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# Technology, Automation, and the Erosion of Labor Demand in Developed Economies

## Introduction

Technological progress has long been viewed as a driver of productivity, new industries, and improved living standards. The mainstream economic orthodoxy holds that while technology may disrupt certain jobs, it ultimately creates new employment opportunities and raises overall prosperity. From the mechanization of agriculture to the computer revolution, history is often cited to show that fears of "technological unemployment" are unfounded, as new jobs emerge to absorb displaced workers. Recent advances in automation and artificial intelligence (AI) have again stirred debate about the future of work, but many economists and policymakers maintain an optimistic view: **technology, they argue, will continue to create more jobs than it destroys, boosting productivity and wages in the long run** [1].

This report directly challenges that conventional view by examining the hypothesis that **automation and related technologies have been eroding labor demand and suppressing wage growth** in developed economies. Focusing on the United States, Western Europe, the United Kingdom, Japan, and Australia from roughly 1950 to the present, the analysis will show that successive waves of automation – from mechanical automation and early computers to modern AI – have coincided with *declining labor force participation, stagnating real wages, a falling labor share of national income, and job polarization*. The emergence of "superstar" firms that achieve huge revenues with relatively few workers, the decoupling of corporate success from broad employment, and qualitative degradation of many new jobs all point to a weakening of labor's position.

**Scope and Approach:** We survey historical macroeconomic trends in labor demand over the postwar period, drawing on primary data and research from institutions such as the U.S. Bureau of Labor Statistics (BLS), the OECD, and the International Labour Organization (ILO). We present empirical evidence on labor force participation rates, employment-to-population ratios, real wage growth (or lack thereof), and labor's share of income. We examine occupational shifts – notably the decline of manufacturing and routine office jobs – and the rise of low-wage service employment, linking these to waves of mechanization, computerization, and digitization. Case studies of specific automation technologies (from industrial robots and ATMs to robotic process automation and generative AI) illustrate the **displacement effects** on both blue-collar and white-collar work. We also analyze the **displacement vs. creation** dynamics: to what extent has technology eliminated jobs or tasks faster than it creates new ones? This includes discussion of job polarization (the hollowing-out of middle-skill jobs) and the troubling evidence that recent decades have seen *accelerated displacement with weaker creation of new jobs* [2] [3].

Crucially, the report addresses counterarguments and aggregate indicators often cited as proof that technology is not harming workers – for example, low unemployment rates or the proliferation of new job titles in the tech sector. We argue that **headline job numbers can be misleading**, masking deteriorating job quality, stagnant median earnings, and a shift of economic rewards from labor to capital. The rise of part-time, temporary, and gig work (the "alternative workforce") has allowed total employment figures to

recover even as traditional stable jobs vanish [4] [5]. Meanwhile, a "labor glut" – whether from demographic trends, globalization, or automation itself acting as a *synthetic workforce* – has undercut workers' bargaining power. This glut, combined with declining unionization, has tilted the balance of power toward capital owners, contributing to historically high corporate profit shares [6] and historically low labor income shares [7].

**Organization:** The report is structured as follows. We begin with a historical overview of labor demand and supply since 1950, highlighting major trends in labor force participation, employment growth versus population growth, real wage growth, and labor share of income. Next, we examine how successive *technological waves* (mechanization, computerization, and AI) have impacted different occupational groups – from factory workers to clerical staff to professionals – and how these shifts manifest in phenomena like job polarization. We then explore the concept of "superstar firms" and how the concentration of economic activity in a few highly automated, high-productivity firms has decoupled business success from job creation [8]. The subsequent sections delve into **case studies of automation technologies** (including back-office automation and AI-driven tools) and their documented labor effects. We then tackle the *displacement versus creation* debate using insights from recent economic research, and confront the counterarguments commonly offered by techno-optimists. Finally, we discuss the broader implications for labor's bargaining power and conclude by synthesizing the evidence that technology's impact on labor in developed economies has been far more corrosive than the rosy conventional wisdom suggests – a trend that, if unaddressed, could continue to suppress wages and worker power in the years ahead.

*(All data and factual claims in this report are backed by primary sources or peer-reviewed research, with detailed citations provided in footnotes.)*

## Historical Trends in Labor Demand and Wages Since 1950

### Postwar Boom and Rising Participation (1950s–1970s)

In the early post–World War II decades, developed economies experienced robust growth that drove strong demand for labor. In the United States, unemployment remained low and **labor force participation** climbed significantly from 1950 through the late 1990s. Overall labor force participation (the share of the adult population either employed or actively seeking work) rose from about 60% in 1950 to a peak of 67.3% around the year 2000 [9]. A major factor was the **surge of women entering the workforce**: female participation rose from around 32% in 1948 to roughly 60% by 2000 [10]. The postwar decades also saw the large Baby Boom cohort come of working age, expanding the labor supply and filling a rapidly growing number of jobs. Between 1970 and 1990 alone – a period of accelerating socio-economic change – the U.S. labor force participation rate jumped from 60.4% to 66.4%, with women's entry accounting for the bulk of this increase [11] [12]. Similar trends played out in many Western European countries, where rising female employment and expansion of white-collar sectors drove participation upwards (albeit often starting from lower levels than the U.S.). Japan likewise saw high labor demand during its postwar economic miracle, maintaining low unemployment even as its population grew. In essence, the mid-20th century was a time when technological advancements (e.g. industrial automation on factory floors) coincided with **broad-based economic growth that generated new jobs in manufacturing, construction, and burgeoning service industries**. Real wages rose in tandem with productivity, and labor's share of national income remained comparatively stable during this period.

However, even in these boom years, technology began to reshape the job landscape. Mechanization and productivity improvements in agriculture dramatically reduced farm employment as a share of the workforce (freeing up labor for industry and services). In manufacturing, **automation** through mechanized assembly lines and early computers increased output per worker, but the expanding postwar consumer economy absorbed displaced factory workers into new roles. The orthodox economic narrative solidified: productivity growth would *increase* labor demand by fueling higher incomes, which in turn created demand for more goods, services, and jobs – a virtuous circle. Policymakers largely saw technology as complementary to labor, not a substitute, during this era. This view seemed to be validated by the conditions of the time: strong unions bargained for a share of productivity gains, real **median wages rose**, and the income of a broad middle class grew steadily through the 1950s and 1960s [13] [14] .

**Turning Point: Stagnation and Divergence (1980s–2000s)**

Around the 1970s and 1980s, the landscape began to change. A confluence of factors – oil shocks and stagflation, globalization, the spread of computers, and policy shifts – led to **slower growth in labor demand** relative to supply. In the United States, labor force participation continued to edge up through the 1980s and 1990s (largely due to women and Baby Boomers), but **by 2000 it hit a plateau and then began to decline** [9] . The overall U.S. participation rate fell from its 67.3% peak in 2000 down to the low 60s in recent years [9] . Notably, **prime-age male participation had been sliding for decades** – U.S. men's participation dropped from 86.7% in 1948 to about 73% by 2005 [15] , and stands at roughly 67–68% today [10] – reflecting the long-run exit of men from the labor force as manufacturing jobs dried up and some failed to transition to other work. In Western Europe and Japan, labor force trends differed due to demographic and cultural factors (for instance, European female participation increased later and more gradually, and Japan's population began aging earlier). But many advanced economies shared a common outcome by the late 1990s and 2000s: **employment growth no longer kept pace with population growth**, leading to either rising inactivity or higher unemployment, especially for less-skilled workers. In other words, the demand for labor was no longer automatically absorbing all available supply as it had in the postwar boom.

One stark indicator is the **employment-to-population ratio** for prime working-age adults. In the U.S., the employment rate for workers aged 25–54 climbed to around 81% in 2000, then fell markedly after 2000 and again after the 2008 financial crisis, only returning to roughly 80% by the late 2010s. Other developed nations similarly saw **jobless recoveries** after recessions in the early 1990s, 2000s, and 2010s – periods where output (GDP) recovered but employment lagged, suggesting that firms were meeting renewed demand through productivity/automation gains or offshoring rather than rehiring workers. This phenomenon contributed to what many economists described as **structural unemployment** or underemployment: even when jobs were available, they were often not in the same sectors or locations as the workers who had lost jobs, nor of the same quality.

Most crucially, **real wage growth for the typical worker slowed dramatically after the 1970s**. In the United States, the postwar linkage between productivity gains and wage gains broke down. From 1979 to 2019, net productivity (output per hour) in the U.S. nonfarm business sector rose by roughly 70%, yet **the inflation-adjusted hourly compensation of a typical worker rose by only about 12–15% in the same 40-year period** [16] . Earlier data show that between **1973 and 2013, productivity grew ~74% while the average worker's hourly pay rose just 9%**, barely budging in real terms [16] . This well-documented *productivity–pay gap* [17] [18] illustrates that overall economic growth did not translate into broadly shared wage growth as it once did. A number of explanations have been offered – from globalization and

weakened unions to policy choices – but a significant part of the story is **technological change** altering the demand for different types of labor. We will explore this in depth, but the broad pattern is clear: **real median wages have essentially stagnated in many advanced economies since around 1980**, even as GDP and productivity continued to rise. Western Europe saw a similar divergence in some countries (though generally less extreme than in the U.S.), with wage growth for middle and lower earners slowing and inequality rising. Japan experienced literal wage decline – average real wages in Japan in the 2010s were lower than in the 1990s – amidst decades of sluggish growth and extensive automation in manufacturing.

Another fundamental trend is the **decline in labor's share of national income**. The labor share (the portion of GDP paid out as wages, salaries, and labor compensation as opposed to capital income) was once thought to be relatively constant, but since the 1980s it has fallen in many countries [7]. **Globally, the labor share has "significantly declined since the early 1980s,"** as documented by Karabarbounis and Neiman (2014), who find the decline occurring in "the large majority of countries and industries" [7]. In the United States, labor's share of GDP dropped several percentage points in recent decades, reaching historically low levels by the 2010s [7]. For example, one study notes that the U.S. labor share fell sharply after 2000, and **by the mid-2010s it was several points lower than in the 1970s**, reflecting trillions of dollars that shifted from wages to profits. Many European countries have seen similar declines in labor share since the 1980s [7] [19]. In Australia, the trend has been especially pronounced in recent years – by 2022 the **share of GDP going to employees in Australia hit a record low (around 44%), while the share going to corporate profits hit a record high (~30%)** [20]. This inverse movement of labor and capital shares is a strong indication that **workers are capturing a smaller portion of the economic pie** than they used to, with capital owners taking more [6]. Crucially, research has tied roughly half of the global labor share decline to technology: cheaper capital (e.g. information technology and automation equipment) has induced firms to **substitute machines for workers**, thus shifting income away from labor [21]. One landmark study found that the *falling price of investment goods* (computers, software, robots, etc., made cheaper by tech progress) explains about 50% of the labor share decline, as businesses found it economical to **"shift away from labor and toward capital."** [22] This dynamic directly links the adoption of new technology to the erosion of labor's overall claim on output.

In summary, by the early 21st century, **developed economies had entered a regime where labor demand was no longer keeping up with labor supply**, and where the gains from economic growth were increasingly accruing to capital and a small segment of high-skilled labor rather than the broad workforce. The historical data on participation, wages, and income distribution all reflect this shift. The next sections will drill down into how *technology and automation* have been at the center of these transformations – altering the structure of employment and enabling outcomes that diverge from the earlier mid-century pattern in which rising tides lifted all boats.

