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IN FOCUS

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The Impact of Generative AI on Labor Markets: Frameworks

Rapid advancements in the capability and availability of artificial intelligence (AI)—particularly of generative artificial intelligence (GenAI), a subset of AI that can generate new content—have been accompanied by concerns that these technologies will disrupt labor markets. These concerns include the possibility of displacing current workers and the possibility of fewer job opportunities for new entrants to the labor market. Broader concerns include the devaluation of certain skills, including skills gained via costly investments in education. Workers, policymakers, students, and parents want to know which types of work will have greater and less demand as new AI tools are adopted, and what sort of training may be needed for jobs of the future.

This In Focus describes frameworks for understanding potential impacts of GenAI on labor markets. Some are general frameworks used in understanding previous waves of technological change, while others are specific to GenAI.

General Frameworks

Concerns about new technology displacing workers are long-standing. For example, Congress passed the Manpower Development and Training Act of 1962 (P.L. 87-415) to aid workers displaced by automation. Some general frameworks are used in understanding the impacts of any kind of new technology on labor markets.

Labor Productivity

Labor productivity is the efficiency with which goods and services are produced by human labor, often expressed as output per hour. There is a direct link between the impact new technologies have on labor productivity and the impact these technologies may have on labor demand. When new technologies make workers more productive in the same tasks, fewer workers are needed to do the same amount of work. When workers become more productive, their work can generate more revenue, which can increase their wages.

Substitution and Complementarity

Most jobs involve doing many different tasks throughout the course of a workday. New technologies often replace some work tasks but not others, changing how people spend their time in jobs that continue to exist.

New technologies can directly *substitute* for workers in some tasks, but can also make workers more productive (*complement* or *augment* their work) in other tasks. At the extreme of complementarity, new technologies make new types of work possible. For example, computer application engineering was a new type of work in the 20th century.

Substitution for Tasks Rather Than Jobs

New technologies can substitute for workers in some tasks, complement their work in other tasks, and make it possible for entirely new tasks to become part of doing jobs. This can mean people with the same job title in different time periods do very different tasks during their workdays.

One example of new technology changing a job rather than replacing people doing that job is the deployment of automated teller machines (ATMs) in U.S. banks in the 1970s and 1980s. The spread of these machines was associated with growth in the number of bank branches and an increase in the overall employment of bank tellers. This technology shifted the jobs of bank tellers from dispensing cash to explaining financial services to customers. (However, more recent changes in banking technology have been associated with more banking services moving online, accompanied by declines in bank teller employment.)

New technologies can lower wages for workers if they substitute for the job tasks that previously required the most *expertise*. They can raise wages for workers if technology replaces the job tasks that required the least expertise.

Adoption and Diffusion of Technology

New technologies that change the way work is done in many jobs in many industries are considered *general purpose technologies (GPTs)*. Such GPTs can affect the organization of work, further increasing labor productivity.

One historical example of a GPT is the electric motor. Before electric motors, factories connected machines to central steam power plants with belts attached to overhead driveshafts and machines were positioned to optimize driveshaft power. This meant production processes involving a great deal of moving materials around (and up and down) factories to the machine locations. Electric motors attached to each machine made it possible to build factories that optimized flows of materials between machines. These new factories were not only more productive, but also lighter, cleaner, and safer for workers.

Production process changes associated with electric motors were transformative for many industries but took decades to be fully implemented as new factories were built. In contrast, many production processes that may be changed by AI and GenAI are already done on computers, so these changes may happen more quickly.

In a competitive economy, firms choose which technologies to adopt and how many people to employ. One study of AI adoption shows firms that adopted early forms of AI from 2010 to 2023 grew faster than other firms in their industries. Within these firms, the composition of jobs

shifted away from jobs in which early forms of AI could substitute for more tasks. However, firm growth meant increased employment overall—with employment growth on net even for jobs in which AI substituted for more tasks.

Labor Market Disruptions

Many previous technological innovations have led to layoffs for previously employed workers in the short term, but well-paying new jobs for a greater number of workers in the long term. These innovations mean more productive workers in jobs that remain, as well as jobs doing new types of work. The new jobs are said to *reinstate* labor.

