Working Paper

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Federal Revenue When AI Replaces Labor

An Examination of Economic Scenarios with Highly Capable Artificial Intelligence

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About This Working Paper

As the world, and the United States in particular, confronts the challenges of economic mobility, health and longevity, and new frontiers of technology and human well-being, have we designed our social and economic systems to effectively address these convergences? RAND is addressing these questions through an effort called Social and Economic Policy Rethink to transform the approach to solving social and economic policy problems. The broader volume encompasses eight publications that describe key social and economic stakes for policy on artificial intelligence (AI) adoption, examine how policymakers can account for rapid AI capabilities development and adoption in and across sectors, and showcase how industry and policy leaders can responsibly meet the challenges of an era of transformative AI.

This report is a publication in this Rethink volume, which examines a scenario in which artificial intelligence and other automation technologies substitute for human labor with the intent of examining the effect on federal revenue. We first build a framework for understanding the replacement of the vast majority of currently remunerated tasks. Then we simulate a large, but less dramatic transitional scenario in which 10 percent of the workforce is displaced by automation. This report is intended to be of interest to economists and policymakers considering the economic and fiscal implications of AI systems.

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Summary

The pace and breadth of economically useful advances in artificial intelligence (AI) have raised the risk of mass unemployment stemming from labor replacing systems. In light of this concern, we design and apply a framework for exploring how AI systems that are substitutes for human labor affect federal revenue and then use tools from the RAND Budget Model Initiative to explore quantitative outcomes.

- In 2024, the bulk of federal revenue, 84 percent, came from either individual taxes or payroll taxes, which are both derived primarily from labor (about 66 percent of federal revenue is due directly to labor). Thus, labor displacing technologies could disrupt the majority of federal revenue.
- Even if displaced workers found other jobs with similar compensation, the temporary disruption to federal revenues as those workers are gradually reemployed could be comparable to a recession.
- Since most households rely on labor income to support consumption, the disruption of labor income could reduce economic activity in general and therefore shock revenue from businesses and consumption.
- Additionally, if AI systems are owned primarily by monopolists, then the majority of the labor income could become profit for businesses. However, because the marginal tax rate for businesses is typically lower than for individuals, the revenue from business income tax would likely not be able to offset the revenue from displaced labor unless the corporate rates were roughly doubled to be at parity for labor tax rates.
- Alternatively, if highly capable AI systems are widely accessible for the general population at or near the cost of inference (this could occur if the models were open weight), firms would become significantly less profitable. Thus, AI induced deflation could cause federal revenue stemming from business and capital to decline substantially.

Looking at a less extreme, transitional scenario, we applied a macroeconomic model to assess the effects of a highly capable AI system that replaced ten percent of current jobs spread across the income distribution under different assumptions as in Table S.1.

Table S.1. Simulation Results for a 10 Percent Employment Shock

	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
New Jobs for Humans?[a]		Yes	No	Yes	No
Pricing of AI[b]?		Monopolistic	Monopolistic	At-cost	At-cost
Annual Real GDP Growth	1.8%	2.0%	1.8%	1.9%	1.7%
Nominal GDP 2035 ($ Trillions	43.9	43.0	48.3	32.4	33.2

	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Federal Revenue Personal Income (% of GDP)	14.0%	14.2%	12.5%	15.6%	14.5%
Federal Revenue Corporate Income (% of GDP)	2.8%	3.6%	3.0%	1.9%	0.7%
Interest Rate[c]	3.5%	3.4%	4.1%	1.5%	1.4%
Inflation Rate[d]	2.0%	1.7%	3.5%	-2.0%	-2.0%

SOURCE: RAND macroeconomic simulations of the 10 year time horizon from 2025-2035. Our simulations implement a set of shocks that begin in the first quarter of 2025 and last for a fixed duration: the specific set of shocks and their durations depend on the scenario. Details are presented in Appendix B. In all scenarios we adjust Total Factor Productivity so that the net change in output associated with replacing human labor is zero.[1]
NOTE: [a]New Jobs for Humans indicates whether human labor displaced by AI are able to find other jobs in new industries in this scenario. [b]Pricing of AI indicates whether or not the AI is priced monopolistically. [c]The interest rate shown is the projected average rate of interest on the existing federal debt in 2035. [d]The Inflation Rate is the projected core consumer price inflation rate in 2035. The reported growth rate of real GDP, nominal GDP, and federal revenues from personal income taxes and corporate income taxes are projected values in 2035.

The key implications of model results from these scenarios are:

- Nominal Gross Domestic Product (GDP) is substantially lower if AI systems lead to substantive deflation, but the real GDP growth rate is similar.
- Lower nominal GDP would also lower federal revenues by about a quarter if AI leads to substantive deflation. This makes it much harder to service the national debt because interest payments are based on the debt in nominal dollars.
- Because federal revenue disproportionately comes from individual and payroll taxes, scenarios where people are able to find other jobs after being displaced by AI result in substantially higher revenue.
- AI systems that are priced by monopolists result in much higher inflation and interest rates, particularly if individuals cannot find employment after being displaced.

Narratively, the shock to either the employment or labor force participation rate leads the Federal Reserve, based on its mandate to sustain maximum employment, to take steps to lower interest rates which can spur investment and economic growth. If firms see high profits from their investment because they are able to receive monopolistic returns, then the economy continues to grow. However, if AI systems are predominately either open weight or AI systems are otherwise able to be priced at cost, deflation leads to less investment and therefore a lower GDP.

[1] It is important to note that this increase in productivity is the mechanism to keep the economy's output the same while eliminating ten percent of employment. It does not represent productivity growth from AI complementing the existing workforce except in so far as complementarity is the mechanism by which jobs are replaced.