## Technological Waves and Occupational Shifts: From Factory Floor to Office and Beyond

Technology's impact on labor is perhaps most vividly seen in **occupational shifts** – certain job categories shrink or disappear while others grow. Since 1950, developed economies have undergone several major waves of technological change, each affecting different segments of the workforce:

- **Mechanical Automation and Factory Productivity (1950s–1970s):** Widespread adoption of automatic machinery, industrial robots (beginning in the 1960s), and improved industrial processes

boosted manufacturing output but gradually reduced the number of workers needed on the factory floor. Industrial employment initially grew in absolute terms (peaking in many countries around the 1970s) but began to decline as productivity gains outpaced demand growth.

- **Computerization and the Digital Revolution (1980s–2000s):** The introduction of computers, software, and the internet automated many routine tasks, not only in manufacturing but in offices and service industries. This era saw **middle-skill "routine" jobs** – typified by assembly line work, clerical and administrative roles, and repetitive service tasks – come under pressure. Many manufacturing production jobs were offshored or replaced by robots, while clerical tasks (filing, typing, bookkeeping) were increasingly handled by computer programs.

- **Advanced Automation and AI (2010s–present):** Recent advances in machine learning, robotics, and AI now threaten tasks that were previously considered safe, including many white-collar and professional duties. Technologies like *robotic process automation (RPA)* can handle back-office processes, and *generative AI* can produce human-like text, potentially affecting fields from customer service to journalism and software coding. This wave is still unfolding, but early signs show companies using AI to streamline roles in ways that could significantly reduce demand for certain skilled workers.

Let us examine some key occupational impacts in detail.

**The Decline of Manufacturing Employment**

Nothing illustrates the impact of automation on labor demand better than the fate of manufacturing employment in advanced economies. In the mid-20th century, manufacturing was a dominant source of jobs for workers without college degrees. In 1950, roughly **30% of all jobs in the United States were in manufacturing** [23]. This was mirrored in other industrialized nations: manufacturing comprised a large share of employment in postwar Western Europe and Japan as well. However, over the decades, technology radically increased manufacturing productivity, meaning far fewer workers were needed to produce the same output.

By the early 21st century, manufacturing employment had plummeted. In the U.S., manufacturing fell to **only about 8% of total employment by 2023** – an all-time low in modern records [13]. **Figure 1** below illustrates this dramatic long-term decline in the U.S.: from about one-third of the workforce in the 1950s–60s down to roughly one-twelfth today [13]. Other advanced economies saw similar trends. For example, the United Kingdom went from around 25% of workers in manufacturing in the 1970s to under 8% by the 2010s. Even Germany – often noted for its strong industrial base – has seen manufacturing's employment share fall significantly from postwar highs. Japan's manufacturing employment peaked in the 1990s and has since declined both in share and absolute terms (exacerbated by an aging population).

*Figure 1: Manufacturing's share of total employment in the United States, 1939–2023. The sector's employment share fell from about 30% in the 1950s–60s to just 8.3% by mid-2023, reflecting the impact of automation, productivity gains, and offshoring on industrial jobs [13]. Similar declines in manufacturing employment share have occurred across advanced economies.*

The reasons for manufacturing job loss are multifaceted – globalization (offshoring production to lower-wage countries) played a role, as did economic shifts to services – but **automation was a key driver**.

Industrial robots and computer-controlled machinery took over tasks on assembly lines that used to require many pairs of hands. For instance, automobile factories that once employed tens of thousands now produce even more cars with only a few thousand workers overseeing robotic systems. One telling statistic: U.S. manufacturing output (real value-added) in 2019 was higher than in 1990, yet the sector employed **about 7 million fewer workers** than it did in 1990 [24]. This suggests that *productivity gains, largely enabled by automation and better technology, allowed more output with far less labor.* Academic studies confirm this, finding that the introduction of industrial robots has had sizable negative effects on manufacturing employment and wages in local labor markets exposed to these robots [2]. In the aggregate, the shift is clear – manufacturing is no longer the mass employer it once was, even though societies still consume manufactured goods in large quantities.

For the workers affected, this transition was painful. Many **displaced manufacturing workers** (often mid-skill roles with decent pay) struggled to find equally well-paying work elsewhere. Some transitioned into lower-paying service jobs, others left the workforce entirely or faced long-term unemployment. As manufacturing receded, the jobs that grew were disproportionately in services – but not all services are equal, as we'll explore. Notably, **manufacturing's decline disproportionately hurt workers without college degrees**, contributing to a widening wage gap based on education. It also weakened labor unions (which had been strongest in manufacturing sectors), thus reducing collective bargaining power in the economy as a whole. We will later see how these changes tie into labor's declining share of income and bargaining power.

**Automation of Routine Office and Administrative Work**

If factories were the first front in the automation story, offices were the second. Starting in the 1980s, the spread of personal computers, database software, and eventually the internet enabled the **automation of many routine clerical and administrative tasks**. Jobs that involved processing information, maintaining records, or performing repetitive calculations were ripe for computerization. Over time, roles such as typists, switchboard operators, filing clerks, bank tellers, travel agents, and many secretaries saw sharp declines. For example, the number of **secretaries and administrative assistants** in the U.S. workforce fell significantly as executives and professionals began doing their own typing/email and as office management software handled scheduling and record-keeping. Many back-office functions in banking, insurance, and government were streamlined through software, reducing the need for clerks.

Empirical data bear this out. A recent analysis by the Federal Reserve Bank of Cleveland highlights that from **1980 through 2015, the share of clerical jobs (office and administrative support roles) in the U.S. workforce declined substantially** [25]. Importantly, this decline was *uneven across regions*: it was much **steeper in large, high-tech cities** (which adopted information and communication technologies faster) than in smaller cities [25]. In high-cost metropolitan areas like New York or San Francisco, the share of workers in clerical occupations dropped by about 6.5 percentage points between 1980 and 2015, whereas in smaller, less tech-driven locales the drop was around 2.3 percentage points [25]. Essentially, **as businesses embraced personal computers, spreadsheets, and later the internet, they eliminated many support roles** – especially in the most technologically progressive firms and cities. The remaining administrative workers in big cities increasingly needed higher skills (often a college degree) and took on more complex tasks complementary to professionals, as simpler duties were taken over by software [25] [26].

More recent data shows that this trend continued into the 2010s and accelerated with new automation tools. **Across all office and administrative support occupations, the U.S. lost over 2 million jobs**

**between 2016 and 2021** [27]. Financial clerks (e.g. bookkeeping, payroll, accounts clerks) and secretaries/ administrative assistants were hit especially hard, shrinking 10.3% and 8.7% respectively in just a five-year span [27]. This coincides with the deployment of *robotic process automation (RPA)* in many companies – software "bots" that can perform data entry, invoice processing, and other routine digital tasks – as well as the continued improvements in standard enterprise software that reduce clerical workloads. The Conference Board attributes these rapid recent declines to **automation replacing specific tasks**: for instance, secretaries' traditional duties in scheduling meetings, making travel arrangements, and managing paper files have largely been supplanted by integrated calendar apps, online booking systems, and digital document management [28]. Similarly, **financial clerks** who once manually recorded transactions or processed forms have seen those tasks "optimized through automated integrated bookkeeping systems" [29]. In short, many traditional *white-collar support jobs have been disappearing*, their functions absorbed by technology.

This shift has contributed to the phenomenon of **job polarization**: the labor market's middle rungs (both blue-collar manufacturing and white-collar clerical roles that offered middle-class wages) have hollowed out, while growth has concentrated at the high-skill/high-pay top and the low-skill/low-pay bottom [30] [31]. Professionals like managers, engineers, and computer scientists (whose jobs are *complemented* by technology) have generally thrived, as have low-end service workers (whose jobs are *insulated* from automation but often pay poorly, such as food servers, home health aides, janitors). The ones in between – factory workers, administrative assistants, sales clerks, etc. performing routine tasks – have borne the brunt of automation-driven displacement.

It's worth noting that technology doesn't always directly eliminate jobs one-for-one; sometimes it changes the **composition of tasks within jobs**. For example, an administrative assistant today might handle more complex responsibilities (like project coordination) than a 1980s secretary did, because the simpler tasks (typing letters, maintaining physical files) are done by computers. In many cases, though, organizations simply require **fewer people** in support roles than before. A telling comparison can be made: Large corporations in the past had floors of clerks and typing pools; today, a much leaner administrative staff supports a given number of executives, thanks to digital tools. This "labor-saving" aspect of office technology has clearly weakened demand for those workers who historically filled these occupations.

**The Rise of Service and Knowledge Work – but Not Always Good Jobs**

As manufacturing and routine office jobs declined, the sectors that expanded were mainly **services** – but with a dichotomy. On one hand, **knowledge-intensive services** grew: industries like finance, consulting, software, education, and healthcare added many jobs, including highly skilled roles (financial analysts, software developers, medical professionals) that are often well-paid. On the other hand, **lower-skilled services** also grew rapidly: retail, hospitality, food service, cleaning, caregiving, and other person-to-person services proliferated, often offering precarious employment and low wages. This bifurcation again reflects technology's influence. High-skill service jobs typically involve non-routine cognitive tasks that computers historically couldn't automate (though AI is now encroaching on some). Low-skill service jobs often involve manual or interpersonal tasks (cleaning a hotel room, taking care of an elderly person, serving food) that, despite advances in robotics, remain difficult to automate at scale. Middle-skill jobs, by contrast, often involved routine procedures that machines handle well – hence their decline.

One striking milestone underscoring this shift: in the United States, **by 2008 employment in the leisure and hospitality sector (restaurants, hotels, etc.) surpassed employment in manufacturing** [32]. This

symbolic crossover represented a substitution of traditionally lower-wage service jobs for what used to be higher-wage factory jobs. And indeed, the workers themselves often had to make that switch – displaced manufacturing workers frequently ended up in service roles. The **consequence for wages was severe**: the average worker in leisure and hospitality earns *58% less* than the average manufacturing worker in the U.S., as of recent data [32]. Thus, when someone loses a manufacturing job and takes a job at a restaurant or hotel, they suffer a steep drop in income on average [32]. This dynamic has been a major contributor to regional economic distress (e.g., in former industrial towns) and to the stagnation of incomes for workers without higher education.

Meanwhile, the growth of "knowledge economy" jobs has benefited those with higher education and specialized skills. Sectors like tech and finance expanded with the help of technology (they create and use the latest tech) and have been able to pay premium salaries. However, even in some of these sectors, **automation is now making inroads**. For example, algorithmic trading reduced the need for as many traders in finance; automated coding tools can make software engineers more productive (potentially reducing the total number needed for a project); and AI-driven diagnostic tools are beginning to assist (though not yet replace) professionals in law and medicine. Until recently, the consensus was that high-education jobs were *complemented* by technology (making those workers more productive and thus increasing demand for them), whereas only low/medium-skill jobs were substituted. But as AI grows more sophisticated, *even some high-skill jobs have parts that can be automated*.

Nonetheless, the dominant story of the late 20th century was a **shift from goods-producing to service-providing employment**, and within services, a polarization between high-wage and low-wage work. **Job polarization** has been documented in the U.S. and across numerous European economies [31] [33]. For example, a study by MIT economist David Autor found that in the U.S., from 1979 to 2012, employment in middle-wage occupations fell significantly as a share of total jobs, while low-wage and high-wage occupations increased their shares [34] [31]. The driving factor identified is *routine task automation*: jobs heavy in routine manual or cognitive tasks (which were prevalent in manufacturing, clerical, and sales) saw employment contractions, whereas jobs requiring either high-level problem solving or physical presence and dexterity (personal services) grew [34] [35]. European research similarly points to technology (along with globalization) as key in reducing mid-level jobs like craftspeople, machine operators, and clerical workers [36] [37].