However, the workers laid off from old jobs are not necessarily the same people employed in new jobs. New jobs may be located in different industries or even in different places. Research has shown labor market disruptions are associated with many negative outcomes for workers who lose jobs, including long term reductions in incomes, social connections, and even in health.

Frameworks Specific to GenAI

Recent improvements in AI and GenAI technology are based on combining computing power and technical advances in underlying AI models with massive amounts of data on the work done by workers and the outcomes of that work. Transcripts of conversations by call center workers, reports written by consultants, and clinical decisions made by doctors are all examples of labor data used in GenAI. Much of what GenAI can do is based on using detailed data about what people do on the job to mimic human activity. This could be different from previous technological innovations in the way it affects labor markets.

Automating Tasks That Are Difficult to Explain

GenAI performs work based on examples rather than instructions. This allows it to automate tasks that are less routine than the physical (factory work) and mental (office work) tasks automated by previous technologies. GenAI is being applied to tasks that previously relied on knowledge and experience, such as writing code or prose, creating art, making medical diagnoses, and reviewing job applications, though even advanced GenAI models still make mistakes.

Teaching Workers

In some applications, GenAI makes suggestions to workers about what they could do, rather than fully automating work. This can teach less experienced workers how their most expert colleagues would carry out a task (or remind experienced workers how they themselves previously carried out unusual tasks). For example, in a study of GenAI used by customer-support agents, a GenAI tool gave agents suggestions on what to say, based on transcripts of previous calls handled by the best-performing agents in the firm. These suggestions improved the skills of less experienced agents, and their skill improvements continued even when they temporarily lost access to the GenAI tool.

However, other research has shown applications of GenAI can reduce how much workers learn. In one example, a study of GenAI use by software engineers, engineers given access to GenAI while learning a new set of software modules showed less understanding of these modules than a comparison group without access to GenAI. A second example, a study of essay writing while undergoing brain monitoring of people with and without access to ChatGPT, showed those who had access to ChatGPT had less brain activation and remembered less of what they wrote.

Shifting the Boundary of Expertise between Human Capital and Employers' Intellectual Property

When firms collect data on what their best employees do and use GenAI to make suggestions about doing work in similar ways to other employees, it makes expertise more easily sharable. However, it also complicates who owns this expertise. GenAI can shift the boundary of expertise from skills possessed by expert employees to something owned by their employers.

The Role of GenAI in Uncommon Situations

Some studies of GenAI suggest it is most useful in moderately rare situations that experienced workers encounter infrequently and inexperienced workers have not encountered before. In situations that even experienced workers have not encountered before, GenAI can be less useful. One hypothesis is that people are better at dealing with rarely encountered situations because they can use outside knowledge or models of how things work. This is sometimes called the *long tail hypothesis*.

Jagged Intelligence

GenAI can do some tasks very well but does not do other, seemingly very similar, tasks well at all. Sometimes, GenAI can do a task that is difficult for people while being unable to do a similar task that is easier for most people to do. Error patterns of AI are different from human mistakes. For example, a GenAI model may recommend walking instead of driving to wash a car at a car wash. One study showed a GenAI model correctly answered more difficult math problems and fewer easy math problems than people. This is called *jagged intelligence.* It may make it less possible for GenAI to fully substitute for work by people.

Impact on Entry-Level Workers

Because GenAI mimics the work of more experienced workers in commonly encountered tasks that are often assigned to entry-level workers, there are concerns that this technology will substitute for workplace roles previously occupied by entry-level workers. This would be harmful to inexperienced workforce entrants (such as young people, recent graduates, and people re-entering the workforce). In the long run, a lack of entry-level positions would mean fewer pathways for inexperienced workers to become the experienced workers still needed in a world with greater GenAI adoption.

Uncertainty

Previous technological innovations tended to replace work done by workers with low or middle levels of education. New entrants into the labor market could find similar paying jobs to those that had been automated. Getting more education was generally a way to find work that new technology could not replace. However, GenAI is capable of some tasks that previously required extensive education. This is leading to uncertainty over which educational investments might be considered *GenAI-proof*. It is also

unclear how much these new technologies will be used to automate work rather than expand new forms of work.

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