There are several policy interventions that could be considered to prepare for the possibility that AI dramatically disrupts the U.S. economy. Some options for the federal government include:

- Reducing the federal debt so the federal balance sheet can withstand future shocks.
- Changing the tax code to raise more revenue from corporations or through excise taxes to reduce the dependence on labor income.
- Inducing inflation to maintain nominal prices.
- Introducing an AI excise tax.
- Eliminating tax avoidance schemes such as moving intellectual property to foreign subsidiaries.
- Provide a universal income to replace people's income and prevent the collapse of consumption capability for households that lose the ability to earn labor income.
- Nationalize concentrated AI models.[2]

[2] This would be a substantial change to the economic system of the United States and may require changes to U.S. Code or even the Constitution.

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Federal Revenue When AI Replaces Labor

Many leaders of artificial intelligence (AI) companies[3] have made statements suggesting that AI will be sufficiently capable to replace a sizeable portion of labor tasks in the near future. While there are skeptics of this claim,[4] analyzing the hypothetical question of "how would the economy function without the need for human labor" can provide insights into indicators that might be useful for policymakers to track. In particular, because the majority of federal revenue in the United States comes from taxes related to labor earnings, the shift away from human labor could lead to an untenable fiscal situation. In this paper, we examine the implications on tax revenue of a world where a large share of current remunerated work is replaced by AI systems. This is fundamentally a scenario where AI systems are substitutes, not complements, for human labor. While our baseline may be considered a "hard takeoff" scenario in which the capabilities of AI systems rapidly accelerate, we will discuss some variation in sequencing and timing of the advancement in AI capabilities.

We are not the first to consider the effects of AI in the federal budget. The Congressional Budget Office explored the possible effects of AI on the federal budget but did not examine in detail the effects of AI systems that are substitutes for labor.[5] The Internal Revenue Service examined the use of AI and found that using AI to improve tax collection could potentially reduce the estimated $542 billion lost in 2021 from underreporting income but did not look at changes to the broader collection environment.[6] Additionally, many studies, such as Brynjolfsson, Rock, and Syverson (2020)[7], Trammell and Korinek (2025)[8], and Nygaard,

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[3] For example, see: VandeHei, Jim and Mike Allen. "Behind the Curtain: A white-collar bloodbath", Axios. May 28, 2025. https://www.axios.com/2025/05/28/ai-jobs-white-collar-unemployment-anthropic and Altman, Sam and Michelle Bowman "Fireside Chat with Vice Chair for Supervision Bowman," Integrated Review of the Capital Framework for Large Banks Conference. Federal Reserve Board, July 22, 2025. As of September 26, 2025: https://www.federalreserve.gov/conferences/integrated-review-of-the-capital-framework-for-large-banks.htm

[4] Cappelli, Peter and Valery Yakubovich. "AI May Not Be a Job Killer, After All", The Wall Street Journal. May 9, 2024. As of September 26, 2025: https://www.wsj.com/tech/ai/will-ai-be-a-job-killer-call-us-skeptical-9b4199bd

[5] Congressional Budget Office, "Artificial Intelligence and Its Potential Effects of the Economy and Federal Budget," December 2024. As of September 26, 2025: https://www.cbo.gov/publication/61147

[6] Treasury Inspector General for Tax Administration "The IRS Could Leverage Examination Results in Artificial Intelligence Examination Case Selection Models and Improve Processes to Evaluate Performance." Report Number 2025-308-022. May 19, 2025. As of September 29th, 2025. https://www.tigta.gov/sites/default/files/reports/2025-05/2025308022fr.pdf

[7] Brynjolfsson, Erik, Daniel Rock, and Chad Syverson. "The Productivity J-Curve: How Intangibles Complement General Purpose Technologies." NBER Working paper. January 2020. Available as of October 3, 2025, at http://www.nber.org/papers/w25148

[8] Trammell, Philip and Anton Korinek. "Economic Growth under Transformative AI" NBER Working Paper. September 2025. Available as of October 3, 2025 at http://www.nber.org/papers/w25148

Welburn, and Nergui (2025)[9] focus on AI as a driver of productivity growth.[10] So, while these studies provide some useful context, they do not answer the question about federal revenue in a world where AI is purely a substitute for human labor.[11]

Because automation technology that can replace all human labor is, at present, hypothetical, we make assumptions about the nature of this AI. We used data collected as part of the RAND Tax Code Analysis Tool[12] that has been developed for the von Furstenberg Family Foundation RAND Budget Initiative[13] to identify the key revenue channels and their magnitude. We grouped these channels into labor-derived revenue, capital-derived revenue, and other revenue. Next, we identified how labor-replacing AI could disrupt each of those channels and what assumptions qualitatively drive the outcomes. Then, we simulate the economic outcomes of a less extreme scenario where AI replaces 10 percent of jobs. Finally, we discuss policy implications of this work and possible future directions.

Federal Revenue

Figure 1 shows the empirical distribution of federal revenues from 1929 to 2024. Over this 95-year period, there have been substantial changes to the mixture of federal revenue. Most notably, in 1939, income tax revenue grew in response to many of the New Deal policies implemented by the Roosevelt Administration. In the eighty years following World War II, the sources of federal revenues have shifted gradually from half of revenue coming from businesses (corporate taxes and excise taxes) and the other half from individuals (individual taxes and payroll taxes[14]) in 1950 to 84 percent of federal revenue coming from individuals in 2024.

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[9] Nygaard, Vegard M., Jonathan W. Welburn, and Anujin Nergui, Macroeconomic Implications of Artificial Intelligence. Santa Monica, CA: RAND Corporation, 2025. https://www.rand.org/pubs/perspectives/PEA3888-3.html.

[10] The implications of productivity induced by AI are generally relevant to understanding this question of economic growth and federal revenue. However, because our focus is on AI as a substitute for labor, we will largely ignore the productivity implications, particularly those pertaining to labor productivity. In the most extreme case where AI replaces all remunerated labor, labor productivity is irrelevant to economic output because there is no demand for paid labor. For an intermediate case where AI replaces some paid labor, the labor productivity effects are relevant to understanding economic output, but we will assume that labor productivity does not increase so that we can produce a lower bound on the revenue changes.