In sum, successive waves of technology have continually reshaped the occupational structure: first replacing many blue-collar jobs, then automating white-collar routine work, and now encroaching further into skilled domains. Each wave has tended to **shift labor demand downward (toward lower-paid jobs) or upward (toward a smaller number of very high-paid jobs), but has hollowed out the middle**. This has far-reaching implications for wages and inequality, which we will discuss later in the context of labor's bargaining power and job quality.

Before that, we turn to another critical aspect of the modern economy that ties technology to labor outcomes: the emergence of *"superstar firms"* and the decoupling of corporate success from employment.

# The Rise of Superstar Firms and the Decoupling of Employment from Output

One of the paradoxes of today's economy is that we see **companies reaching unprecedented size and profitability, yet employing relatively few people** compared to the industrial giants of the past. Advances in technology – particularly digital technology – have enabled firms to scale up revenues and market reach with far less labor input. This has led to the phenomenon of "superstar firms": highly productive, highly profitable companies that capture large market shares while employing a comparatively small workforce. The rise of such firms is both a *result* of technological dynamics and a *cause* of further shifts in labor's fortunes.

**High Output, Low Headcount: A New Corporate Model**

Consider this striking comparison: In 1979, General Motors (GM) – an icon of industrial capitalism – employed about **840,000 workers** and earned substantial profits (1979 was near GM's peak year) [38] [39]. Fast-forward to 2012: Google (now Alphabet), a leading tech company, had less than **5% of GM's workforce (around 38,000 employees)** yet generated **20% more in inflation-adjusted earnings than GM did at its peak** [40] [39]. In other words, Google was *more profitable* than GM had ever been, despite having a tiny fraction of the number of employees. This example encapsulates the stark decoupling of employment from corporate value in the modern era. GM's success in 1979 provided middle-class incomes to hundreds of thousands of families (and indirectly supported many more in supply chains and local communities). Google's success in 2012 (and even more so today) enriches its much smaller pool of employees and shareholders, with far fewer direct jobs created. One analysis framed it this way: GM in 1979 provided income to support an estimated 2.5 million people (workers and their families), whereas Google in 2012 supported perhaps 114,000 people by the same measure – **GM provided roughly 21 times more people with a decent living** than Google did, even though Google made more money [39].

This shift is not just about comparing two companies – it reflects a broad economy-wide trend. Research by economists David Autor and others finds that across many industries, especially since the 1980s, sales have become more concentrated in a small number of **"winner-takes-most" firms** [8]. These leading firms often have **higher productivity and profit margins but lower labor share** – they simply don't spend as much on wages relative to their output [8]. As a result, when they capture larger market share, the overall share of income going to labor in that industry falls [41]. Autor et al. (2020) document this pattern in the U.S. Economic Census data: **industries where concentration increased the most saw the largest declines in labor's share of value-added**, largely because output shifted to firms that operate at high productivity with fewer workers [42]. This "superstar firm" effect has been empirically linked to the aggregate drop in labor share in the U.S. and other countries [43] [37]. In plain terms, **today's leading companies can generate enormous revenues with a skeleton crew of workers, thanks to technology**, and as those companies account for a bigger slice of the economy, fewer overall workers reap the benefits of that output.

We can see this in concrete metrics like **revenue per employee**, which has skyrocketed in tech-driven sectors. For instance, Apple – the world's largest company by market capitalization – generated about $2.4 million in revenue per employee in 2024 [44]. Many other tech or finance firms routinely post six-figure or seven-figure revenues per employee. By contrast, large employers of the past (and present in traditional sectors) like automakers or retailers have revenue per employee in the low hundreds of thousands or even tens of thousands. This indicates that tech-rich firms require far less human labor to create value. In

extreme cases, some highly digital companies earn *millions of dollars per employee* (e.g. certain software firms or payment platforms), whereas labor-intensive businesses like hospitals or hospitality might earn only $50,000–$100,000 per employee. **Technology has enabled a small workforce to leverage software, automation, and intellectual property to serve millions of customers** – something not possible in older industries that needed a worker for every incremental unit of production or service.

Another aspect of superstar firms is their **market power and profit margins**. Leading tech firms often enjoy high markups and dominant platforms, which allow them to capture value without needing to add employees proportionally. For example, once software is written, distributing it to more customers doesn't require lots more workers – it's infinitely replicable at near-zero cost. This is fundamentally different from, say, manufacturing a car or serving a meal, which scales with labor. The consequence is that many of today's largest firms simply don't create mass employment the way industrial giants did in the mid-20th century. **Amazon** might be an exception in terms of headcount (it employs over a million, though many in low-wage fulfillment center roles), but companies like **Google, Facebook (Meta), Microsoft, Apple,** etc., employ on the order of tens or hundreds of thousands, not millions. Even outside tech, industries have consolidated: a few big box retail chains dominate instead of numerous small shops, employing fewer people per dollar of sales through efficiencies and centralized distribution.

The **macro-level implication** of these changes is a further weakening of labor's position. In an economy dominated by a few mega-firms, workers have fewer employers to bargain with (potentially depressing competition for labor). And if those firms operate at high productivity with relatively lean staffing, overall *labor demand is reduced*. A recent OECD working paper noted that countries with falling labor shares have witnessed both **declines at the technological frontier (leading firms reducing labor share) *and* a reallocation of market share toward these low-labor-share "winner takes most" firms** [37] [45]. This suggests that technological dynamism – the ability of top firms to out-produce others with less labor – rather than just anti-competitive forces, has driven the trend [37]. In other words, it's not simply monopolistic behavior, but genuine tech-enabled efficiency, that is concentrating output. However, from the perspective of workers, the result is similar: **fewer jobs created per unit of output, and a smaller slice of income going to wages**.

To illustrate, if we imagine a simplified scenario: In 1970, 10 companies each employ 10,000 workers and each has 10% of an industry output. In 2020, perhaps 2 superstar companies have 80% of the industry between them, each employing 15,000 workers, and a few niche firms have the rest. Industry output might have doubled, but total industry employment might have fallen. Productivity per firm soared, profits soared, but jobs are lost. This is essentially what has happened in many sectors (though simplified). The economy can grow (due to high productivity firms) without a proportional increase in workers or wages – a stark break from assumptions of earlier decades that GDP growth and job growth go hand in hand.

It's important to note that **technology both enables and reinforces this concentration**. Superior technology gives an edge (better product or lower cost), leading to higher market share for the leader; with scale, that firm can invest even more in technology, creating a widening gap. Smaller competitors either go niche or disappear, often leading to layoffs or lower wages in those firms. This virtuous (for the firm) or vicious (for the worker) cycle means the spoils of innovation are not evenly distributed.

In summary, the **"superstar firm" economy is one where technology amplifies the reach of a small labor force to generate outsized output**, contributing to a decoupling between the fortunes of companies (or the stock market) and the condition of the average worker. This trend dovetails with the falling labor

share and rising capital share discussed earlier: as superstar firms account for more of GDP and inherently have a low labor share, the aggregate labor share drops [41] [43]. It also helps explain how we can have booming profits and GDP alongside tepid wage growth and fewer good jobs: the gains of tech-driven growth are concentrated in a narrow segment of the economy – the owners of capital and a relatively small cadre of highly-skilled workers who run those tech engines.

We will next examine specific case studies of how recent **automation technologies** have directly displaced jobs, as well as how the balance of job creation versus destruction is playing out in the current era of AI. These cases will put a finer point on the macro trends by looking at concrete instances of labor being supplanted by machines or algorithms.

## Automation in Action: Case Studies from RPA to Generative AI

Thus far, we have discussed broad patterns and historical shifts. Here, we focus on concrete case studies of **automation technologies** and their observed or expected effects on labor in developed economies. These examples illustrate the mechanisms by which technology can erode labor demand in specific contexts:

**Robotic Process Automation (RPA) in Business Operations**

One of the less visible but widespread automation trends of the past decade has been the adoption of **Robotic Process Automation (RPA)** in corporate back offices. RPA involves software "bots" that perform repetitive, rules-based tasks across computer systems – essentially a digital workforce handling things like data entry, invoice processing, payroll, customer account updates, and other standardized workflows. Many large organizations (banks, insurance companies, telecom firms, government agencies) have implemented RPA to increase efficiency in their operations departments.

The **consequence for employment** in those functions is a reduction in the need for human clerks and support staff. For example, a bank that installs RPA for loan processing can handle a higher volume of loan applications with fewer loan officers or processors. While companies often claim they redeploy workers to higher-value activities, the net effect is frequently hiring less than they otherwise would, or allowing attrition to shrink the workforce. A cited case: **Deutsche Bank** introduced RPA in areas like compliance and transaction processing and reported automating 30–70% of certain tasks where the software was applied [46]. While the bank publicly projected that robots would "complement" humans rather than outright replace them, reports suggested plans to reduce headcount substantially after automation – one 2017 report indicated Deutsche Bank's then-CEO envisioned cutting **around 10,000 jobs** as part of automation and cost-saving efforts (nearly one in five staff at the time) [47]. This underscores that even if companies avoid using the word "layoffs," the intention of RPA is clearly to **reduce labor requirements** in routine office jobs.

Across the banking industry broadly, analysts have predicted large job impacts from automation. A Citibank analysis in 2016 made headlines by estimating that **about 30% of banking jobs could be eliminated by 2025 due to automation** of retail banking and other functions [48]. They dubbed it "Banking's Uber Moment" – suggesting a disruptive change where digital apps, ATMs, and AI-driven systems replace much human labor in branches and call centers [49]. Front-line bank tellers and office support roles were expected to bear the brunt as customers move to mobile banking and banks use automated software for everything from fraud detection to loan underwriting. Indeed, since the mid-2010s, many large banks have steadily reduced their branch networks and staff, while investing heavily in fintech. While new tech-related jobs have

been created (data analysts, compliance specialists, etc.), the net effect is that **fewer total employees are needed to service the same number of customers**. As one article summarized, "Automation has many industries concerned – and now there's a target painted on bank workers' backs," noting the forecast of **~1 in 3 bank jobs potentially being cut** as people hand tasks to machines [50] [49].

Beyond banking, **RPA is used in insurance (claims processing), telecommunications (customer account management), healthcare administration (billing and records), and more**. Everywhere it's applied, it tends to substitute for lower to mid-skill office work. One study on the consequences of RPA in knowledge work noted that when back-office tasks in finance were first automated, it involved things like moving data between systems, processing invoices, etc., which clearly reduced the need for staff to do those manual electronic tasks [51]. As RPA technology matures, its capabilities expand (especially when combined with AI for semi-structured tasks), encroaching further into what previously required a human decision.

Importantly, RPA and similar automation often do not grab headlines the way factory robots do, because the changes happen behind the scenes. But the aggregate impact is visible in the **occupational employment statistics we saw earlier (millions of office/support jobs vanishing)** [27]. It's also reflected in corporate language around "digital transformation" and "efficiency gains" – euphemisms that often entail doing more with fewer employees. Consulting firms promoting RPA frequently cite cost savings and headcount reduction as benefits, even if the official line is that workers will be "freed to focus on higher-value tasks" [52] [53]. The reality on the ground is that many workers see their roles eliminated or significantly changed. This pattern will likely continue as RPA adoption grows; indeed, a **2023 survey by IBM found that 30% of back-office roles could be replaced by AI and automation in just five years** at that company [54]. IBM's CEO announced a pause in hiring for certain support positions and projected roughly **7,800 jobs could be replaced by AI** in the near term, particularly in HR and other non-customer-facing functions [55]. This is a concrete example of a major employer explicitly planning around the assumption that automation will allow them to operate with significantly fewer people in certain departments.

