Weathering AI: Artificial Intelligence, Climate Change, and the Paris Agreement

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- [Pennsylvania State University](#) (Penn State)
- About 90,000 students
- Chula- 40,000 students
- Thammasat – 40,000 students
- [Penn State Great Valley](#)
- Graduate programs only
- World Campus

Notable Programs

- [Master of Artificial Intelligence](#)

- [Master of Data Analytics](#)

- [Master of Finance](#)

Introduction - The Big Picture

- Two Defining Forces in Business Today:

- Rapid AI Adoption: Artificial intelligence (AI) "is revolutionizing industries, creating new opportunities for growth, and forcing firms to rethink how they adapt".

- Accelerating Climate Risk: The growing severity of climate-related risks, intensified by policies like the Paris Agreement, demands new strategies for businesses.

- Our Goal: To understand how companies using AI are affected by major climate policy changes, specifically looking at how their stock market value reacts.

Why This Matters - Quotes

- Why AI and Climate Change Together?

- "AI is one of the most important things humanity is working on. It is more profound than electricity or fire." — Sundar Pichai, Google CEO, January 2018

- "We are the first generation that can end poverty, the last that can end climate change." — Ban Ki-moon, UN Secretary General, 2015

- These quotes highlight the immense importance and potential of both AI and addressing climate change in our world today.

In Thailand

- [Department of Climate Change](#)

- Department of Artificial Intelligence

The Paris Agreement: A Key Event

- What is the Paris Agreement?

- Adopted in December 2015, it is a "turning point in global climate governance".

- It "mandates substantial reductions in greenhouse gas emissions and enhancing adaptation measures".

- This agreement significantly reshapes the rules and market environment for businesses worldwide, prompting them to rethink their sustainability plans.

- **Why is it important for our study? We use the stock market's reaction to this major global policy event as a "natural experiment" to see how AI affects company value.**

How We Measure AI: The AI Workforce

- It's About People, Not Just Technology.

- The "critical driver behind the successful adoption of AI is not merely technology itself but the skilled workforce capable of leveraging AI systems effectively".

- **We use a unique dataset from Babina et al. (2024) that analyzes employee resumes to identify "AI-skilled employees".**

- This helps us understand how many AI-skilled workers a company has, giving us a measure of its "AI workforce adoption".

Our Core Question: Two Competing Ideas

- **The "Adaptation Advantage" Idea (Our Hypothesis 1):**

- AI helps companies become more resilient and adaptable to climate change.

- This leads to positive reactions from investors, boosting shareholder value.

- Think: AI helps companies innovate, become more efficient, and manage risks related to climate change.
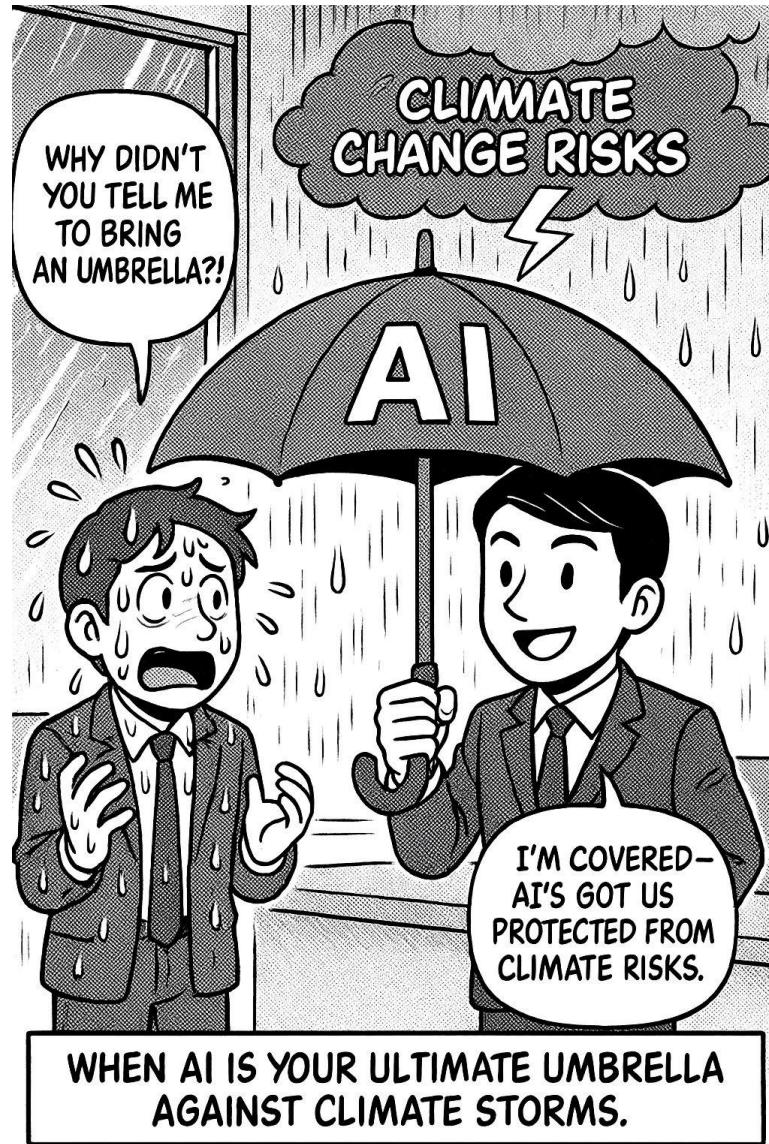
The "AI Burden" Idea (Our Hypothesis 2):