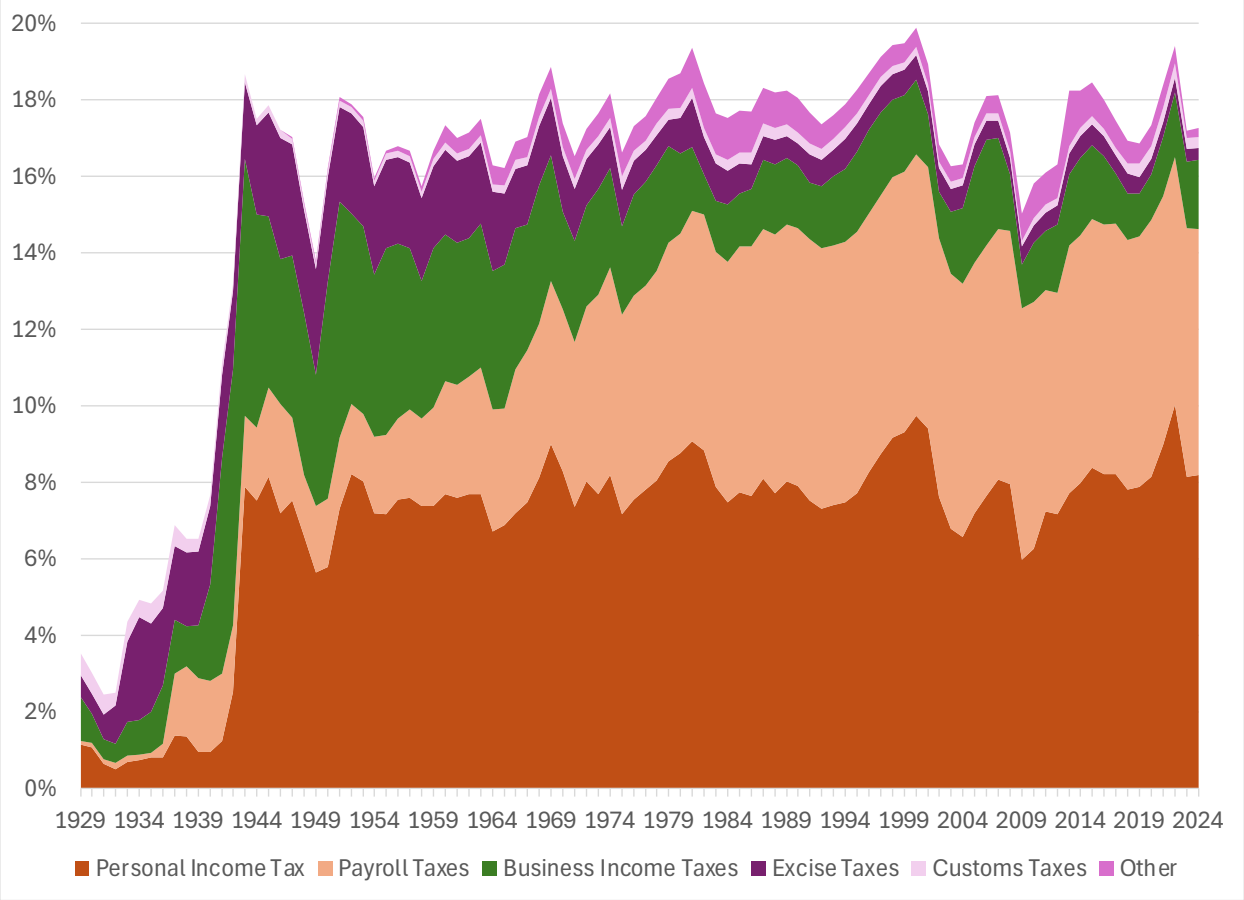
[11] Alternatively, AI could be a complement to human labor such that AI improves labor productivity as described in Systema, 2025 and other studies. We focus on the substitution effects of AI, which are not mutually exclusive with complementary effects, except for extreme cases. For example, an AI system that makes senior coders much more efficient could also replace junior coders.

[12] Price, Carter C., Leonardo Bueno, Kara Jia, Sabahat Zafar, and George Zuo. "Tax Code Analysis Tool: Applying Machine Learning to Map the Tax Code," RAND Corporation, WR-A4129-1, 2025. As of August 21, 2025: https://www.rand.org/pubs/working_papers/WRA4129-1.html

[13] For more information, see: RAND, "RAND Budget Model Initiative." As of September 26, 2025: https://www.rand.org/education-and-labor/projects/rand-budget-initiative.html

[14] Payroll taxes are generally split evenly between an individual and employer but is typically linked to wage and salary income. So, while payroll tax is not strictly paid by individuals alone, it is linked to an individual's labor.

Figure 1. Federal Income as a Share of Gross Domestic Product by Source from FY1929 to FY2024



SOURCE: Bureau of Economic Analysis, "Table 1.1.5. Gross Domestic Product" National Income and Product Accounts. March 27, 2025.

There is substantial variation in the amount of revenue raised by each type and the vulnerability of the revenue from each type to AI. Broadly speaking, we can classify federal revenue into six categories: personal income taxes, payroll taxes, corporate income taxes, excise taxes, customs taxes, and other revenue (typically fees).