**AI and Generative AI: A New Wave of White-Collar Automation**

If RPA represents the incremental automation of routine digital tasks, the advent of **AI – especially "generative" AI like large language models (e.g. GPT-4) – signals a more profound potential substitution for human labor**, including in cognitive and creative domains. In the past few years, AI systems have demonstrated the ability to draft emails and reports, write computer code, create marketing copy, analyze and summarize documents, generate graphics, and even advise on strategy (albeit with varying reliability). This has led to growing expectations (and fears) that **many knowledge workers could have their jobs significantly changed or even displaced by AI in the coming decade**.

Early signs of this are emerging. In mid-2023, the CEO of IBM mentioned above took action by **freezing hiring for roles like HR specialists**, precisely because those jobs involve relatively structured tasks (processing paperwork, basic queries) that AI could handle [54]. He estimated that about **30% of such roles could be automated within 5 years** – implying thousands of positions the company would no longer need to fill [54]. IBM's move made headlines because it was one of the first large companies to publicly connect a hiring decision to AI's capabilities. But IBM is likely not alone. Surveys indicate many CEOs and executives are exploring how AI can improve efficiency, which often boils down to labor savings. For instance, in customer service, **AI chatbots** are rapidly being deployed to answer routine customer queries, reducing the need for large call center teams. Some companies have reported being able to handle a significant portion of customer interactions with AI, handing off to humans only the more complex issues.

The scale of AI's potential impact was highlighted by a 2023 analysis from Goldman Sachs, which estimated that **the equivalent of 300 million full-time jobs globally could be affected by generative AI** automation of tasks [56] . They projected that in the United States and Europe, AI could automate roughly one-fourth of current work tasks across all jobs [57] . While not all those tasks equate to job losses (some will augment workers rather than replace them), the figure underscores how broadly AI could change labor demand. The bank noted that legal, administrative, and engineering sectors are among those with high "exposure" to AI – meaning a high share of their tasks could be done by AI [57] . If these predictions hold even partially true, it suggests that tens of millions of jobs in advanced economies might be eliminated or significantly downgraded due to AI in the coming years.

Some concrete examples of where AI is already displacing work: **Media and content creation** – outlets like news websites experimented with AI-written articles (some, like CNET, had to pause due to accuracy issues, but the intent was fewer human writers needed). **Programming** – AI coding assistants (GitHub's Copilot, etc.) can generate code for routine functions, potentially reducing demand for junior software developers. **Graphic design and marketing** – AI image generators and copywriters can produce basic designs and ad text quickly, threatening entry-level roles in those fields. **Customer support** – AI systems can handle chat and email support queries, leading companies to scale back hiring of support agents. There have been anecdotal reports of companies laying off content moderation or customer service teams after implementing AI tools (though often they cite other reasons). Even in more specialized fields like law and consulting, AI can draft legal briefs or analyze data far faster than any paralegal or junior analyst, hinting at future staff reductions in those areas.

It is important to stress that **AI's impact is just beginning** – unlike manufacturing robots, which have been around for decades, generative AI only hit mainstream capability around 2022–2023. So the direct job losses attributable to it so far are limited. However, companies are clearly anticipating changes: A 2023 Bloomberg survey of executives found over 50% were planning to implement AI in ways that would likely result in reduced workforce needs. Already, in the tech sector itself, we saw major firms like Meta, Microsoft, and others announce layoffs in 2023 even as they increased investments in AI – suggesting a reorientation of staff and a belief that new AI tools could maintain output with fewer people.

One of the highest-profile early signals was the *Chegg* case: Chegg, an education technology company, warned that the emergence of ChatGPT was reducing student demand for its services; its stock plunged and it indicated it might need to pivot its business model – an indirect effect on employment (fewer tutors or support staff needed if students flock to free AI help). Similarly, the freelance market has been disrupted: clients who might hire a human copywriter or illustrator are now trying AI tools first. This could **hollow out gig-economy jobs** in content writing, design, translation, etc., which many people in advanced economies rely on for income.

The overall point is that **the latest automation wave driven by AI is moving beyond routine tasks into fields that were previously considered "safe" from automation** due to requiring human judgment or creativity. While AI is not yet at human-level general intelligence, it can perform a surprising variety of work-related tasks to a satisfactory degree. This raises the likelihood that **labor demand for many white-collar occupations will shrink**. The tech industry itself may ironically become less labor-intensive: for example, one tech CEO noted that with AI coding assistance, perhaps a smaller engineering team could accomplish the same product development, meaning companies won't need to hire as many programmers. Over time, if each skilled professional's productivity is greatly amplified by AI, employers might hire fewer of them (the

exact “lump of labor” outcome mainstream economists often dismiss, but which can hold in specific skill categories if technology does a large share of the work).

It must be noted that new technologies like AI also spur **new job categories** – for instance, “prompt engineering” or AI model training specialists – but these tend to be niche and require advanced skills, and are far fewer in number than the broad swath of jobs potentially affected. We will examine in the next section how the balance of job destruction vs. creation is playing out in aggregate.

Before moving on, let us briefly highlight that even **physical automation and AI in service sectors** is advancing. Examples include self-checkout kiosks in retail (reducing cashiers), autonomous vehicles in transportation (threatening driving jobs once fully realized), and warehouse robots (reducing manual picking labor). Amazon’s warehouses, for instance, use thousands of robots, which hasn’t stopped Amazon from hiring many workers but has meant each worker handles more output than they would without automation. Some retailers now run stores with primarily self-service and minimal staff (Amazon Go stores, etc.). Fast-food chains are piloting automated kitchens or ordering systems that could cut down on staff. These innovations are still in early adoption, but as costs fall and tech improves, they could lead to further labor displacement in sectors that employ large numbers of low-skill workers. This, combined with the white-collar automation discussed, presents a scenario where **both ends of the occupational spectrum face pressure** – potentially a recipe for much slower overall labor demand growth than population growth.

Having looked at specific technologies and cases, we now turn to the broader **dynamic of displacement versus creation**. Does technology create as many jobs as it destroys? Mainstream economics historically says yes, but emerging evidence suggests we may be in a new phase where that is no longer guaranteed.

## Displacement vs. Creation: Are New Jobs Keeping Pace with Automation?

A core question in the debate over technology and employment is whether the jobs eliminated by tech advances are offset (or exceeded) by new jobs created *because of* those advances. The traditional optimistic view, supported by historical anecdotes, is that technology may automate certain tasks but also creates new industries and demands for labor – from the weavers put out of work by mechanical looms eventually finding new occupations in textile design or retail, to switchboard operators replaced by automated dialing who might become customer service reps for the phone company, and so on. Indeed, it is often pointed out that many jobs in today’s economy (web developers, DNA lab technicians, digital marketers, etc.) **did not exist decades ago** – evidence of technology’s creative force. A recent study quantifying this found that about *60% of current jobs in the U.S. are in occupations that were newly created since 1940* [31]. That is an astounding figure, highlighting the dynamic churn of the labor market. In the long run, according to this narrative, **technology has been a net creator of jobs** [1] – even as it destroyed old occupations, it opened doors to new ones that absorbed the growing workforce.

However, as noted earlier, **there is growing evidence that this balance has tilted in recent decades toward net displacement**. MIT’s David Autor and colleagues conducted research separating job changes into those due to “automation” of tasks and those due to the creation of “new tasks” (augmentation). They found that *particularly since 1980, the rate of automation has outpaced the rate of new task creation in the U.S.* [34]. In other words, *technology has been replacing more jobs than it’s been generating* in the more recent period [34]. This aligns with the earlier observation of sluggish employment growth and the productivity-pay

divergence. Autor summarized the findings: “there does appear to be a faster rate of automation, and a slower rate of augmentation, in the last four decades (1980 to present) than in the four decades prior” [58]. They developed a methodology using historical census data and text analysis of patents to actually measure how many jobs were lost vs. created by tech changes over time – something that was previously hard to quantify. The results confirmed suspicions that many had: *the last few decades have not seen the same magnitude of new job creation as past technological leaps did* [59].

Acemoglu and Restrepo (2019) formalize this concept with the “task content of production” framework. In their framework, **automation** is defined as machines taking over tasks previously done by workers – this produces a *displacement effect* that **always reduces the labor share and can reduce total labor demand** [2]. The countervailing force is **the creation of new tasks in which labor has a comparative advantage** – a *reinstatement effect* that **increases labor demand and labor’s share** [60]. Historically, they note, the introduction of entirely new job categories (from automobile repairmen in the early 1900s to IT professionals in the late 20th century) has been crucial in keeping labor demand growing. But if the pace of new task creation slows while automation accelerates, the result can be stagnating or even declining net labor demand [61]. Their empirical analysis for the U.S. from the 1980s to 2016 suggests exactly that: *an acceleration in displacement (especially in manufacturing) and a weakening of new task creation, alongside slower productivity growth, account for the much slower employment growth of the last few decades* [61]. In plainer terms, *the economy has not been inventing new jobs fast enough to replace those lost to technology* in recent times.

Why might the recent period be different from, say, 100 years ago? One reason could be the nature of modern technology: **general-purpose digital technologies can be applied very broadly** across industries, automating a wide array of tasks all at once (especially as AI improves). By contrast, older technologies rolled out more gradually and often created whole new industries even as they displaced others. For example, the mechanization of agriculture in the early 20th century freed workers who then could go into manufacturing (which was booming at the same time). Manufacturing in turn eventually released workers who moved into services, which expanded with new roles. But now, we have technology simultaneously making inroads into manufacturing (robots), services (AI and software), and even creative fields. The *scope* of automation has widened, meaning **the pool of potentially affected jobs is enormous**. At the same time, it’s not obvious what the next “engine of job creation” is – we don’t see yet a huge new labor-intensive sector on the horizon that could absorb millions of workers (some point to the green economy or elder care, but those come with constraints or are often smaller scale).

Another factor is **globalization** and the “great doubling” of the global labor force after 1990 [62] [63]. While not a technology per se, globalization was enabled by technology (container shipping, telecommunications, the internet), and it created *effective labor abundance* that reduced incentives to create labor-saving technologies in some domains (why automate if you can offshore to cheap labor?) but increased the impact of labor-saving tech in advanced economies (since offshoring itself is a form of labor arbitrage or substitution). The integration of China, India, and the former Soviet bloc **doubled the available global workforce for multinational firms** [64] [63]. This huge increase in labor supply put downward pressure on wages and employment in tradable sectors in the West, akin to a massive labor-displacing shock (though in this case it “displaced” jobs to other countries rather than to machines). Some economists argue this labor glut and offshoring wave worked *in tandem* with automation – e.g., factories relocated overseas and also automated, a one-two punch for Western manufacturing workers.

Regardless, the outcome observed is that **labor markets in developed countries have experienced a sustained period of slack and wage suppression despite economic growth**, indicating demand for labor has not kept up with supply. **Labor force participation declines** (especially among men in prime age, and youth in some countries) are one symptom. For example, in the U.S., participation among prime-age men fell steadily over decades as mentioned, and even women's participation leveled off and declined slightly after 2000 [9] [10]. Many who left manufacturing or other declining sectors did not find new jobs easily and some exited the workforce altogether (an issue particularly acute in parts of the U.S. and UK, less so in some European social welfare states where policies differ). This stands in contrast to the mid-century period when, broadly speaking, if one sector shed workers, another was growing to absorb them (plus overall population was younger and labor demand was robust).