-   Heavy investment in AI might take away resources needed for direct climate strategies.

-   This could lead to negative reactions from investors.

- Think: Companies might be seen as prioritizing AI over immediate climate action, which investors might not like.
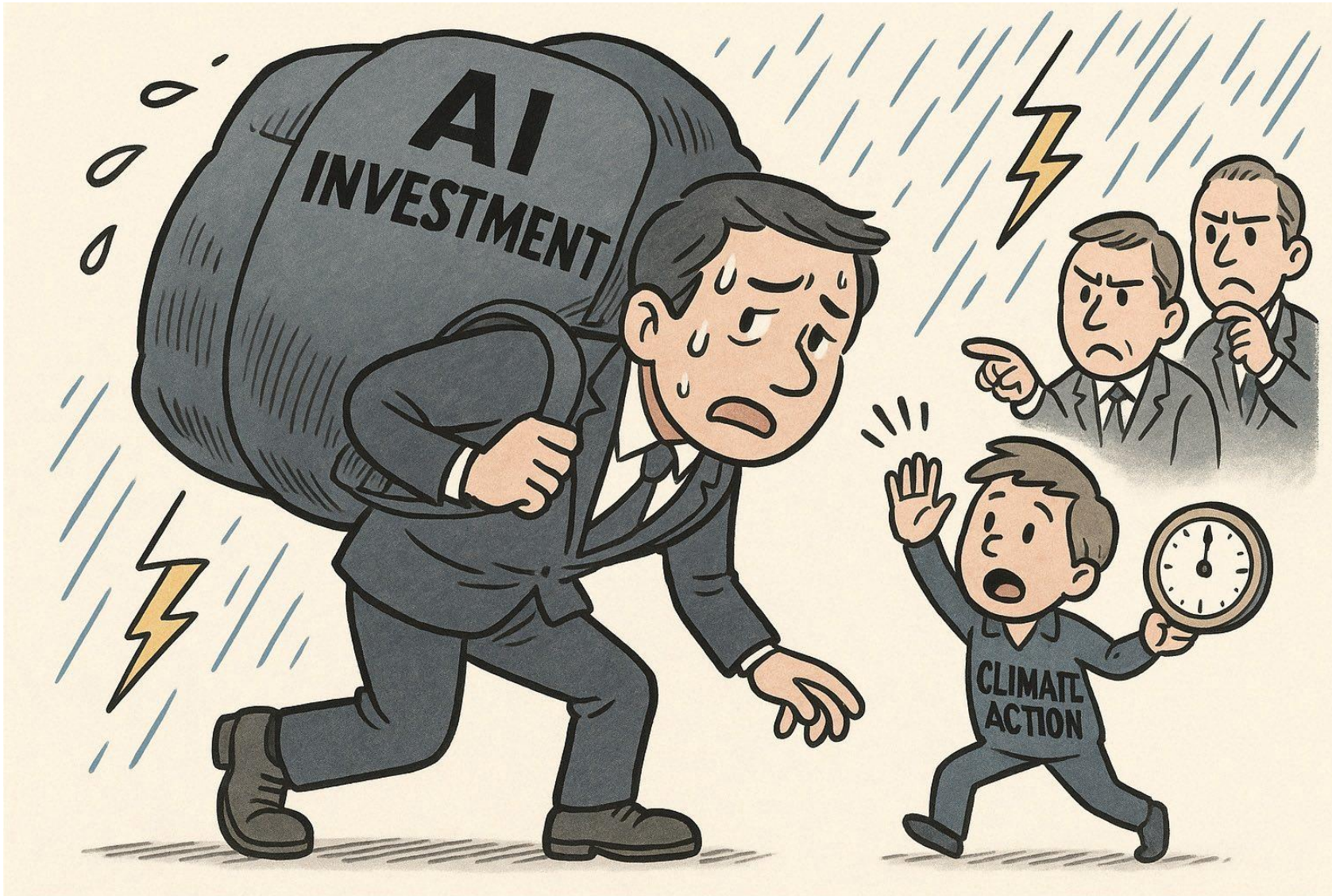
Our Data - Who and What We Study

