26087: Labor and Finance - Firm Investments in New Technologies

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Recap

Overview

Family Firms

- **Unique characteristics:** Family firms often provide a stable and loyal work environment, with a focus on long-term growth
- **Labor implications:** While wages may be lower, job security and non-monetary benefits can make family firms attractive employers
- **Challenges:** The potential for nepotism and limited career progression opportunities can pose challenges for non-family employees.

State Owned Enterprises

- **Dual Objectives:** SOEs often operate with both commercial and social goals, influencing their labor practices and overall efficiency
- **Labor Impacts:** Job security and employment levels in SOEs are often higher, but this can come at the cost of operational efficiency
- **Privatization Risks and Benefits:** Privatization can lead to job losses and wage adjustments, but also to improved firm efficiency

Listed Firms

- **Ownership structure:**
  - Dispersed ownership of listed firms can create **entrenchment**, **short-termism**, and a greater focus on **shareholder wealth**
- **IPOs:**
  - Often leads to **professionalization** and improves the **financing capabilities** of the firm
- **Labor Implications:**
  - Being listed or listing can **benefit** or **harm** workers
  - **Short term**: higher/lower pay and more/fewer layoffs
  - **Long term**: less training, less career development, fewer internal opportunities

Private Equity Buyouts

- **PE Business Model:** Build on **incentive alignment** and **leverage** to drive change in portfolio companies in the medium run (5-10 years)
- **Job Security:**
  - PE buyouts often lead to restructuring and layoffs and increases bankruptcy risk
  - Focus on cost-cutting and unemployment can increase uncertainty and stress among employees
- **Wages and Benefits:**
  - **Short-Term Pressure:** There may be downward pressure on wages and benefits as PE firms seek to reduce costs
  - **Long-Term Potential:** Successful **turnarounds** and **growth LBOs** can lead to better pay and career prospects

Objectives for Today

- **Understand the Impact of Technology on Firms and Human Capital:**
  - Explore how firms' investments in new technologies influence demand for different types of skills and reshape the labor market
- **Analyze Drivers of Firm Technology Adoption:**
  - Identify the key factors that motivate firms to adopt new technologies: labor and finance related factors
- **Examine Effects on Careers:**
  - Discuss how technology adoption affects the employment mix, skill requirements, and career progression
- **Government policy:**
  - Understand how policies such as R&D incentives, education initiatives, and labor market regulations, influence the adoption of technology and careers

Outline

Technology, Firms and the Labor Market

Overview

Technological Change as a Central Force in Shaping Labor Markets

1. **First Industrial Revolution (Late 18th to Early 19th Century):**
   - Mechanization and the rise of factories.
   - Shift from agrarian work to industrial labor; significant job displacement and creation.
2. **Second Industrial Revolution (Late 19th to Early 20th Century):**
   - Mass production, electrification, and the assembly line.
   - New industries emerged; increased demand for semi-skilled labor.
3. **Digital Revolution (Late 20th Century):**
   - Information technology and the internet.
   - Automation of routine tasks, emergence of the knowledge economy.
4. **The AI Revolution?**

Key Concepts: SBTC and the Task-based Framework

- **Skill-biased technological change (SBTC)**:
  - Technological advancements favor skilled workers with higher education and cognitive abilities
  - **Increases demand for skilled labor**, reduces demand for less-skilled workers, driving wage inequality
- **Task-based framework**:
  - Technology automates **routine tasks** (manual and cognitive)
  - Non-routine analytical and interpersonal tasks are complemented by technology

Key Concepts: Creative Destruction and Capital-Labor Substitution

- **Creative destruction (schumpeterian)**:
  - Innovation disrupts existing industries, leading to **job losses in old sectors**
  - **Creates new industries** and opportunities, offsetting some of the job displacement
- **Capital-labor substitution**:
  - Technology is adopted to **replace labor with capital** (e.g., automation, robotics).
  - Repetitive tasks are automated, reducing labor demand in affected sectors.

