existential risk of AI
  - AI should not generate mass unemployment!

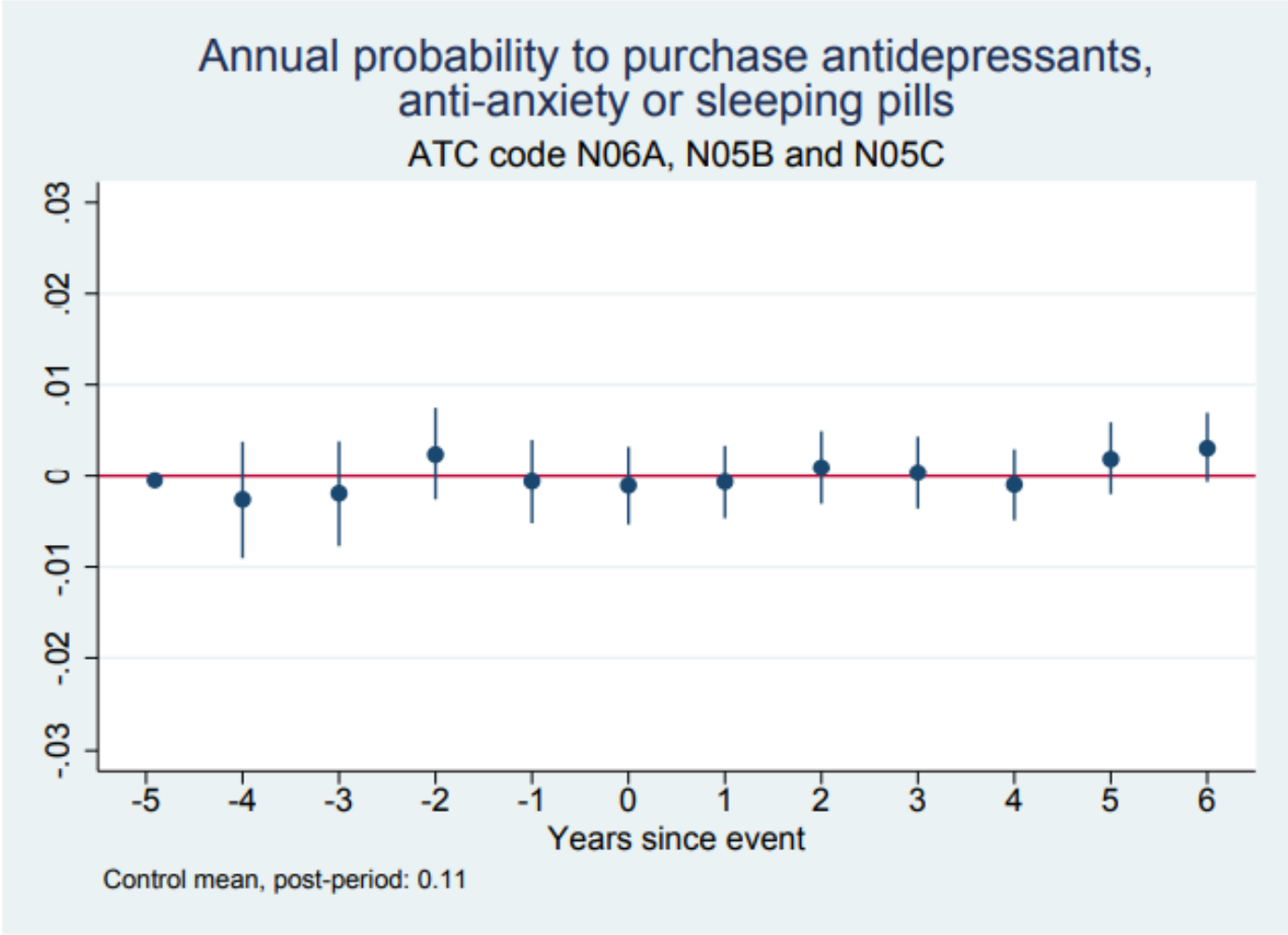
- Yet, need appropriate institutions and policies for AI to boost growth and employment
  - Adequate competition policy reform
  - Education and labor market policies

CONCLUSION

- Competition: factor in entry and innovation
- Labor market policy: flexsecurity