- **Our Sample:**

- We analyzed **1,501 publicly listed U.S. companies from 2015**

- **Where Our Data Comes From:**

- **AI Workforce Data:** From Babina et al. (2024), based on employee resume data, identifying AI-skilled talent.

- **Stock Market Data:** From the Center for Research in Security Prices (CRSP) to measure stock returns.

- **Company Financials:** From COMPUSTAT for details like firm size, profitability, etc.

- **Climate Change Exposure:** From Sautner et al. (2023), using advanced textual analysis of earnings call transcripts.

Artificial intelligence, firm growth, and product innovation

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How AI Workforce Data is Generated

- **Finding AI Talent in Resumes**

- **Data Source:** We use the **Cognism resume database**, which contains millions of job histories and skills.

- **Identifying AI Skills:** AI-skilled workers are identified by looking at:
  - Job titles (e.g., "Machine Learning Engineer")
  - Specific skills (e.g., "TensorFlow")
  - Achievements like patents or publications.

- **"AI-Relatedness" Score:** Each skill gets a score based on how often it appears with core AI competencies (like machine learning, natural language processing). Skills like "deep learning" get high scores, while general skills like "Microsoft Office" get low scores.

How AI Workforce Data is Generated

- **Classifying and Validating AI Roles**

- **Job Classification:** A job is considered "AI-related" if its average AI-relatedness score is above a certain level. This ensures we focus on true AI integration, not just general data tasks.

- **Company-Level Measurement:** These classified AI roles are then added up for each company to find the "proportion of AI-skilled employees relative to a company's total workforce".

- **Accuracy Check:** We perform "rigorous validation," including manual checks and comparing our measure to things like increased R&D spending, to ensure accuracy.

Empirical Strategy

- The regression equation used in the study to examine the effect of AI

$$CAR_i(-1, +1) = \alpha + \beta_1 (Share\ of\ AI\ Workers)_i + \beta_2 (Controls)_i + Industry\ Fixed\ Effects + \epsilon$$

- CARi(−1,+1) represents the cumulative abnormal return for firm *i* over the event window from Day -1 to Day +1.

- (Share of AI Workers)i is the proportion of AI-skilled employees at firm *i*.

- (Controls)i represents a set of control variables for firm *i*.

- Industry Fixed Effects accounts for industry-specific influences.

- ϵ is the error term.

- Our empirical strategy has a few advantages

- It relies on an exogenous event beyond the control of individual firms, thereby reducing endogeneity

- It is linked to shareholder value directly.