Key Concepts: Polarization and the Race

- **Wage polarization:**
  - The labor market is increasingly divided, with wage growth concentrated among high-skill occupations and stagnation or decline in middle-skill jobs
  - The low end is more affected in the US compared to in Scandinavia → inequality effect not as pronouced
- **Job polarization:**
  - The erosion of **middle-skill jobs** due to automation, leading to a dual labor market
  - Example: Decline of manufacturing jobs, rise of service sector and high-tech jobs
- **Race between technology and education**:
  - The education system struggles to keep pace with the rapid evolution of technology, affecting skill supply

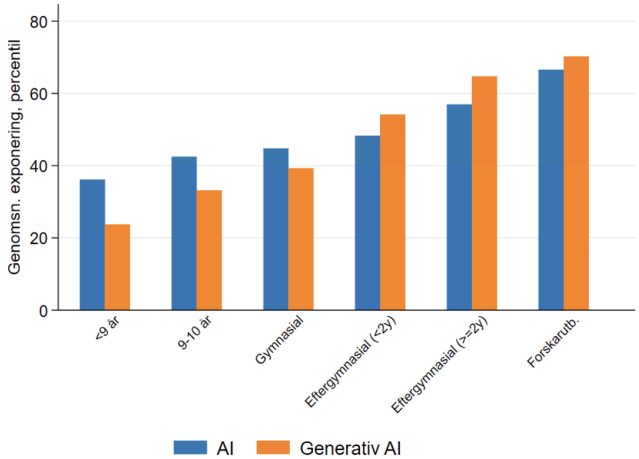
Modern Technological Change

- **Speed and Scale:**
  - Rapid pace of innovation; technologies like **Generative AI and robotics** are diffusing quickly across industries.
  - Global reach, affecting labor markets in both developed and developing countries
- **Complexity:**
  - Modern technologies are increasingly complex, requiring specialized knowledge and skills
  - Integration of multiple technologies (e.g., AI, IoT, big data) within firms
- **Disruptive Potential:**
  - Potential to radically alter entire industries and create new business models
  - Constantly a **race between technology and education**
  - Evidence of **different impacts** compared to previous waves

Gardberg et. al. 2024: Mapping Generative AI Exposure

- Mapping **occupation exposure levels** across Sweden in 2021
- How exposed a given occupation is to **Generative AI (Large Language Models)**: Felten, Raj, and Seamans (2023)
  - Most exposed: Lawyers, psychologists, event and telephone salespeople, university and college teachers, marketers, communicators, PR managers, etc.
- How exposed a given occupation is to **AI or Robotization**: Webb (2020)
- Linked to Swedish occupational, individual, and company data from SCB and then aggregated

Education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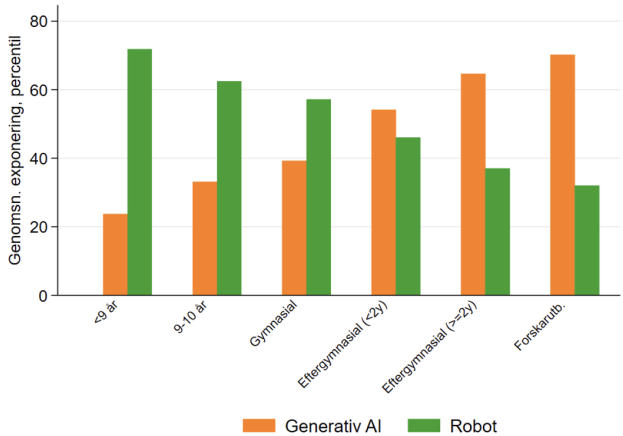
Eftergymnasial (>=2y)
Forskarutb.
AI
Generativ AI