It's instructive to examine **net employment growth vs. population growth**. In the three decades from 1990 to 2020, the U.S. population grew by roughly 90 million (35%), but employment grew by only about 60 million (around 50%) – meaning the employment-to-population ratio actually declined after accounting for demographic composition (and aging doesn't fully explain it, as prime-age ratios fell too). Europe's population growth was slower, but many countries saw minimal net employment gains outside of boom/bust cycles, with unemployment remaining structurally high in some (e.g., much of the 1990s in continental Europe). Japan's population peaked in 2000s and its workforce shrank, but that masked underlying underemployment issues and was cushioned by a culture of keeping people employed often regardless of productivity. In short, **the trend across advanced economies has been that it's becoming harder to maintain full employment without slack** – a hallmark of insufficient labor demand.

The **job polarization effect** further complicates the picture: even if, say, 100 routine jobs are lost and 100 new non-routine jobs are created, if the new jobs are either very high-skill (few people qualify) or very low-wage (not attractive or sufficient), then matching workers to those jobs is problematic. This can result in simultaneous job vacancies *and* unemployment – a skills mismatch. That has been observed in some countries; for instance, unfilled vacancies in IT or nursing coexisting with unemployed manufacturing workers who lack the qualifications or means to transition.

Another issue is **geography**: Tech-driven job gains often concentrate in certain urban hubs (Silicon Valley, Seattle, London, etc.), whereas job losses from automation (like in manufacturing or clerical work) are more spread across different regions, including rural or small-town areas. This leads to regional disparities where some areas prosper and others decline, and workers cannot or do not all migrate to the booming areas (due to housing costs, community ties, etc.). Thus, even if on paper new jobs equal jobs lost, the distribution matters – and in many cases it has left pockets of high unemployment or dropout.

Now, it is important to address some **counterarguments and nuances**. Tech optimists would point out that unemployment in many countries reached very low levels by the late 2010s (e.g., the U.S. was at 3.5% unemployment in 2019, Germany around 3% in 2019, UK ~4%). Doesn't that indicate that, ultimately, jobs were created for those who wanted them? Superficially yes – but those low unemployment rates came after long expansions and with the help of other factors (like very low interest rates spurring demand). They also hide the labor force non-participation issue (people not counted in unemployment because they stopped looking). For instance, the U.S. in 2019 had low unemployment, but **labor force participation was ~63%, down significantly from 67% in 2000** [9], meaning a smaller share of the population was engaged in work. Many of those out of the labor force were less-educated men, a group heavily impacted by the disappearance of mid-skill jobs. If we included some measure of "discouraged workers," the picture would

be less rosy. Additionally, **underemployment** was prevalent – many were working part-time involuntarily or in jobs below their skill level.

We saw earlier that **94% of net job growth in the U.S. from 2005 to 2015 was in "alternative work arrangements" (gig, contract, temporary)** [4], not traditional permanent jobs. This means a lot of people ended up in more precarious positions. It's not a stretch to suggest that if automation had not advanced as much, perhaps more traditional jobs might have been available; instead the jobs that did appear were often less secure.

All this suggests that **the labor market absorption of technological disruption in recent times has been weaker than in the past**. The evidence indicates that we are in a phase where net creation of jobs from technology is slower. Indeed, **aggregate employment growth in advanced economies has been modest relative to GDP growth**, meaning more output with fewer workers – a sign of high productivity but also of labor-saving bias. Some economists refer to the current period as one of "jobless (or low-job) growth." For example, after the early 2000s recession, the U.S. took years to regain lost jobs even as output recovered ("jobless recovery"), and after 2008 it was a long slog as well – suggesting many tasks eliminated during the downturn were permanently automated or never rehired.

That said, **counterarguments** remain. One might argue that *new job creation is simply harder to measure or takes time to emerge*. For instance, the AI revolution might spawn entirely new industries we can't yet imagine (akin to how the internet eventually gave rise to e-commerce, social media jobs, etc.). It's true that forecasting future jobs is difficult – in 1900, nobody could foresee the rise of the IT sector, and in 1980 few would predict millions of people would make a living as software developers or web designers by 2010. There may well be jobs in, say, **renewable energy, AI maintenance, or biotech** that grow significantly. However, to absorb tens of millions of workers, those sectors would have to grow labor-intensive or at least neutral, which is not apparent yet (renewable energy is growing, but once built, solar farms don't need many workers; AI maintenance is itself a highly automated field; biotech can create jobs but often requires high skills).

Moreover, even when new categories arise, the key question is **the quality and remuneration of those jobs** compared to the ones lost. Recent history shows many new jobs (e.g., ride-share driver, warehouse fulfillment associate, content moderator) are relatively low paying or precarious, whereas many jobs lost (e.g., union factory jobs, stable office careers) provided better wages/benefits. So there is an asymmetry: technology may create jobs, but not necessarily *like-for-like replacements* in terms of income or stability. This contributes to inequality and a sense of insecurity among workers, even if they are technically "employed." We will delve into this in the next section on the qualitative aspects and distribution, but it's worth noting here that **the debate is not only about quantity of jobs but also their quality**.

To sum up, a growing body of research and data challenges the idea that technology will inevitably generate enough new employment to compensate for its displacement of workers. **Evidence from approximately 1980 onward shows an imbalance: significant automation-driven job losses and task elimination, with weaker compensatory job creation** [61] [58]. The result has been slower labor demand growth, manifested in phenomena like jobless recoveries, declining labor force participation, and the proliferation of low-wage work even in rich economies. This sets the stage for examining why conventional measures (like headline employment rates or GDP growth) might give a false sense of security, and why many workers feel left behind despite positive macro indicators.

In the next section, we will confront the **counterarguments and the "aggregate job growth" narrative** directly, and then explore how the changing nature of jobs – and an oversupply of labor – has favored capital over labor.

## Counterarguments and the Hidden Realities of Technological Impact

It is important to address the **counterarguments and mainstream perspectives** head-on, to understand where they come from and why they might be misleading or incomplete in the current context. The pro-technology orthodoxy often cites several points:

1. **Historical Resilience of Employment:** Despite waves of panic (the Luddites in 1811, automation fears in the 1960s, etc.), employment has kept growing over the long run. Today, more people are employed worldwide than ever, and standards of living are higher. The argument is that each innovation creates new opportunities – for example, the ATM did not destroy bank teller jobs as feared; instead, banks opened more branches and tellers shifted to customer service roles, and overall bank employment held up. Similarly, personal computers eliminated typing pools but created the IT industry with millions of jobs. The underlying faith is in human adaptability and the limitless nature of human wants – if productivity increases, we'll find new things for people to do.

2. **Low Unemployment and Job Creation Statistics:** In many developed countries, unemployment is at or near historical lows (bar disruptions like the COVID-19 pandemic). The U.S. pre-pandemic unemployment under 4% was touted as effectively "full employment." Even after massive technological change since the 1980s, most people who want jobs have them. Additionally, job openings in certain sectors (tech, healthcare) exceed qualified candidates, suggesting tech is creating a skills *shortage*, not surplus, in those areas. Proponents also point to the proliferation of *new job titles*: app developer, data scientist, social media manager – none of which existed a generation ago. This, they argue, demonstrates that technology is constantly spawning new lines of work.

3. **Productivity Gains and Consumer Benefits:** Higher productivity from technology leads to lower prices or new products, which means consumers have more disposable income to spend elsewhere, generating jobs in those other areas. For instance, cheaper automobiles due to factory automation freed consumer money which might be spent on tourism, creating jobs in hospitality. The aggregate effect is a richer society where people can afford more services – and services are often labor-intensive, thus boosting employment. This is essentially the classical economic argument of technological progress leading to a reallocation of labor to sectors where there is increased demand (sometimes called the *compensation effect* through lower prices, higher real incomes, etc.).

4. **Human Creativity and Complementarity:** Many experts believe that **humans will always find tasks to do that complement machines** – that AI and automation, rather than wholesale replacing us, will mostly augment our capabilities. They foresee a future of **"human-AI teams"** where AI does the routine grunt work and humans focus on creative, interpersonal, or complex analytical tasks that machines aren't good at. Thus, workers could become more productive (and presumably earn more) by leveraging AI, similar to how an accountant who uses Excel is far more productive than one using paper ledgers, but still remains employed doing accounting (just at a higher level). This line of

thinking suggests that new skills and roles will develop for humans in synergy with technology (for example, managing AI systems, providing the human touch in automated services, crafting creative strategies using AI outputs, etc.).

5. **Historical Wage Growth and Living Standards:** It's also argued that even if some wages stagnated, overall living standards have risen due to technology making goods and services cheaper/better. So while a factory worker's wage might not rise, they benefit from cheap electronics, longer lifespans (due to medical tech), and so on. In mainstream models, eventually wages should catch up with productivity – if they haven't, some say it's due to non-tech factors like globalization or policy, not an inherent tech issue.

Now, each of these points has validity in certain contexts or timeframes. But the **analysis in preceding sections reveals cracks in these optimistic narratives**:

- **Employment numbers vs. Quality:** Yes, unemployment was low in 2019, for example, but consider *what kinds of jobs people were in*. A large number were in low-wage, unstable jobs. The fact that someone is "employed" by gigging for Uber Eats 15 hours a week while wanting full-time work is not a success of technological progress; it's arguably a reflection of lack of better opportunities. As we noted, **94% of net new jobs from 2005–2015 were alternative work arrangements** (temp, gig, etc.) [4], a startling statistic that suggests the traditional job has given way to a more precarious model for many. Headline unemployment also ignores those *not actively looking*. In the U.S., prime-age male non-participation hit record highs; many of these men are not counted in unemployment but are effectively without work (some on disability, some just dropped out). There are sociological studies of these men ("Men Without Work") linking their loss of employment (due in part to automation and trade) to issues like opioid addiction and social decay. So **the low unemployment rate masked a lot of hidden unemployment or underemployment**. Europe similarly has underemployment (people wanting full-time but only getting part-time, etc.) and until recently higher official unemployment especially among youth in some countries – again partially a result of insufficient growth of good jobs.

- **New jobs exist, but how many and for whom?** Yes, there are app developers and data scientists now, but these are relatively small in number and require high education. The median worker cannot easily pivot to these roles. In the U.S., only about a third of adults have a bachelor's degree. Telling an unemployed factory or office worker in their 50s to learn coding and become a data scientist is not very realistic at scale. The *distributional aspect* is key: tech has been great for the highly skilled (who often enjoy wage premiums), but for the rest, it often means accepting lower-skilled service work. Some data even shows a **downgrading of educational job matches** – e.g., many college graduates now end up in jobs that historically did not require degrees (driving taxis, baristas), indicating a saturation of high-skill job openings relative to supply of educated workers. This can be partly due to credential creep, but also simply because the number of top-tier jobs is limited. Not everyone can be a software engineer or biomedical researcher; someone still ends up stocking shelves or cleaning, and if those are the only jobs growing for those without advanced degrees, then that's where they go, often with stagnant pay.

- **Productivity gains not translating to wages:** The mainstream would say productivity ultimately raises wages, but the **decoupling since the late 1970s refutes that** [17] [18]. If technology were truly benefiting labor broadly, we would see wages rising in line with productivity. Instead, we see a

divergence: productivity up, median wages flat, implying that productivity gains are being captured as profits or by top earners. This suggests that the complementarity story has broken down – technology is no longer broadly complementing the average worker; in many cases it's replacing or bypassing them. Even where workers use technology, the gains have been siphoned off (due to weakened bargaining power of labor, globalization, etc.). **So the mere presence of productivity growth does not ensure worker gains** – it matters who has the leverage to claim those gains. In recent decades, that has been capital owners and highly skilled specialists, not the median worker.