- **Predominately Labor Taxes:**
  - **Personal income taxes** are collected from individuals based on income from wages and salary, investments, transfer payments, and other sources.
  - **Payroll taxes** are paid by workers and employers for Medicare and Social Security.
- **Predominately Capital Taxes:**
  - **Corporate taxes** are collected from certain classes of businesses (i.e., typically not tax-exempt organizations).
- **Other:**

- **Excise taxes** are "indirect tax[es] on specific goods, services and activities"[15] such as the fees attached to the sale of airline tickets, fuel, or tobacco.
- **Customs taxes** include tariffs.
- **Other revenues** include revenues that agencies receive from fees or other non-tax revenue. For example, the U.S. Citizenship and Immigration Services is primarily a fee-funded agency where applicants and petitioners pay fees to process their applications and petitions.

For the purposes of this analysis, we group these six categories into three types: taxes derived from labor, taxes derived from capital, and other revenue. Since the revenues from the "other" type amounted to less than five percent of federal revenue in 2024, we will largely ignore them in this analysis.[16] Table 1 has descriptions of each type of tax.

Table 1. Categories of Federal Taxes

Type of Tax	Share of Total Federal Revenue in 2024[17]	Revenue from Labor	Revenue from Capital	Notes
Personal Income	47%	60	21	Wages and salaries make up 60 percent of the total income that is taxable.[18] The remainder includes capital gains (about 13 percent of total taxable personal income), taxable retirement and pension income (10 percent), business income (8 percent), and various other sources that are not tied to business or labor income. Thus, we can say that roughly 60 percent of personal income taxes are labor taxes, and 21 percent are capital taxes (the capital gains and business income).[19] The remaining 19 percent come from income sources not directly affected by capital or labor (these are primarily some form of transfer income).
Payroll	37%	100	0	These taxes are entirely labor taxes.
Corporate	10%	0	100	For this analysis, we classify the revenue from corporate taxes as capital taxes.
Excise	2%	0	0	These are typically paid by businesses but are most closely linked to consumption. These are not directly vulnerable to either labor or capital shocks but could

[15] Internal Revenue Service, *Basic things all businesses should know about excise tax*, August 1, 2022. https://www.irs.gov/newsroom/basic-things-all-businesses-should-know-about-excise-tax

[16] As of August 25, 2025, there have been several tariff proposals that could substantively increase customs revenue. That said, this revenue would not be directly related to labor or capital, but rather consumption. Thus, we will not include it at this point, but future versions of this study may.

[17] All data on the share of federal revenues come from the Bureau of Economic Analysis, "Table 1.1.5. Gross Domestic Product," National Income and Product Accounts. As of March 27, 2025: https://apps.bea.gov/iTable/?reqid=19&step=2&isuri=1&categories=survey

[18] All data on the distribution of personal income, come from the Internal Revenue Service, "Statistics of Income: 2022 Individual Income Tax Returns Line Item Estimates," Publication 4801 (Rev.12-2024). 2024.

[19] Importantly, capital income is typically taxed at a lower marginal rate than income from labor.

Type of Tax	Share of Total Federal Revenue in 2024[17]	Revenue from Labor	Revenue from Capital	Notes
				decline or increase from behavioral responses to a shock that induces a change in consumption.
Customs	<2%	0	0	These are a function of consumption and therefore not tied to labor or capital directly.
Other	<2%	0	0	These are not directly tied to labor or capital.

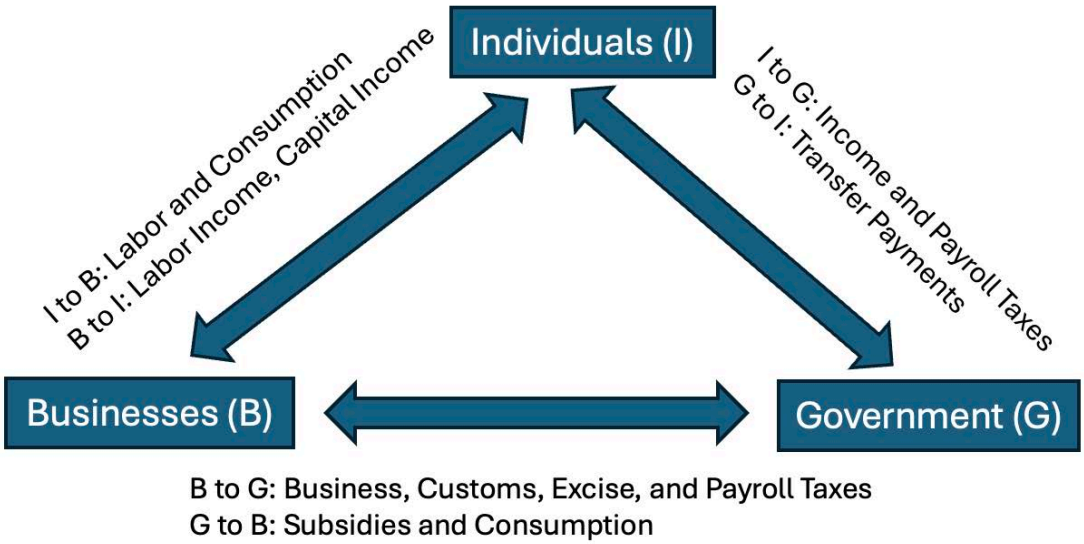
Since 1950, federal revenue has been 16 to 20 percent of Gross Domestic Product (GDP), while federal expenditures are typically a few percentage points higher. In a fiscal environment with high and rising debt, the federal government may not be able to feasibly provide a strong safety net in the case of a large labor disruption.[20] In particular, Social Security is funded by a payroll tax and the Social Security trust fund, but once the trust fund is exhausted benefits would need to be cut to make up for any shortfalls in the payroll tax revenue barring a change in the law.

Framework

As discussed above, this analysis examines the revenue implications of a scenario in which widespread availability of AI systems can perform all currently remunerated tasks at some point in the near future. We are not distinguishing between intellectual labor and physical labor, so we assume that these AI systems would necessarily include robots. Because our focus is on federal revenue, we focus on the effects of AI on labor income and capital income.