Education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Generativ AI
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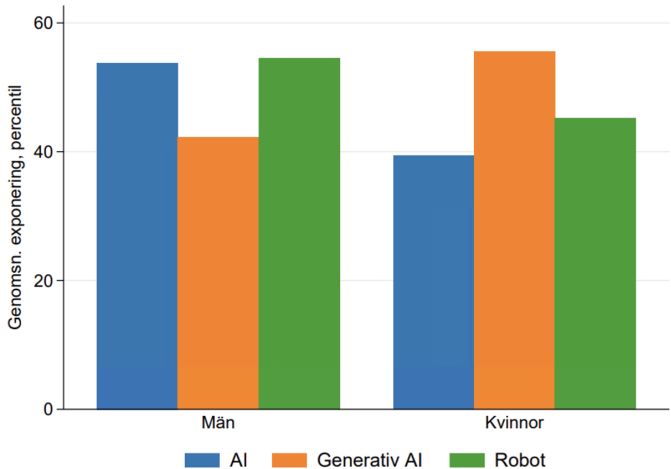
Gender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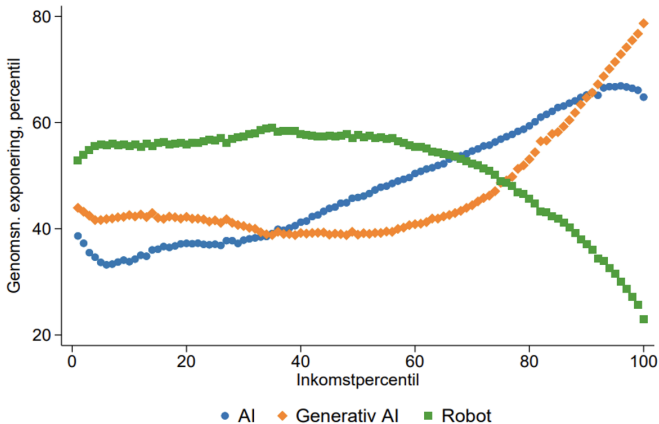
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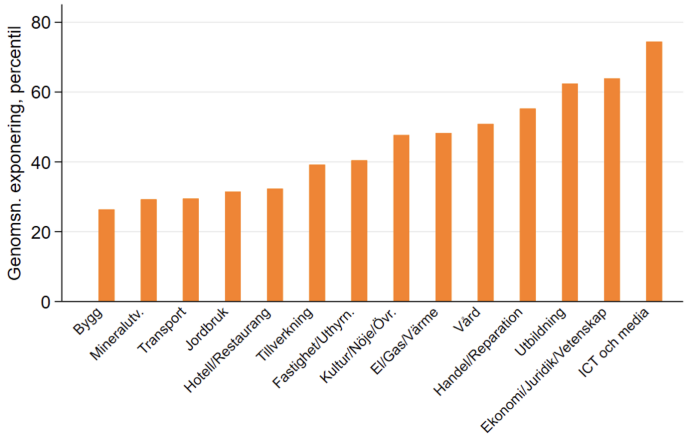
Industry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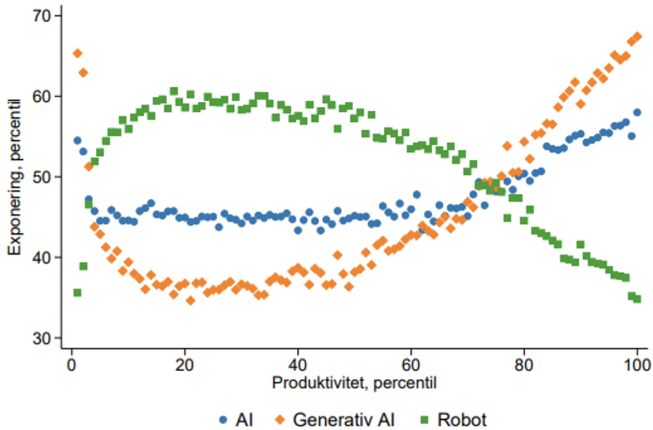
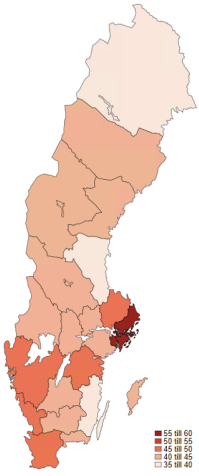
Hotell/Restaurang
Tillverkning
Fastighet/Uthyrn.
Kultur/Nöje/Övr.
El/Gas/Värme
Vård
Handel/Reparation
Utbildning
Ekonomi/Juridik/Vetenskap
ICT och media

Productivity



Region



Takeaways and Labor and Finance Angle

- **Technology as a Double-Edged Sword:**
  - While technology can enhance productivity and create new career opportunities, it also poses challenges in terms of job displacement and inequality
- **Focus on Firm-Level Technology Adoption:**
  - Capital investments, often in new technologies, is a **key corporate finance decision**
  - How do **labor market frictions** affects **corporate investment decisions**?
  - How do **financial and governance frictions** affect **corporate investment in new technologies?**
  - The rest of this lecture will explore how firms' adoption of technology drives changes in labor demand and shapes worker careers