What We Find: The "Adaptation Advantage" Wins

- Key Finding 1: AI Workforce Boosts Shareholder Value

- "Firms with higher shares of AI-skilled employees experience more favorable market reactions to the Paris Agreement" .

- This supports the "adaptation advantage hypothesis".

- Investors see AI-skilled employees as a "strategic asset," helping companies be resilient and innovative during policy changes.

- Economic Significance: A one standard deviation increase in the share of AI workers results in a 4.7% improvement in stock market reactions. This is a meaningful impact!

What About Companies More Exposed to Climate Change?

- Key Finding 2: Benefits Diminish for High Climate Exposure

- "Firms with greater climate change exposure derive smaller benefits from AI adoption" (Abstract).

- This "likely reflects the heightened expectations and scrutiny faced by firms with greater climate exposure" (Section 5.6).

- Investors might question if AI investments are truly aligned with climate goals for these highly exposed companies (Section 5.6).

How AI Interacts with Company Strengths

- Key Finding 3: AI is Most Valued When It Complements Strengths

- R&D Investments: AI adoption "enhances R&D efforts, signaling strong innovation potential" (Abstract). Investors see this combination as creating long-term value (Section 5.8).

- Profitability: For highly profitable firms, AI adoption "raises concerns about resource allocation" (Abstract). Investors might worry about misaligned priorities (Section 5.8).

- Leverage (Debt): Higher leverage can signal "managerial discipline," which strengthens investor confidence in AI investments (Section 5.8).

What About Corporate Governance?

- Key Finding 4: Traditional Governance Has Limited Influence

- We looked at factors like:
- - Percentage of independent directors on the board.
- - Percentage of female directors on the board.
- - Managerial ownership (how much of the company executives own).

- Our findings suggest these "have limited influence on market perceptions of AI workforce adoption during climate-focused events" (Section 5.9).

- This means we might need to rethink how governance frameworks support both technology and environmental goals (Section 5.9).

Long-Term Impact: AI Predicts Future Value

- Key Finding 5: Short-Term Reactions Predict Long-Term Value

- The positive stock market reactions to AI workforce adoption during the Paris Agreement "predict long-term firm value" (Abstract).

- This means the market's initial optimism about AI's role in climate adaptation translates into "sustained economic benefits" over time (Section 5.10).

- "Firms with greater AI workforce adoption are likely to gain a competitive edge through enhanced innovation, operational efficiency, and resilience to climate-related risks" (Section 5.10).

Practical Takeaways for Managers

- What does this mean for business leaders?

- Align AI with Climate Goals: Clearly show how your AI investments contribute to sustainability, like tracking emissions or managing climate risks. This builds investor confidence.

- Strategic Investment: View AI as a long-term strategic asset, not just a short-term trend. Integrate it into core business processes and sustainability initiatives.

- Leverage R&D: If your company has strong R&D, AI can amplify its innovation potential.

- Communication is Key: Especially for companies highly exposed to climate change, clearly communicate how AI helps address these challenges.

Practical Takeaways for Investors & Policymakers

- What does this mean for investors?

- Assess AI Alignment: Look for companies where AI adoption is clearly linked to innovation efforts and climate action.

- Be Cautious: Be wary of highly profitable firms adopting AI without a clear connection to climate strategies, as this might signal misaligned priorities.

- What does this mean for policymakers?

- Incentivize AI-Driven Climate Solutions: Consider offering tax incentives or grants for AI projects that focus on reducing emissions and managing climate risks. This encourages meaningful AI adoption for sustainability.

Conclusions

- AI and Climate Change: A Powerful Combination

- Our study shows a clear positive link between AI workforce adoption and how investors value companies during major climate policy events like the Paris Agreement.

- AI helps companies adapt, innovate, and manage risks in a climate-conscious economy.

- However, the magnitude of this benefit varies across firms, depending on their characteristics and level of climate change exposure.

- Ultimately, AI is a "strategic asset" for building "climate resilience and sustainable growth" (Section 5.10).

Questions & Discussion

- Thank You!

- Questions?