- **Adaptive possibility vs. speed of change:** Historically, labor markets did adjust, but often over generations. Farmers moved to cities over decades, not overnight. The industrial revolution caused enormous social upheaval and it took many decades and deliberate policies (and unrest) to reach a new equilibrium. Today, the pace of technological change is arguably faster and more pervasive. If AI in the next 10 years can truly perform a huge range of jobs, the question is can society adapt that quickly to create entire new avenues for tens of millions of displaced workers? The optimistic view assumes yes, but that's a gamble; we might instead see a long period of dislocation. Some economists warn that even if the long-run outcome is new job creation, the **transition could be very painful**, with a "lost generation" of workers who never find their footing.

- **Jobs numbers vs. hours and income:** Another subtle issue is that even if the number of people employed stays high, the *total hours of work* or *total compensation* might not. For example, two part-time gig jobs might replace one full-time job; employment count stays 2 vs 1 (so looks like more jobs), but total hours worked could be the same or less, and benefits/security are worse. If many are piecing together multiple gigs, we might double-count employment. In some countries, people hold multiple jobs to make ends meet – again, giving illusion of more jobs created. What really matters to living standards is total labor income going to the non-rich. We saw that **labor's share of income fell** [7], meaning even if jobs exist, the slice of economic pie going to workers (especially average workers) shrank. This is a critical concealed fact behind healthy employment rates – those jobs command a smaller share of output than before.

- **Sectoral shifts and hidden unemployment:** When manufacturing collapsed in the Rust Belt, the unemployment rate eventually went down – but partly because people left those regions or stopped looking or took much worse jobs. The distress is not captured by the neat unemployment figure. Similarly, rural and small-town decline across the U.K. or US is not captured by national employment stats – many left-behind places have low official unemployment because young people moved out or many are on disability. Thus, aggregate statistics can hide *geographical and demographic concentrated pain*.

- **Technology as one factor among many:** Mainstream arguments often attribute wage stagnation and inequality more to globalization or policy (decline of unions, eroded minimum wage, etc.) than to technology. Indeed, all these factors are intertwined. However, **technology facilitated globalization** (the container ship and the internet made offshoring feasible at scale), and technology contributed to union decline (e.g., automation reduced unionized factory jobs; also, the threat of automation can weaken unions' bargaining stance). So it's hard to cleanly separate causes. But increasingly, economists like Acemoglu have argued that the *direction of technological change itself* has been a choice that favored automation over creating labor-friendly innovations [2] [3]. For instance, in healthcare, we invested a lot in automating back-office billing (cutting clerical jobs) but relatively less in innovations that would make nurses or primary care more effective (and thus

increase demand for those roles). This argument posits that the **automation bias in R&D** (partly driven by tax incentives and cheap capital) skewed tech progress against labor.

Given these considerations, the **headline job numbers can be seen as concealing distributional and qualitative issues**. As noted, one key issue is **wage distribution**. Virtually all the income growth of the past decades went to the top 10% or even 1% of earners [65]. For example, between 1979 and 2013, real annual wages of the bottom 90% of U.S. workers rose only about 15%, whereas wages of the top 1% rose 138% [65]. This stark inequality correlates with technology since high earners are often those who can leverage technology (e.g., finance professionals using algorithms, superstar CEOs in tech, highly educated engineers) or those who control capital. Meanwhile, *low and middle earners saw very small gains* – in fact, when adjusting for inflation properly, many saw declines in real pay. In some countries like Germany, median wages were flat from 2000 to 2015 until very recently when they ticked up due to labor scarcity (and deliberate policy). In the UK, real wages in 2020 were roughly at 2007 levels – a "lost decade" of wage growth, partly due to a surge of labor supply from Eastern Europe and tech constraints on jobs. Japan's median wage is lower than in the 1990s. So the wage stagnation story is broad-based across advanced economies to varying degrees, not just a U.S. phenomenon (though the U.S. is an extreme case in inequality).

**Job quality degradation** is another hidden issue. A job is not just a job; factors like stability, benefits, working conditions, and potential for growth matter. Technological and organizational innovations (like just-in-time scheduling, gig platforms, etc.) have allowed companies to **shift to more flexible, on-demand labor models**. This often means less stable hours for workers, fewer benefits (since gig workers are contractors, not employees), and more risk shifted to workers (e.g., Uber drivers bear car depreciation, not Uber). So even if unemployment is low, if a large proportion of those jobs are unstable or dead-end, workers are worse off than in an era of plentiful stable jobs. Data shows declines in **union membership** – e.g., the U.S. went from ~20% unionized in 1983 to just 10% in 2022 [66] – which is one proxy for job quality, as union jobs tend to have better pay and benefits. Similarly, many European countries saw increased **labor market dualism**: a core of protected jobs and a growing periphery of temporary or part-time workers (especially among youth). For example, in Spain and Italy a huge share of young workers are on temporary contracts, which often lead nowhere. This dualism is partly a result of trying to increase flexibility (often justified by needing to adapt to technological or competitive change), but it has created a generation of under-employed youth. So looking at just employment rates misses that story.

Furthermore, **multiple jobholding** has increased in some places. If one person has two jobs, that counts as two in job statistics but is still one person working more to compensate for low wages. And multiple jobholding often is indicative of not earning enough from one job, which speaks to wage issues.

Lastly, consider **working hours and precarity**: In some countries like the US, average hours for full-time workers haven't dropped (Americans work about as much or more than decades ago), whereas technology was supposed to make life easier. The gains have instead been channeled into more output or profit, not more leisure for all. In countries like Germany or France, work hours have reduced somewhat (due to policy choices like more vacation, or partial employment for more people), but they still have persistent unemployment or underemployment for youth historically.

The **bargaining power** of labor is a crucial underlying theme here and is the focus of our next section. But clearly, a surplus of labor – whether from population growth, globalization, or automation – **weakens workers' ability to demand higher pay or better conditions**. Companies can point to automation or

offshoring as alternatives if workers push too hard: e.g., threatening to automate a plant if the union doesn't agree to wage cuts, or to move production abroad. This dynamic has played out repeatedly. For instance, during contract negotiations, it's not uncommon to hear, "if labor becomes too expensive, we'll invest in machines to do this." Whether the threat is real or bluff, it places a ceiling on what workers feel they can ask for.

Therefore, even without mass unemployment, technology can exert **downward pressure on wages – a phenomenon some call the "threat effect" of automation**. Just as a high unemployment rate disciplines workers (they fear being easily replaced), so does the credible threat of being replaced by a machine or software. It's been argued that this is one reason why despite low unemployment in late 2010s, wage growth remained relatively subdued in some countries – because globalization and automation still loomed as alternatives, keeping workers cautious and employers confident they didn't need to raise pay much.

In conclusion of this section, while the mainstream arguments highlight real positive aspects of technology, they often ignore the distribution and power dimensions. Aggregate job and output figures might look fine, but underneath lies a story of many workers getting a smaller slice of the pie and facing more job instability. The "average" outcomes can mask severe disparities. As Nobel laureate economist Joseph Stiglitz put it, we've been growing, but *who* benefits from growth is the question – and recently it's been skewed. Technology has played a role in that skewing by favoring certain skills and eroding others.

Having examined these hidden realities, we now turn explicitly to the question of **labor gluts and bargaining power**: how an excess supply of labor, whether naturally through demographics or artificially through automation, tilts the balance in favor of capital and what evidence we have for this dynamic in developed economies.

## Labor Gluts and the Erosion of Worker Bargaining Power

When the supply of labor exceeds the demand for labor, workers as a whole are in a weaker position to negotiate wages and benefits. This basic principle of economics – surplus supply leads to lower price (in this case, the price of labor, i.e., wages) – has manifested in various ways in developed economies, and technology has been a significant contributing factor to creating an effective **"labor glut."** This glut can be *natural* (demographic or policy-driven increases in labor supply) or *"synthetic"* via automation (machines augmenting or replacing labor, effectively expanding labor supply or reducing labor needs). Both have been at play in recent decades.

**Demographic and Global Labor Surplus**

In the postwar decades, many developed countries actually experienced tight labor markets at times – which empowered unions and led to strong wage growth. But starting around the 1980s, two things occurred: - **Demographic shifts**: The Baby Boomers fully entered the workforce by the 1970s-80s, swelling the labor supply. Women's participation soared, as discussed, adding millions of workers by the 1990s [67] [12]. This dramatic increase in labor supply (in the US and many Western countries) put downward pressure on wages absent a commensurate increase in labor demand. In earlier times, strong industrial growth absorbed these workers, but by the late 20th century, with manufacturing shrinking and service growth not keeping pace in quality, the effect was more competition for jobs. Some economists argue that the large influx of women into paid work, while a positive societal development, might have contributed to wage stagnation because it eased labor shortages that might have forced employers to pay more. (Of course, it

also increased overall household incomes since more people were working, but individual wages faced pressure.)

- **Globalization's Great Doubling**: Perhaps even more consequential was the entry of **China, India, and ex-Soviet bloc** into the global capitalist economy by the 1990s. Harvard economist Richard Freeman famously called this the "Great Doubling" of the world's labor force [64] [63]. All of a sudden, Western corporations had access to billions of additional workers – many of them eager to work at a fraction of the wage of Western workers. This created a global labor glut in tradable sectors. The immediate impact was offshoring of jobs (so Western workers lost jobs to equally capable but cheaper labor abroad), and the longer-term impact was a threat effect: even jobs that stayed domestic were under the shadow that they *could* be offshored or the products imported. This drastically weakened unions and workers' leverage. For instance, in manufacturing and even some service industries (like call centers, IT support), employers could credibly say, "If you demand higher pay, we will move this operation to Asia or Eastern Europe." Often they did move anyway. The result was that **workers lost bargaining power because their employer now had alternative labor sources globally**. This was a huge shift from the mid-20th century when, for example, an American auto company's alternative to Detroit labor was limited (they more or less had to produce in America to sell in America). By the 2000s, that company could produce in Mexico or China and ship back, or source parts globally – and they did.

The combination of these factors meant that by the 2000s, **labor was relatively abundant on a global scale**. The effect on wages was observable: real wages for lower-skill jobs either stagnated or declined in many rich countries, especially in sectors exposed to trade. A study of trade impact on U.S. manufacturing (Autor, Dorn, Hanson 2013) found significant job losses and wage depression in regions exposed to Chinese import competition – essentially showing labor in those areas faced an oversupply on a global stage and lost out.

Now, these *natural* surpluses were not caused by automation per se, but they set the stage such that **when automation came in, workers were already on the back foot**. There was not a tight labor market forcing firms to share productivity gains; rather, there was slack or the ability to tap cheaper labor, so firms had every incentive to keep cutting labor costs – either through outsourcing or investing in technology to replace workers. Automation can be seen as part of the toolbox companies had to reduce reliance on (expensive) domestic labor.

**Automation as "Synthetic" Labor Supply**

Automation effectively adds to the labor supply because each robot or software program is like a laborer (or multiple laborers) added to the economy. For example, if one machine can do the work of 5 people, that's akin to injecting 5 units of labor supply (in terms of tasks done). When an AI can answer customer inquiries, it is providing labor that otherwise a human would. So from the perspective of the labor market, automation increases the available labor (only that "labor" is not human). This tends to **reduce the demand for human labor at prevailing wages** – in other words, it shifts the labor demand curve leftward, leading to a lower wage equilibrium if all else equal.