Drivers of Firm Level Technology Adoption

Overview

General Drivers of Technology Adoption by Firms

- **Competitive Pressure:**
  - To stay competitive, firms often adopt new technologies that their rivals are using
- **Market Demand:**
  - Firms may adopt technology to meet customer expectations for faster or better services/products
- **Regulatory Requirements:**
  - Some firms adopt technology to comply with industry standards or government regulations

General Drivers of Technology Adoption by Firms

- **Cost Efficiency:**
  - Firms adopt technology to reduce operational costs (including labor) and improve productivity
- **Access to Capital:**
  - The availability of financial resources can influence a firm's ability to invest in new technology
- **Management Expertise:**
  - Leadership that understands and supports technological change drives adoption within the firm

Drivers of Technology Adoption by Firms

- We cover select **labor and finance** related drivers of technology adoption
- **Labor related drivers**:
  - Labor Scarcity
  - Labor Regulations
- **Finance related drivers**:
  - Financial Constraints
  - Governance and Management

Drivers of Firm Level Technology Adoption

Labor Drivers

Firm's Choice Between Capital and Labor in Production

- **Basic trade-off:** Firms choose between labor and capital based on relative costs
  - **Labor:** Wages, benefits, and labor protections
  - **Capital:** Cost of machines, technology, and investment in automation
- **Cost minimization:**
  - Firms minimize production costs by substituting between labor and capital depending on relative prices
  - When labor costs rise, firms may shift toward more investments in new technologies
- **Labor scarcity and protection:** Labor scarcity (e.g., skilled workers) and strict labor protection laws increase the incentive to adopt technology and automation

Ouimet et al 2024: Opioids and Labor Scarcity

- **Research question:**
  - How does the opioid crisis affect firm value, labor supply, and technology adoption?
- **Data and Identification:**
  - Uses Merative MarketScan health data covering 37.8 million US individuals
  - Changes in opioid prescriptions and their impact on employment and firm outcomes
  - Exploits geographic differences in opioid use and industry heterogeneity
- **Key Findings:**
  - Higher opioid use are associated with lower employment and sales growth
  - Firms invest in automation technologies to mitigate labor shortages
  - Abnormal positive returns in response to state legislation aimed at reducing opioid prescriptions

Bena et al. 2022: Employment Protections

- **Research Question**: How does increased employment protection impact firm performance and innovation, specifically in terms of process innovation?
- **Data and Identification**: The study uses firm-level data on innovation and profitability to analyze the effects of changes in employment protection. The focus is on firms' ability to adapt production processes when labor costs increase.
- **Key Findings**:
  - Firms with higher innovation ability are better at maintaining profitability when labor dismissal costs rise.
  - Increased labor protection encourages process innovation, allowing firms to substitute capital for labor.
  - The shift towards process innovation may have unintended long-term consequences, such as job displacement.

Drivers of Firm Level Technology Adoption

Finance and Governance Drivers

Finance and Governance Drivers

- **Financial constraints:**
  - Firms facing financial constraints may not have the capability to optimally invest in new technologies
  - Governments often offer tax credits, deductions, or other incentives for firms investing in R&D and new technologies.
- **Agency costs:**
  - Agency costs from dispersed ownership might mean that management are not optimally investing in new technologies (”quiet life”) or investing too much due to private benefits (”the tech-bro CEO”)
- **Ownership changes often lead to technology adoption** as governance and financing capabilities are strengthened

Kim et al. 2024: SEOs and Tech Investments

- **Research Question**:
  - How do seasoned equity offerings (SEOs) affect technology investments, employee skill composition, and firm-level employment?
- **Data and Identification**:
  - Panel data from Chinese publicly listed firms (2000-2012)
  - 557 SEOs and regulatory shocks as instrumental variables
- **Key Findings**:
  - SEOs increase the proportion of high-skilled workers but reduce overall employment
  - Low-skilled workers are disproportionately replaced due to technology adoption
  - SEOs are more impactful for financially constrained firms

Ma et al. 2024: M&As and Tech Investments

- **Research Question**:
  - How do M&As impact technology adoption, labor reallocation, and wage inequality at target firms?
- **Data and Identification**:
  - Occupational Employment and Wage Statistics (OEWS) data for U.S. firms (2001-2017)
  - Matched sample of 2,924 target establishments and 1,159 horizontal M&A events
- **Key Findings**:
  - Routine workers are replaced by technology, with a 5.3% decline in routine employment share
  - M&As increase wage inequality, with a 2.4% increase in mean wages and 3.2% rise in wage dispersion