[20] Nygaard, Vegard M., Carter C. Price, and Akshaya Suresh. "Preliminary Strategies for Reducing the Burden of Federal Debt: How the United States Reduced the Debt Burden Following World War II and What It Would Take to Do So Again, RAND Corporation, RR-A2614-4, forthcoming."

Figure 2. Framework for Assessing Fiscal Effects of AI



As seen in Figure 2, there are six channels relevant to assessing the fiscal effects of AI:

- Individuals to Government: Individuals pay income and payroll taxes to the federal government.
- Government to Individuals: The government provides transfer payments to some individuals.
- Businesses to Government: Businesses pay business income, customs, excise, and payroll taxes to the federal government.
- Government to Businesses: The government provides subsidies to some businesses and consumes products and services from businesses.
- Individuals to Businesses: Individuals supply labor to businesses and consume products and services from businesses.
- Businesses to Individuals: Businesses provide wage and salary income to their workers and capital income to business owners (or security holders).

The direct effect of AI in our thought experiment will be a shock to the labor/capital income channel (Individuals-to-Businesses/Businesses-to-Individuals in Figure 2), but this will have second-order ramifications for the other channels based on the labor and capital effects.

Does the adoption of AI create new work for humans?

AI that replaces all currently remunerated tasks would naturally be expected to eliminate revenue from labor taxes (i.e., most personal income taxes and all payroll taxes). However, as many economists have noted, the introduction of labor replacing AI may result in new industries or tasks that employ humans as the economy has done for other technological shocks throughout

history.[21] Thus, the degree to which new tasks for humans come into existence (and the associated income distribution), will determine the degree to which federal revenue from labor income disappears.

If the labor demand from existing industries is fully replaced with labor demand from new industries, the precise change in labor income will depend on the change in distribution of income but could plausibly result in little change in federal revenue from individual and payroll taxes in the long run.

While it is challenging to know in advance what those new industries may be, economist Brad Delong describes "six ways that humans have historically created value: through our legs, our fingers, our mouths, our brains, our smiles and our minds."[22] With AI and advanced robotics, human workers could still have employment through social and emotional labor or "smiles" in Delong's terms. These future jobs may be difficult to conceptualize like a social media influencer would have been difficult to conceive of thirty years ago or a software engineer would have been difficult to explain to someone two hundred years ago. For context, Autor, et al. examined the employment numbers by occupation and found that about sixty percent of workers in 2018 have job titles that did not exist in 1940.[23]

However, if AI is primarily labor replacing and there are not new industries that emerge, then 37 percent of all federal revenue from payroll taxes would go away. As stated above, 60 percent of personal income is from wages and salary which would also be vulnerable to labor replacing AI. The remaining 40 percent is about half from transfer payments and half from business or capital income. This means that roughly 28 percent (60 percent of the 47 percent as seen in Table 1) of all federal revenue is connected to individual wage and salary income. So, the labor related taxes amount to approximately 65 percent of total.

Because 67.9 percent of U.S. GDP was personal consumption expenditures in 2024,[24] the stability in business and capital income would depend greatly on whether consumption remains stable, but in the absence of a source to replace the labor earnings for individuals (such as transfer income), business and capital income could be expected to decline as well. Other business and capital income is derived from investment, which accounted 18 percent of GDP in 2024,[25] and while this is not directly linked to consumption, investment returns are often tied to

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[21] Autor, David. "Applying AI to rebuild middle class jobs." National Bureau of Economic Research Working Paper No. w32140, 2024.

[22] Delong, Brad. "Will robots make our lives better or worse?" World Economic Forum. October 1, 2014. https://www.weforum.org/stories/2014/10/j-bradford-delong-robots-workers-productivity/

[23] Autor, David, Caroline Chin, Anna M. Salomons, and Bryan Seegmiller, New Frontiers: The Origins and Content of New Work, 1940–2018, Working Paper Series, Working Paper No. 30389, National Bureau of Economic Research, August 2022. As of June 3, 2024: http://www.nber.org/papers/w30389

[24] Bureau of Economic Affairs. "Table 3: Gross Domestic Product: Levels and Change from Preceding Period" September 26, 2025. Available as of October 2, 2025, at https://www.bea.gov/data/gdp/gross-domestic-product

[25] Ibid.

the expected returns on the investment, which may depend on consumption. Thus, if human labor is no longer economically valuable, the factors that drive the bulk of federal revenue could be at risk.

How are AI Systems Priced?

Similarly, the pricing of AI systems will determine the revenue generated from capital and business income. If the prices for AI systems are set by monopolists, then there will be substantial net income to be taxed. On the other hand, if AI systems are accessible at- or near-cost, then there will be little or no profit and hence income from taxation. As discussed more thoroughly in Appendix A, the pricing and profit will depend on the industrial organization of the AI systems in each market. If the market for AI systems for a given task is concentrated in a single firm, the costs will differ from a market that has many participants. The extreme concentration case would be a single supplier with a high barrier to entry such as proprietary data, high requirements for compute, or a highly specialized algorithm. On the other end, the extreme case for a market with multiple participants would be something like open weight models that can be run on personal devices.[26]

Extreme concentration would be expected to have the highest market prices and corporate profits, assuming other factors remain constant. Barring tax avoidance approaches such as shifting intellectual property to foreign subsidiaries, higher profits would result in higher government revenue from corporate taxation and capital gains. Alternatively, in a broadly distributed market, there may be no profits at all and therefore no revenue from corporate taxation on those profits.

If access to AI systems is at-cost or near-cost such as with models that are open weight, then firms in many sectors could be replaced by those AI systems. For example, if an AI system run by taxpayers is capable of competently performing tax accounting and filing functions, then commercial tax accounting firms could be driven out of the market. Thus, if profitable firms were replaced by at-cost AI systems such that substantial profits were no longer collected, the 10 percent of federal revenue from business taxes would be disrupted as would the 7 percent federal revenue from the capital component of individual taxes.[27] Notably, the AI system need not be open weight for it to replace the majority of firms in a market if access to the AI is priced such

[26] Open weight models are those that have the trained weights and parameters publicly available. Currently, many such LLMs are publicly available including the Gemma series by Alphabet, the Llama series by Meta, and the Qwen series by Alibaba. Open weight models are similar to, but not the same as, open source because the training data and code would also be released with open source.