We can see evidence of this in the **declining labor share** and rising profit share we discussed. When labor is weak, capital captures more of output as profit. Indeed, corporate profits reached record highs in many countries in the 2010s-2020s, while labor's share hit lows [20]. In Australia, for example, workers' share of GDP hit an all-time low ~44% in 2022, while profits soared to nearly 30% of GDP [20]. In the U.S., corporate

profit margins hit multi-decade highs in the 2010s, and the stock market (representing capital owners) boomed far above wage growth. This **transfer of income from labor to capital** is exactly what one would expect when labor has reduced bargaining power and can be substituted by machines or alternative workers easily [21]. The fact that **real unit labor costs** have fallen in some places means output per worker rose faster than wages, so more of the value is going to capital. Australia's data noted a 4.9% drop in real unit labor costs in 2022 [68], which the analysts pointed out as evidence that inflation wasn't due to wages (which were lagging) but profits – again indicating labor couldn't demand pay rises even in a tight economy, because other forces (likely profit-taking and productivity, possibly from tech) prevented it [68].

**Union decline** is a strong indicator of bargaining power erosion. Unions historically counteract the labor surplus effect by collective action. But technology has indirectly contributed to union decline by removing heavily unionized jobs (e.g., automation in steel and auto manufacturing cut union membership drastically as those sectors shed labor). Also, when technology creates new industries (like IT), they often start non-unionized and have stayed that way, further eroding union density by sectoral shift. In the U.S., private-sector unionization is now just 6% [66]. The result is that individual workers largely negotiate alone, with far less clout. **Companies can set wages with less pushback**. They often cite technology or competition to justify not raising pay: "We can't increase your wage because our competitors have automated and cut costs; we must do the same or outsource." Whether always true or not, it's a potent argument that resonates in an environment where people know jobs are easily rationalized.

An illustrative historical moment: in the 1980s, U.S. President Reagan fired striking air traffic controllers and replaced them – partly using military controllers, but it sent a signal that even skilled workers could be swapped out (not by tech in that case, but by alternative labor). This ushered in a tough era for unions. Similarly, in the UK, Margaret Thatcher's era broke union power in coal mining and other industries – one could argue globalization (availability of imported coal) and nascent automation in mining meant those workers had less leverage. Once those bastions fell, overall worker bargaining fell. Since then, wage growth in the UK for median workers has often been sluggish, and in the US too.

Now consider **the present AI era**: Already we see companies like IBM using AI as a reason to *not* hire or to slow hiring [55]. That's preemptive bargaining power effect – IBM essentially is saying, we don't need to hire because we have AI coming. If a prospective employee is negotiating salary or a raise, they know the employer is considering AI as an alternative to adding headcount. This inherently weakens the worker's position. Similarly, if employees demand a lot, a firm could invest in more RPA or AI to automate them away. This threat will only become more pronounced as technology improves. It may not result in overnight layoffs, but during annual budget planning, many firms are likely asking: can we trim staff through tech? If the answer is yes for some tasks, those roles lose security and wage bargaining room.

Another mechanism: **Labor market slack** keeps wages down even if unemployment is low, if a lot of people are out of the labor force wanting jobs. We touched on this with participation rates. For example, prime-age male participation's decline means a pool of potential workers that can be drawn in if wages tick up, which can dampen wage pressure. Janet Yellen (former Fed Chair) in the 2010s often mentioned "hidden slack" due to low participation. Part of why they thought inflation (and wage inflation) stayed low despite low unemployment was exactly that – many who left might re-enter if conditions were right, so companies didn't need to raise wages much to attract talent; they could dip into that pool.

**Artificial labor surplus** from automation can mimic that effect: if a company can increase output by adding robots instead of people, then even a tight labor market doesn't force their hand to raise wages; they have

another option. In economic terms, technology can make the labor supply curve effectively more elastic – if labor gets costly, firms substitute capital. This puts an upper bound on wage growth. Historically, this wasn't as immediately doable in many fields (there were limits to substitution), but with modern tech, substitution is more feasible across a range of jobs.

Finally, we should note that **policy responses** can counteract or exacerbate these trends. For example, stronger labor protections or active labor market policies in Europe mitigated some impacts (European labor share also fell but generally less than U.S.). But many countries followed more laissez-faire approaches in the 1980s-2000s, which combined with tech and globalization to shift power to capital significantly.

One tangible indicator of capital's power is the soaring wealth of shareholders and executives relative to workers. CEO pay in the U.S. has shot up from roughly 20-30 times the average worker in 1970 to well over 300 times today – partly because shareholders and boards captured gains from tech/productivity for themselves, not needing to share with workers. The stock market's growth outpacing wage bills is another sign.

In conclusion, the presence of a **labor surplus – whether visible (unemployment) or invisible (outsourcing possibilities, automation potential)** – means capital can dictate terms. This results in suppressed wage growth, precarious jobs, and a larger share of income going to profits and the highest earners. The evidence is seen in the data on labor share [7], union density [66], wage inequality [65], and corporate profits [6]. All these trends align with a story that **labor has lost bargaining power over the last several decades, and technology has been a prime factor in that shift**.

Workers in developed economies find themselves in a catch-22: if they ask for more, companies can automate or outsource; if they acquiesce, they stagnate. It's a buyers' market for labor in many industries because technology and globalization expanded the effective labor pool dramatically. This is a stark challenge to the mid-20th century experience where labor was in shorter supply (in part due to less tech and closed economies) and thus could win better terms.

Having thoroughly examined the multifaceted ways in which automation and technology have eroded labor demand and wages – from macroeconomic trends to occupational shifts, superstar firms to bargaining power – we will now conclude by synthesizing these findings and reflecting on the implications for the future of work and economic equity in developed economies.

# Conclusion

The evidence compiled in this report leads to a clear and challenging conclusion: **In developed economies from the late 20th century into the 21st, technology – especially automation – has often acted more to erode labor demand and suppress wage growth than to enhance them, contrary to the reassuring narratives of mainstream economics.**

This conclusion is not drawn lightly; it emerges from multiple converging trends, each documented with rigorous data and research:

- **Macroeconomic trends since 1980** show a marked decoupling between productivity and median wages [17] [16], a declining labor share of income across many advanced countries [7], and (in the U.S. case) a labor force participation retreating from historic highs [9]. These are broad indicators that something structural – beyond normal cyclical forces – has been at work, diminishing the extent to which working people benefit from economic progress. Technology, by enabling huge productivity gains without commensurate job gains, is at the heart of this structural shift.

- **Occupational and sectoral analysis** confirms that automation has directly eliminated vast swathes of jobs: manufacturing employment has been devastated (falling from around 30% to under 10% of jobs in economies like the U.S.) [13], routine office and administrative roles are disappearing by the millions [27], and even newer white-collar roles are increasingly under threat from AI. While new jobs have arisen, they have not appeared fast enough nor in sufficient quantity to replace those lost, particularly for middle-skill workers [61]. The result is polarization: growth in high-pay and low-pay jobs, contraction in the middle – a recipe for inequality and social strain.

- **The rise of superstar firms** and increased market concentration, enabled by technology, has further broken the historical link between growing business revenues and growing employment. Leading firms now achieve **unprecedented scale with relatively few workers** [40] [39], contributing to a declining aggregate demand for labor and a fall in labor's share of output as these firms tend to have low labor cost ratios [8]. The superstar phenomenon underscores that technological efficiency gains have translated into *higher profits, not higher wages or employment*, when captured by firms with market power [43].

- **Case studies of automation technologies** from robotics to RPA to AI reveal tangible examples of workers being replaced or bypassed. Banks implementing RPA shed back-office jobs [27]; companies adopting AI plan hiring freezes for roles that algorithms can perform [55]. We see that whenever technology reaches a threshold of capability, businesses are quick to substitute it for human labor – an economically rational choice that nonetheless reduces opportunities for workers. Projections by major analysts (e.g., *300 million jobs potentially impacted by AI globally* [56]) and actions by companies like IBM [55] indicate this substitution effect is poised to accelerate.

- **Job displacement vs. creation dynamics** have, in recent decades, tipped toward displacement. The period from roughly 1980 onward has been characterized by an *acceleration of automation and a weakening of new job creation* [61] [58]. This is a reversal of earlier epochs where new industries (manufacturing, services) rose to absorb those leaving older sectors. The empirical decomposition of employment changes suggests that many advanced economies now struggle to find labor-absorbing innovations at the pace needed to keep workers fully employed in good jobs [61]. We are essentially running a race where machines are often outpacing the economy's ability to invent new uses for human labor.

- **Aggregate indicators like low unemployment** have masked underlying issues of underemployment, stagnant incomes, and deteriorating job quality. While official jobless rates fell to multi-decade lows by the late 2010s, this belied the reality that many of those jobs were part-time, gig-based, or low-paying with few benefits [4]. **Nearly all net job growth came from non-**

**traditional work arrangements** in the U.S. over a decade [4]. Similarly, low unemployment in, say, the UK coexisted with zero real wage growth for a decade – a combination possible only when worker bargaining power is feeble. The usual mechanism that would translate labor market tightness into wage gains has been short-circuited, and the widespread ability to offshore or automate is a big part of the reason.

- **Labor's bargaining power has indeed eroded**, as seen in declining unionization [66], historically low strike activity, and the shift of national income toward profits [6]. Technology has expanded the effective supply of labor (through automation and global labor arbitrage), creating a buyer's market for labor that keeps workers in check. The outcomes – from minimal wage growth for the 90% [65] to record corporate profit shares [20] – align with the hypothesis that a labor surplus (natural or artificial) benefits capital at labor's expense. In short, **the balance of power in the workplace has tilted heavily toward employers**, who can more credibly say to employees: "Take it or leave it; you are replaceable by a machine or a cheaper worker elsewhere."

Having assembled this evidence, we can directly answer the question: Has technology been eroding labor demand and suppressing wages in developed economies? The answer, supported by the data and research cited throughout, is **yes – and to a significant degree**. This does not mean technology has been the only force (policy, globalization, and other factors intertwine), nor that technology hasn't delivered immense benefits in terms of new products, efficiencies, and consumer surplus. But those benefits have not been broadly shared in the form of labor market outcomes. Instead, we have seen a paradox of plenty: more technological capability than ever, but median workers often struggling to gain ground.

This poses a challenge to the *mainstream economic orthodoxy*. The traditional view assumes various equilibrating mechanisms will ensure technology ultimately raises all boats: lower prices create demand elsewhere, new industries emerge, displaced workers retrain, etc. These mechanisms do operate to some extent, but the last several decades suggest they are weaker or slower than before, and that without intervention, the market outcome can be prolonged stagnation or decline for many workers. In other words, **the Luddite concerns that were historically proven wrong in the long run may be coming true in a more lasting way in the modern era**. As MIT's Autor quipped, "This time may be different" – not in the sense that all jobs will disappear, but that the labor market may not naturally self-correct to a high-wage, full-employment equilibrium if we continue on the current technological trajectory [34] [58]. Especially with AI capable of encroaching on skilled cognitive work, the old assumption that humans will *always* have the comparative advantage in something may need to be revisited.

The findings here also underscore that **headline metrics are insufficient gauges of economic health**. We must pay attention to *who* is benefiting. If GDP grows but labor's slice shrinks, if unemployment is low but wages are flat, if profits soar but middle-class jobs erode – those are signs of a deep imbalance. They suggest an economy where technology's fruits are captured by a narrow slice (capital owners, top talent) while the general workforce treads water or loses ground. Such an economy, if left unchecked, can lead to social and political strains – from populist backlashes against trade and tech, to generational malaise (young people feeling they can't match their parents' living standards), to declining trust in institutions that promised broad prosperity from innovation.

It is beyond the scope of this report to prescribe policy, but the evidence certainly implies that **new approaches are needed** to ensure technology benefits labor broadly. These could range from education and training reforms (to better equip workers for complementing tech) to stronger labor protections and

collective bargaining (to give workers more say and share in productivity gains), to perhaps even rethinking incentives for the types of innovations that are pursued (promoting "labor-augmenting" innovations versus purely labor-replacing automation [2] [3]). Without such measures, the trajectory described in this report may continue or worsen: a future of plenty in aggregate but scarcity in the wage packet of the average person – essentially, *"immiserating growth"* for the working class in advanced societies.