Takeaways of Drivers of Technology Adoption by Firms

- **General Drivers**:
  - **Competitive Pressure:** Adoption to maintain competitive parity with industry rivals
  - **Market Demand:** Meeting customer expectations for improved products or services
  - **Regulatory Requirements:** Compliance with government mandates
  - **Cost Efficiency:** Reducing operational costs and increasing productivity
  - **Access to Capital:** Financial resources enabling investment in technology
  - **Management Expertise:** Leadership's understanding of technology
- **Labor-related Drivers:** Influenced by labor scarcity and regulatory environment
- **Finance-related Drivers:** Impacted by financial constraints, agency costs, and ownership changes

Effects of Technology Adoption on Human Capital and Careers

Overview

Effects of Technology Adoption on Human Capital and Careers

- Technology adoption significantly impacts **the workforce within firms**, altering employment patterns, skill requirements, and career progression.
- Technology adoption not only reshapes the internal labor market within firms but also significantly impacts the **career trajectories of individual workers**.

Effects of Technology Adoption on Human Capital in Firms

- **Shift in Job Composition:**
  - Adoption of new technologies often leads to a shift in the employment mix
- **Increased Demand for High-Skill Jobs:**
  - Growth in roles requiring advanced technical skills, such as data analysis, software development, and IT management
- **Decline in Routine Jobs:**
  - Routine, manual, and clerical jobs are most vulnerable to automation, leading to potential job losses in these areas
- **Example:** Manufacturing sector: Automation has reduced the need for assembly line workers but increased demand for robotic system operators and technicians

Internal Labor Market Dynamics

- **Career Progression and Opportunities:**
  - Technology can create new career paths within firms, especially in areas like AI, cybersecurity, and data science.
- **Flattening of Hierarchies:**
  - Some firms may see a flattening of organizational hierarchies as technology streamlines management and decision-making processes.
- **Job Security Concerns:**
  - Workers in roles susceptible to automation may face increased job insecurity, leading to higher turnover rates or shifts to less vulnerable positions.
- **Example:** Financial services: Automation of routine tasks like data entry has led to greater focus on advisory roles and relationship management, which are less prone to automation.

Skill Upgrading and Reskilling

- **The Need for Reskilling:**
  - As technology evolves, firms may require workers to adapt by acquiring new skills relevant to emerging technologies instead of replacing them
- **Company Initiatives:**
  - Many firms invest in reskilling programs to help their workforce transition to new roles, particularly in tech-driven industries.
- **Example:** IT industry: Employees trained in legacy systems are often reskilled to work with cloud computing and AI technologies.
- Reskilling is often a major corporate investment decision, yet there is **very little research** on it

Olsson and Tåg 2017: Private Equity, Layoffs, and Job Polarization

- **Research Question**
  - How do private equity buyouts affect layoffs and job and wage polarization?
- **Data and Identification**
  - Data from employer-employee matched dataset in Sweden (2002–2008)
  - DiD analysis comparing firms pre- and post-buyout with controls
- **Key Findings**
  - No overall increase in unemployment, but doubling of layoffs for routine and offshorable jobs
  - Layoffs concentrated in firms with lower ex-ante productivity. Evidence for modernization.
  - Job polarization more pronounced in buyout-affected firms than in the broader economy.

Gardberg et al. 2024: Technology Transfer in M&As and Careers

- **Research Question:**
  - How does technology transfer during M&As affect the long-term careers and wages of workers in target firms?
- **Data and Identification:**
  - Matched employer-employee data from Sweden and foreign M&As
  - Stacked DiD and DiDiD on worker wages
- **Findings:**
  - Technological specificity matters. Wage declines (up to -15%) post-acquisition by tech-intensive firms for substitutable workers
  - Managers and complementary workers see career boosts (up to 6%)
  - Technology transfer through M&As has significant, heterogeneous exposure-dependent impacts on careers

Key Takeaways on Firm Technology Investments and Worker Careers

- **Workforce Impact:**
  - Alters employment patterns, skill requirements, and career progression.
  - Shifts job composition, increasing demand for high-skill roles and reducing routine jobs.
- **Internal Labor Market Dynamics:**
  - Creates new career paths, especially in AI, cybersecurity, and data science.
  - Leads to job insecurity in automatable roles and flatter organizational hierarchies.
- **Career Impacts:**
  - Are technologies are substitutable or complementary?