[27] As described in Table 1, 47 percent of federal revenue come from personal income taxes. Since, 21 percent of personal income is from business or capital, we would expect federal revenues from business or capital income that accrue to individuals to amount to 9 percent of federal income, but it is only about 7 percent because the tax rates for capital income are typically lower than other forms of income.

that incumbent firms cannot compete. In the case of a monopolist owned system, there would be some profit and therefore federal revenue.

As mentioned above, another consideration for business income is the ability of individuals to afford consumption. Consumption could be disrupted both by shocks to labor and capital income and by changes in the price of goods. As discussed above, a shock to labor income could reduce consumption and therefore disrupt business income. On the other hand, a dramatic decrease in the price of goods and services relative to income could lead to substantially more consumption. We do not account for potential changes to consumption in our estimates of the direct effects, but the simulation results discussed later do.

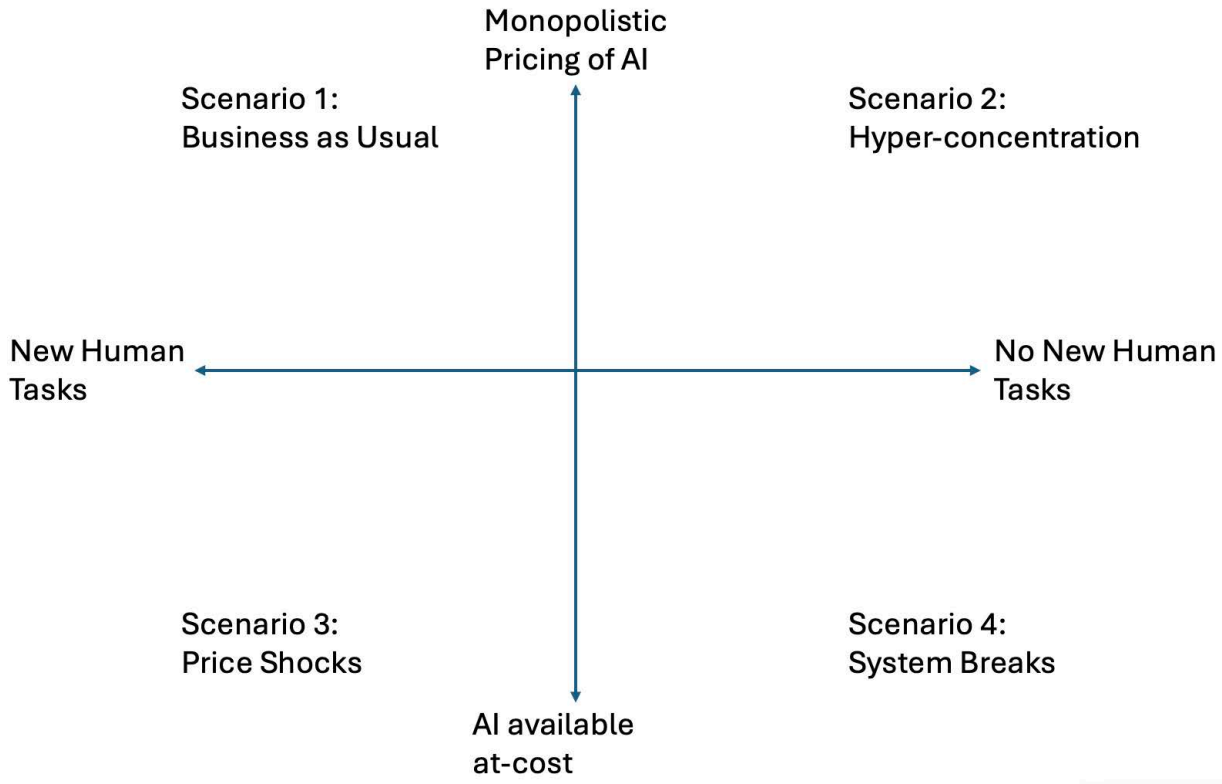
Scenarios

When focusing on the extremes, the two framing questions (do people find new jobs? and how are AI systems priced?) result in four scenarios, presented in Figure 3. These scenarios represent four extreme cases but, it is likely that that the ultimate outcome will differ by the market relevant for each type of task where AI replaces human labor.[28] Thus, while we assume that all markets are homogeneous on these axes, there would likely be variation based on the characteristics of different markets. However, examining the extrema provides an indication of the range of plausible outcomes.

These scenarios differ somewhat from those in Trammel and Korinek and other studies because our focus is the effects of automation as a pure substitute to, and not a complement to, human labor. One implication of this is that our analysis is likely pessimistic because we do not include any productivity gains in addition to the substitution effects. That is to say, we assume that automation produces the goods and services in the exact quantity and quality of the human labor that is replaced.

[28] Here the "market" may be finer than either sector or industry as is commonly used to define a market in economic research, but instead it may be for the specific task in question. So, the market could for the production and filing of a will rather than industry of "Offices of Lawyers."

Figure 3. Scenario Landscape



Scenario 1-Monopolistic Pricing for AI and New Tasks for Humans: Business as Usual

In this scenario, AI replaces human labor in current industries, but humans are able to find other economically valuable tasks. So, while there may be disruptions in the labor market, it will eventually stabilize with people working in new industries. Additionally, this scenario assumes that AI resources are concentrated within each market (and possibly across markets) in a small number of firms.