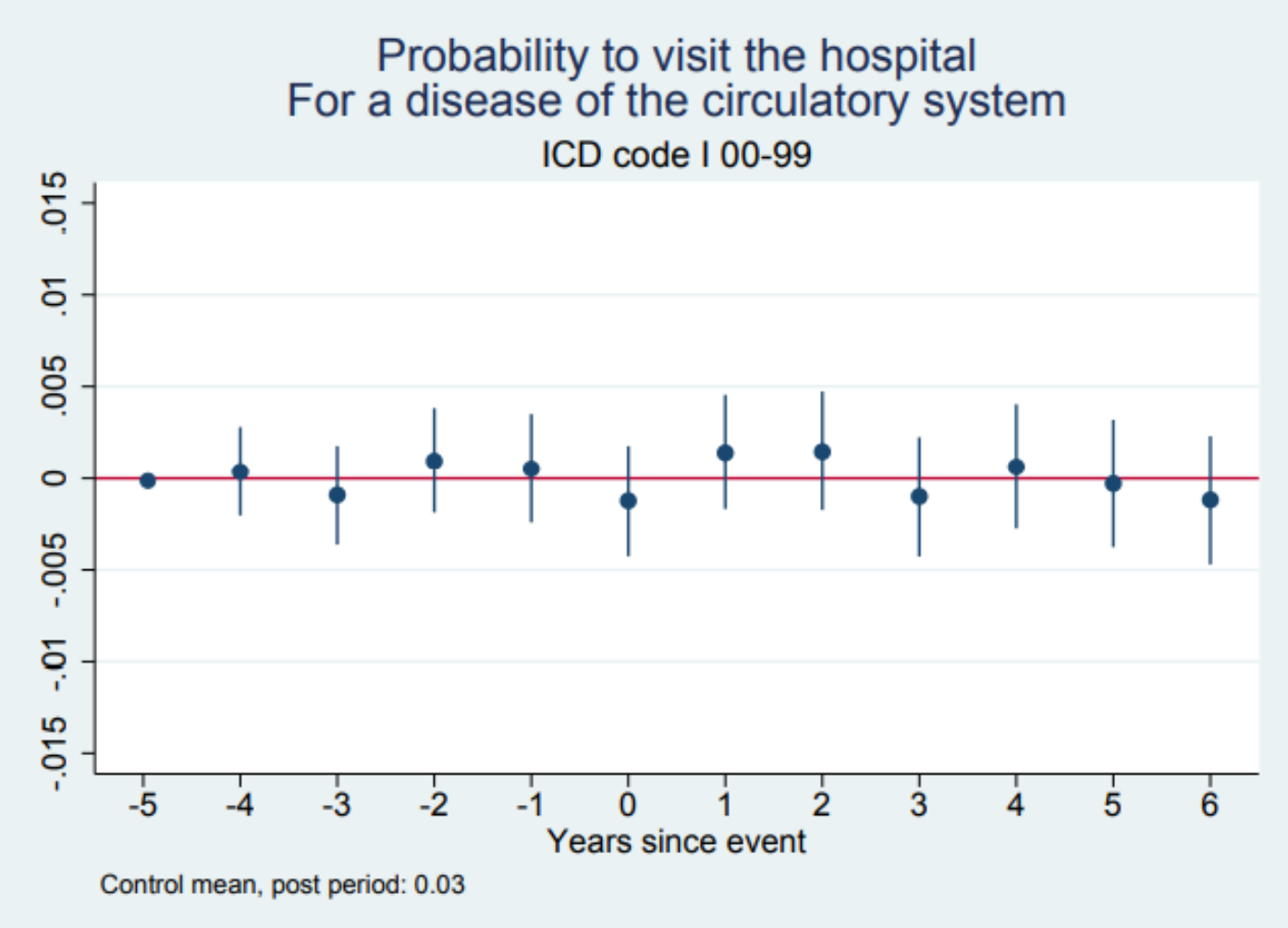
CONCLUSION: DENMARK

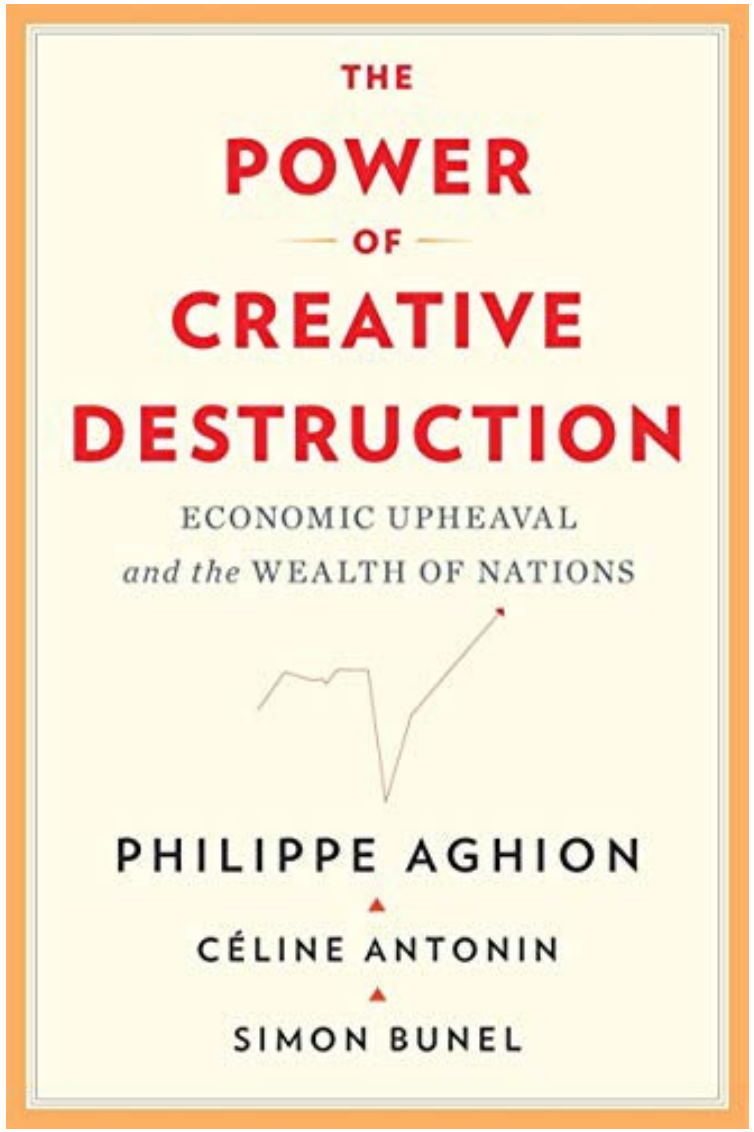
Moving to health: Antidepressants and related drugs