Government Policy

Overview

Firms, Labor, and Government Policy on Technology

- Policy plays a crucial role in shaping **how firms adopt new technologies** and **how these technologies impact labor markets**
- Policy can **guide the direction of tech change** such that it complements rather than displaces labor
  - Subsidies for technologies that improve worker productivity
  - Penalties for technologies that lead to significant job displacement
  - This addresses potential **labor market externalities of technological change**
- **Some key levers the government can pull:**
  - Tax Incentives and R&D Grants
  - Infrastructure Investments
  - Labor Market Regulations
  - Education and Workforce Development Programs

R&D Grants and Tax Incentives

- **R&D Grants:**
  - Governments can provide grants to support research and development in emerging technologies, lowering the financial risk for firms
  - Grants are particularly effective in promoting innovation in industries where upfront costs are high and the return on investment is uncertain
- **R&D Tax Credits:**
  - Tax incentives reduce the cost of R&D
  - Research suggest that R&D Tax Credits can be quite effective tools
- **Tax Incentives to Restructure:**
  - Can be designed to target specific types of corporate investments and to be temporary
  - Complicates the tax code

Tuzel and Zhang 2021: Tax Incentives for IT Investments

- **Research question:** Do investment tax incentives improve job prospects for workers by influencing the demand for different types of labor?
- **Data and identification:**
  - Analyzes US establishment-level data on occupational employment and computer investment
  - Exploits variation from states' adoption of federal Section 179 tax incentives
- **Key findings:**
  - Investment incentives lead to an immediate increase in skilled workers but a delayed reduction in routine-task workers
  - No significant effect on total employment

Hirvonen et al. 2023: Technology Subsidy Programs

- **Research question:** How do technology subsidies affect employment and skill demand in Finnish manufacturing firms?
- **Data and identification:**
  - Uses data on Finnish manufacturing firms from 1994–2018, focusing on technology subsidies for machinery such as robots and CNC machines
  - Compares close winners and losers of subsidy applications
- **Key findings:**
  - Technology subsidies led to a 23% increase in employment
  - No significant changes in the skill composition (education level or occupation)

Education and Workforce Development

- **STEM Education:**
  - Investment in STEM (Science, Technology, Engineering, Mathematics) education to ensure a steady supply of skilled workers
- **Lifelong Learning Initiatives:**
  - Governments can promote lifelong learning and continuous education programs to help workers adapt to technological changes throughout their careers
- **Vocational Training:**
  - Policies that support vocational training and apprenticeships can help workers acquire specific skills needed for new technologies being adopted by firms.

Labor Market Regulations

- **Labor Protection Laws:**
  - Regulations that protect workers from abrupt job losses due to technology adoption, such as requiring severance packages or retraining programs, can mitigate the negative impacts on labor
  - But they can also increase incentives for firms to invest in new technologies
- **Flexible Labor Policies:**
  - Encouraging flexibility in labor markets can help workers transition between roles or industries more smoothly as technology changes the demand for specific skills (Denmark's "Flexicurity" model)

Infrastructure Investments

- **Digital Infrastructure:**
  - Governments play a key role in building the digital infrastructure necessary for firms to adopt and leverage new technologies effectively
- **Broadband Networks:**
  - Investments in broadband and high-speed internet are critical for enabling firms to implement advanced technologies, particularly in rural or underserved areas
- **Impact on Labor:**
  - Improved infrastructure can lead to job creation in tech-driven sectors and among skilled workers
  - May also, however, lead to unskilled workers being left behind

Key Takeaways on Government Policy and Technology

- Policy plays a crucial role in shaping **how firms adopt new technologies** and **how these technologies impact labor markets**
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- **Some key levers the government can pull:**
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Takeaways

Overview

Key Takeaways

- **Focus on Firm-Level Technology Adoption:**
  - Capital investments, often in new technologies, is a **key corporate finance decision**
  - How do **labor market frictions** affects **corporate investment decisions**?
  - How do **financial and governance frictions** affect **corporate investment in new technologies?**
- **Workforce Impact:**
  - Alters employment patterns, skill requirements, and career progression
  - Shifts job composition, increasing demand for high-skill roles and reducing routine jobs and middle management jobs
  - **Key question**: is the technology a substitute or a complement to my job tasks?
- Policy can **guide the direction of tech change** such that it complements rather than displaces labor