In automated industries, the model-owning firms collect profits above the price of the inputs (i.e., if the firm can charge more than the cost of the electricity and water to run the models plus an amortized cost of the chips, hardware, etc., then it will be collecting some profit). To the extent that the market for a task is dominated by a single firm and the input costs with AI are lower than the costs for a human to perform the task, we would expect profits to be higher than they are currently. Because humans are able to find new tasks, labor income would not collapse in the long term. Depending on changes in the distribution of consumption, macroeconomic dynamics may reduce the market size (i.e., the price drop is not offset by a sufficiently large increase in quantity) such that aggregate profits from that market would decline.

The net effect could plausibly be higher federal revenue in the long term if labor income from jobs replaced by AI is matched by labor income from the new jobs and more revenue is generated from the higher profits of the AI-generating firms.

Scenario 2- Monopolistic Pricing for AI and No New Tasks for Humans: Hyper-concentration

Here, AI replaces human labor in current industries, but humans are not able to quickly find other economically valuable tasks. The AI systems are concentrated in a small number of firms, possibly just one.

Some portion of salary and wage income may be replaced by transfer programs such as Unemployment Insurance, Temporary Assistance for Needy Families, Social Security Disability Insurance, and others, but the lack of labor income would leave many individuals and households with a dramatic reduction in their ability to consume, even with transfer income. However, these programs have specific qualifications that could exclude some segments of the population out of work and some have time limits. Thus, these transfer programs do not typically bring people to the living standards of someone who is employed full-time. This may be offset by a substantial reduction in prices,[29] but because we are assuming that firms in this scenario would be collecting some profits, prices may still be too high for many.

Federal revenues tied to labor would collapse in this scenario. Corporate, business income, and capital gains taxes could be higher or lower depending on the change in profitability. However, given that labor provides a higher share of federal revenues and labor is taxed at a higher rate than business income, it is likely that federal revenues would decline. In total, two-thirds of federal revenue would be directly vulnerable because of how it is tied to labor. Of the remaining sources of federal revenue, the business, excise, and customs taxes would be vulnerable due to any reduced consumption caused by the decline in labor income to individuals.

Scenario 3- At-cost Pricing for AI and New Tasks for Humans: Price Shocks

Instead of AI resulting in a net decline in labor income, AI systems could displace existing capital if AI systems are accessible at-cost and there are new sources of labor income for humans. Essentially, existing firms are competing against AI systems that are cheaply accessible in a way that drives down their costs such that most goods are delivered at or near the marginal cost of production. Over time, humans find new jobs.

Here business income declines because broadly available AI has reduced profits in many sectors to essentially zero. There may be some profit generated by firms tied to physical goods such as lumber, minerals, or agricultural products, but firms in services industries such as

[29] Prices for some goods may be "sticky" or slow to respond to the decline in the cost. If that is the case, because the shock to labor income would be immediate, individuals would need to spend from either transfer payments or savings to maintain their consumption.

accounting, consulting, or engineering would be fully replaced by commodified AI systems that provide services at or near cost and hence result in zero profits.[30] As noted by economist Ricardo Marto, U.S. corporate profits reached 16.2 percent of national income in the final quarter of 2024 driven largely by sectors benefiting from "the transition toward the digital economy."[31] Thus, the net effect of lower costs and essentially zero profit on the economy would be substantial deflation in the prices for automated services and a general reduction in the Gross National Income, at least nominally. There is a historical analogue for this type of deflation. As measured by economist David Beckworth, between 1866 and 1897, prices fell an average of two percent per year as the United States industrialized.[32] On the other hand, in markets for some goods, there may be more dollars chasing after the same, or only slightly more, physical goods and therefore there could be inflation. This is analogous to as Baumol's cost disease.[33]

For some taxes, nominal prices are more relevant than real prices. For example, nominal prices are relevant for setting the cost basis used for capital gains taxes and some deductions and credits relevant to both individual and business income taxes. Similarly, some transfer programs have backward looking values and thresholds such that the difference between nominal and real prices are relevant.

In this scenario, federal revenues from business income would likely decline, but not go to zero. Revenue from payroll taxes could remain stable if the income distributions before and after the introduction of labor-replacing AI are similar, though revenue from personal income taxes might decline because of a drop in capital gains revenue. 17 percent of federal revenue would be directly vulnerable through the decline in business income, but the creation of new tasks for humans could create new businesses to replace the loss.

Scenario 4- At-cost Pricing for AI and No New Tasks for Humans: System Breaks

In this scenario, labor income goes away as labor demand is replaced by demand for AI. Similarly, capital income declines because AI systems generate no substantive profit. Essentially, automation is so cheap and productive that human labor cannot compete, and the value of most types of capital have declined because automated systems are widely distributed and accessible. This disruption of both labor and capital makes consumption of any goods from non-automated industries difficult for those people without transfer payments. In this case, the economy fails to

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[30] This is explained in more detail in Appendix A.

[31] Marto, Ricardo. "What's Driving the Surge in U.S. Corporate Profits?" April 21, 2025. On the Economy Blog. Federal Reserve Bank of St. Louis. Available as of September 30, 2025 at https://www.stlouisfed.org/on-the-economy/2025/apr/whats-driving-surge-us-corporate-profits.

[32] Beckworth, David. "Aggregate Supply-Driven Deflation and Its Implications for Macroeconomic Stability." Cato Journal 28(3). Fall 2008.

[33] Aghion, Philippe, Benjamin F. Jones, and Charles I. Jones. "Artificial intelligence and economic growth." National Bureau of Economic Research, No. w23928, 2017.

work as it has historically and federal revenue may collapse. 83 percent of federal tax revenue would be directly vulnerable to disruption from the loss of both capital and labor income.

Table 2 summarizes the effects of these scenarios on each type of tax. Without considering revenue from changes in productivity stemming from AI adoption, the only scenario where we would expect an increase in federal revenue is Scenario 1, business as usual. In other cases, we would expect revenue from most types of taxes to decline.