CONCLUSION: DENMARK

Heart attacks

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ECONOMIC UPHEAVAL
and the WEALTH OF NATIONS
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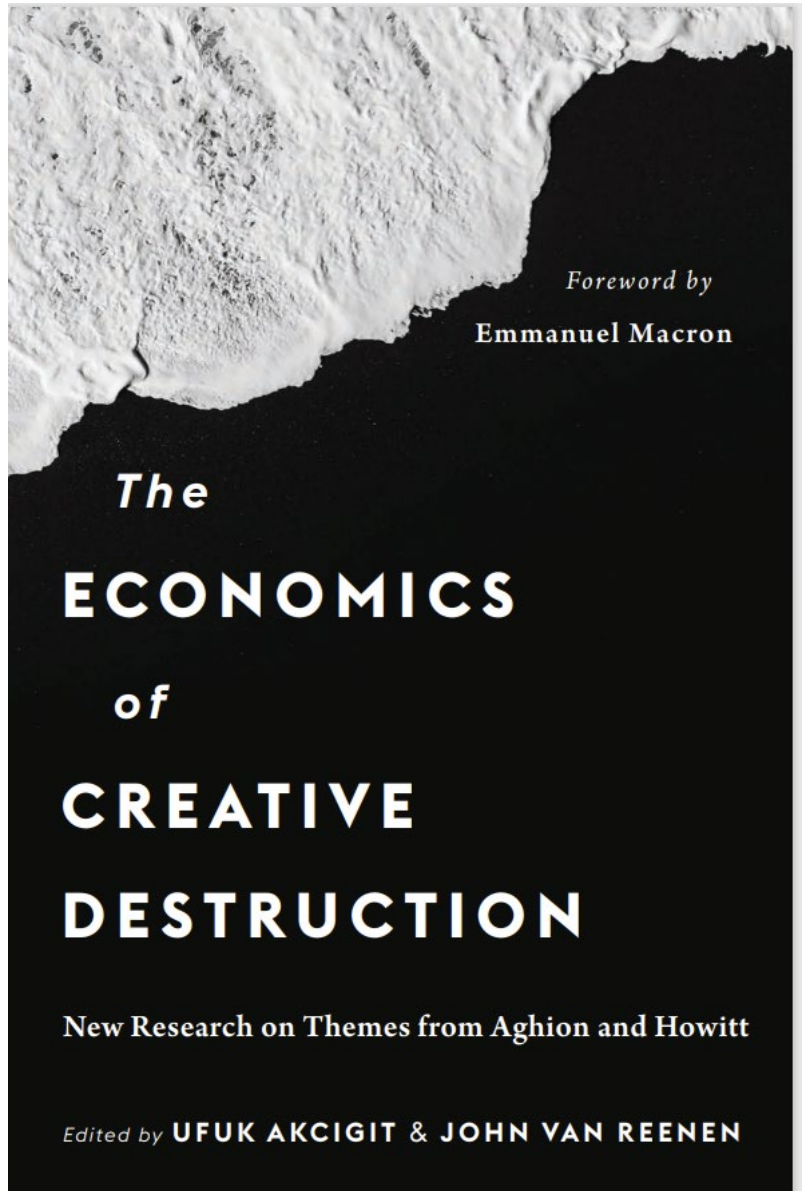
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Emmanuel Macron
The
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CREATIVE
DESTRUCTION
New Research on Themes from Aghion and Howitt
Edited by UFUK AKCIGIT & JOHN VAN REENEN

- Thank you!