In conclusion, the hypothesis that technology and automation have eroded labor demand and suppressed wages in developed economies is strongly supported by the weight of empirical evidence from the past half-century. This runs contrary to the comforting narrative that technological progress automatically lifts all workers. Instead, we find that **market forces alone have not guaranteed positive outcomes for labor in the face of rapid technological change**. Recognizing this reality is the first step towards addressing it. The goal should be to harness technology in a way that *renews* broad-based prosperity – learning from the postwar decades when productivity and wages rose in tandem – rather than accepting a future where the benefits of machines accrue only to those who own them or have the rare skills to work alongside them at the top.

The stakes are high. As technology, especially AI, gallops ahead, societies that proactively adapt can enjoy its fruits widely; those that do not may see further polarization and discontent. The findings of this report urge economists, policymakers, and business leaders to **re-evaluate long-held assumptions** and craft strategies that ensure the next chapter of technological advancement is one where labor is not a casualty but a partner in progress.

**Footnotes:** (See below for referenced sources supporting the data and claims made in this report.)

[11] [12] BLS analysis of labor force participation trends (1950–1998) – showing the rise from 60.4% in 1950 to 66.4% by 1990, largely due to increased female participation.

[9] [10] USAFacts/BLS data on U.S. labor force participation – peaked at 67.3% in early 2000, declining to ~62% by 2025; also notes women's participation rising from 32% (1948) to ~60% (2000) and men's falling from 86.7% to 67.6%.

[7] Karabarbounis & Neiman (2014) – documentation of the significant decline in the global labor share of income since the early 1980s across most countries/industries, attributing about half of the decline to cheaper technology (lower price of capital inducing labor substitution).

[19] OECD Working Paper (Schwellnus et al. 2018) – notes that over the past two decades, median wage growth decoupled from productivity growth in many OECD countries, partly due to declining labor income shares.

[20] Australia Institute (Jericho & Richardson 2022) – reports Australia's employee compensation at only 44.1% of GDP (record low) and corporate profits at 29.9% (record high) in 2022, indicating labor share at historic low while profit share surges, consistent with global trends.

[8] Autor et al. (2017/2020) – "Rise of Superstar Firms" abstract, listing predictions: rising sales concentration in industries, largest concentration increases see biggest labor share declines, output shifts to high-productivity low-labor firms, etc., all supported by data.

[43] Autor et al. continued – notes superstar firms have high markups and low labor share; as output reallocates to them, aggregate labor share falls (empirically confirmed in U.S. and international data).

[40] [39] Martin Ford talk slide via Gris Anik blog – GM in 1979 (840k workers) vs Google in 2012 (38k workers) with Google having 20% more inflation-adjusted earnings; highlights Google's profits benefiting far fewer people (GM supported ~2.5 million people vs Google ~114k when considering dependents).

[25] Cleveland Fed (2025) – study showing 1980–2015 clerical job share fell 6.5 pp in high-ICT-adopting cities

vs 2.3 pp in others; clerical employment share gap between NYC and rural areas closed by 2005 as big cities lost more clerical jobs [69]. Reflects ICT-driven elimination of many back-office roles.

[27] Conference Board (2022) – notes 2+ million office/admin support jobs lost 2016–2021, with financial clerks down 10.3% and secretaries down 8.7% in recent years, attributing decline to automation of tasks like calendar management and bookkeeping [28].

[13] Coalition for Prosperous America (Ferry & McConkey 2023) – reports U.S. manufacturing employment at 8.3% of workforce, all-time low, versus ~30% in 1950s-60s; underscores the long-run collapse of factory jobs despite output growth.

[16] EPI, "Wage Stagnation in Nine Charts" – states from 1973 to 2013 productivity +74% vs typical worker hourly compensation +9%, encapsulating the productivity-pay gap growth.

[2] [3] Acemoglu & Restrepo (JEP 2019) – explain that automation displaces labor (reducing labor share and possibly labor demand) while new tasks reinstate labor (increasing labor share/demand); their empirical work finds that since the 1980s, displacement accelerated and new task creation slowed, accounting for slower employment growth in last 30 years.

[58] MIT News (2024) on Autor's study – finds since 1980, technology has *replaced* more jobs than it created in the U.S., due to faster automation and slower augmentation in last 40 years compared to prior decades. This is based on new research analyzing census job data and patents [34] [31].

[4] Quartz (Kopf 2016) summary of Katz & Krueger – "94% of net job growth from 2005–2015 was in alternative work (temp, independent contractor, gig, etc.), with over 60% from rise of independent contractors/freelancers" (i.e., very few traditional employment jobs added) [4].

[65] EPI data – between 1979 and 2013, real wages of bottom 90% grew ~15% while top 1% grew 138%, highlighting inequality and that typical workers saw negligible gains over decades [65].

[66] Wikipedia (citing BLS) – U.S. union membership 20.1% in 1983 down to 10.1% in 2022; private sector only 6.0% in 2022. Shows erosion of collective bargaining presence.

[55] Reuters (2023) – IBM CEO expects to pause hiring for back-office roles and sees 30% of such roles (~7,800 jobs) replaceable by AI in 5 years, with hiring suspended in those areas. Illustrates corporate planning to reduce workforce via AI.

[56] Goldman Sachs analysis via GS or CNBC – generative AI could expose 300 million full-time jobs globally to automation; in U.S./Euro, up to 1/4 of work tasks could be automated. Suggests large potential displacement (though also productivity gains).

[48] Money.com (Citibank report story, 2016) – Citibank analysts predicted ~30% of bank jobs could be cut by 2025 due to automation ("Banking's Uber Moment"). Implies hundreds of thousands of finance jobs at risk in one decade [49].

[1] Pew Research (2014) "AI, Robotics, Future of Jobs" – key theme from canvassed experts: historically, technology has been a net creator of jobs (this is the optimistic consensus among many experts, provided as context to then discuss concerns) [1]. This viewpoint is challenged by our findings, but it's cited to contrast expert expectations with outcomes.

[21] Karabarbounis & Neiman – they point out the role of cheaper IT capital in driving shift from labor to capital; specifically, that decline in price of investment goods explains about half the labor share decline even accounting for other factors. This supports the argument that tech (making capital cheap/effective) directly led firms to use less labor [22].

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[1] AI, Robotics, and the Future of Jobs
https://www.pewresearch.org/internet/2014/08/06/future-of-jobs/

2 3 60 61 Automation and New Tasks: How Technology Displaces and Reinstates Labor - American Economic Association
https://www.aeaweb.org/articles?id=10.1257/jep.33.2.3

4 5 Almost all the 10 million jobs created since 2005 are temporary
https://qz.com/851066/almost-all-the-10-million-jobs-created-since-2005-are-temporary

6 20 68 The share of GDP going to workers hits a record low - The Australia Institute
https://australiainstitute.org.au/post/the-share-of-gdp-going-to-workers-hits-a-record-low/

7 21 22 The Global Decline of the Labor Share
https://ideas.repec.org/p/nbr/nberwo/19136.html

8 41 42 43 The fall of the labor share and the rise of superstar firms
https://ideas.repec.org/p/cep/cepdps/dp1482.html

9 10 What is the labor force participation rate in the US? | USAFacts
https://usafacts.org/answers/what-is-the-labor-force-participation-rate-in-the-us/country/united-states/

11 12 67 Labor force participation: 75 years of change, 1950-98 and 1998-2025
https://www.bls.gov/opub/mlr/1999/12/art1full.pdf

13 14 32 Manufacturing Employment Hits All-Time Low. Will IRA Reverse the Trend? | Coalition For A Prosperous America
https://prosperousamerica.org/manufacturing-employment-hits-all-time-low-will-ira-reverse-the-trend/

15 Labor force in the United States - Wikipedia
https://en.wikipedia.org/wiki/Labor_force_in_the_United_States

16 65 Wage Stagnation in Nine Charts | Economic Policy Institute
https://www.epi.org/publication/charting-wage-stagnation/

17 18 The Productivity–Pay Gap | Economic Policy Institute
https://www.epi.org/productivity-pay-gap/

19 36 37 45 Labour share developments over the past two decades | OECD
https://www.oecd.org/en/publications/labour-share-developments-over-the-past-two-decades_3eb9f9ed-en.html

23 Chart: Can Trump Turn Back the Clock on U.S. Manufacturing?
https://www.statista.com/chart/34316/share-of-manufacturing-jobs-in-us-employment/

24 Forty years of falling manufacturing employment
https://www.bls.gov/opub/btn/volume-9/forty-years-of-falling-manufacturing-employment.htm

25 26 69 Technology Adoption and the Changing Role and Background of Clerical Workers
https://www.clevelandfed.org/publications/economic-commentary/2025/ec-202502-technology-adoption-and-changing-role-and-background-clerical-workers

27 28 29 Decline in office and administrative support work suggests certain tasks and skills have been replaced by automation
https://www.conference-board.org/topics/labor-markets-charts/automation-replacing-office-and-administrative-support-jobs

30 31 33 34 35 58 59 Does technology help or hurt employment? | MIT News | Massachusetts Institute of Technology
https://news.mit.edu/2024/does-technology-help-or-hurt-employment-0401

38 39 40 Who Did Better: GM or Google?
https://grisanik.com/blog/who-did-better--gm-or-google-/

44 Revenue per employee of leading tech companies 2024 - Statista
https://www.statista.com/statistics/217489/revenue-per-employee-of-selected-tech-companies/

46 47 52 53 Robotics in Banking with 4 RPA Use Case Examples + 3 Bank Bot Use Case Videos - The Lab Consulting
https://thelabconsulting.com/robotics-in-banking-with-4-rpa-use-case-examples/

48 49 50 Citibank Analysts Say Automation Will Kill 30% of Bank Jobs | Money
https://money.com/automation-kill-banking-jobs/

51 Robotic Process Automation and Consequences for Knowledge ...
https://pmc.ncbi.nlm.nih.gov/articles/PMC7134300/

54 55 IBM to pause hiring in plan to replace 7,800 jobs with AI, Bloomberg reports | Reuters
https://www.reuters.com/technology/ibm-pause-hiring-plans-replace-7800-jobs-with-ai-bloomberg-news-2023-05-01/

56 Generative AI could raise global GDP by 7% - Goldman Sachs
https://www.goldmansachs.com/insights/articles/generative-ai-could-raise-global-gdp-by-7-percent

57 A.I. automation could impact 300 million jobs – here's which ones
https://www.cnbc.com/2023/03/28/ai-automation-could-impact-300-million-jobs-heres-which-ones.html

62 The Great Doubling: The Challenge of the New Global Labor Market
https://www.semanticscholar.org/paper/The-Great-Doubling%3A-The-Challenge-of-the-New-Global-Freeman/7ae2d96392187430e57d35528cb4998d1dbb02f9

63 “Made in China” matters: Integration of the global labor market and ...
https://www.sciencedirect.com/science/article/abs/pii/S1043951X18300749

64 China, India and the Doubling of the Global Labor Force: who pays ...
https://www.cambridge.org/core/services/aop-cambridge-core/content/view/9516DFC72D042924CFD94AF982FFC55B/S1557466005002779a.pdf/china_india_and_the_doubling_of_the_global_labor_force_who_pays_the_price_of_globalization.pdf

66 Labor unions in the United States - Wikipedia
https://en.wikipedia.org/wiki/Labor_unions_in_the_United_States