Table 2. Expected Direction of Change in Revenue by Scenarios

Revenue Type	2024 Revenue	Scenario 1: Business as Usual	Scenario 2: Hyper-concentration	Scenario 3: Price Shocks	Scenario 4: System Breaks
Personal Income Taxes	47.5%	0	—	—	—
Payroll Taxes	37.2%	0	—	0	—
Business Income Taxes	10.5%	+	*	—	—
Excise Taxes	1.9%	0	*	0	—
Customs Taxes	1.6%	0	*	0	—
Other	1.3%	0	0	0	0
Net Effect on Federal Revenue	NA	+	—	—	—

NOTE: Here '+' indicates that revenue will likely be higher in the scenario, '—' indicates that revenue will likely be lower, '0' is for revenue that will likely remain the same, and '*' is for cases where the outcome is driven by additional characteristics (in this case, consumption).

Table 3 shows the share of federal revenue directly vulnerable to disruption for each scenario. These values were calculated using the 2024 revenue distribution and whether the income was tied to either labor or capital. The disruption of more types of inputs to federal revenue would lead to a progressively larger vulnerability, though disruptions to labor income are particularly disruptive because federal taxation is disproportionately targeted toward income rather than capital taxation.

Table 3. Share of Federal Revenue Vulnerable to Labor Replacing AI by Scenario using 2024 Revenue Distribution

	New Human Tasks	No New Human Tasks
Monopolistic Pricing	1. Business as Usual (0 percent vulnerable)	2. Hyper-concentration (65 percent vulnerable) [34]
At-Cost Pricing	3. Price Shocks (20 percent vulnerable)[35]	4. System Breaks (83 percent vulnerable)[36]

While the baseline assumption was that there would be no increase in productivity, we can use the values in Table 4 to produce rough estimates for the productivity growth that would be required to make up the revenue. In scenario 1, there is not necessarily any revenue lost and so there is no need for additional productivity growth for AI to be revenue neutral. In scenario 2, the productivity from capital would need to increase by around 77 percent to be revenue neutral (productivity from labor is irrelevant because there is no remunerative labor in this scenario).[37] On the other hand, in scenario 3, productivity would only need to increase by roughly fifteen percent from AI to be revenue neutral.[38] In scenario 4, productivity growth does not raise federal revenues, so there is no revenue neutral level.

Transition Paths to Highly Capable AI

The discussion thus far has been around static end states, but because these technologies are being rolled out incrementally and, in particular, the robots required to do physical labor will take time to build, the displacement of human labor will likely be gradual and job-by-job. Here we will test the four scenarios above with 10 percent of the workforce displaced by AI rather

[34] Revenue associated with labor is vulnerable here so all of the 37 percent from payroll taxes and the 28 percent from the labor share of individual taxes (60 percent of 47 percent).

[35] This comes from corporate income taxes (10 percent of federal revenue) and business and corporate income in the individual tax code (21 percent of 47 percent).

[36] This is the sum of the 66 percent of federal revenue associated with labor and the 17 percent associated with business and capital.

[37] If we assume the tax rate for capital is half that of labor and use 2025 data on corporate profits ($3.9 trillion) and wage and salaries ($12.9 trillion), in scenario 2 where all labor is completely replaced by monopolistic AI companies with profit about the same size as wage and salary income, then output would need to be (12.9 + 3.9*0.5)/(0.5*3.9 + 0.5*12.9) = 1.77, So, productivity would need to be 77 percent higher. National Income by Type of Income on the Corporate Profits FRED, “Table 1.12 National Income by Type of Income” Federal Reserve Bank of Saint Louis. https://fred.stlouisfed.org/release/tables?rid=53&eid=15372

[38] Using the same assumptions as for scenario 2, for scenario 3, output would need to be (12.9 + 3.9*0.5)/(12.9) = 1.15, So, productivity would need to be 15 percent higher.

than the full workforce.[39] We will first use a simulation model where the displaced workers come from across the income distribution to compare outcomes for the four scenarios described above. Then we will consider the implications of a case where the top ten percent of workers are displaced.

Simulation of Transition Scenarios

We tested four scenarios using a Dynamic Stochastic General Equilibrium (DSGE) model developed as part of the RAND Budget Model Initiative that is based on the Federal Reserve Board's FRB/US model.[40] For this study, we modeled each of the four scenarios as a shock and then evaluated the outcomes after ten years. So, ten percent of workers from across the income distribution are replaced by AI in a single year and then the economy rebalances assuming no more shocks. While it is certainly plausible that labor replacement from AI would either be more spread out over time or not constrained to ten percent of the workforce, this simulation provides an indication of the scale of the effects from a sudden shock. Additional details about the simulation are available in Appendix B. Table 4 has the effects on the economy at the end of 10 years for the different scenarios.

Table 4. Simulation Results for a 10 Percent Employment Shock

	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
New Jobs for Humans?[a]		Yes	No	Yes	No
Pricing of AI[b]?		Monopolistic	Monopolistic	At-cost	At-cost
Annual Real GDP Growth	1.8%	2.0%	1.8%	1.9%	1.7%
Nominal GDP 2035 ($ Trillions	43.9	43.0	48.3	32.4	33.2
Federal Revenue Personal Income (% of GDP)	14.0%	14.2%	12.5%	15.6%	14.5%
Federal Revenue Corporate Income (% of GDP)	2.8%	3.6%	3.0%	1.9%	0.7%
Interest Rate[c]	3.5%	3.4%	4.1%	1.5%	1.4%
Inflation Rate[d]	2.0%	1.7%	3.5%	-2.0%	-2.0%

[39] The specific level of 10 percent is arbitrary. However, 10 percent works well for this analysis because it is sufficiently large that it can have measurable effects with our simulation, but not so large that it breaks the assumptions of the simulation model.

[40] Board of Governors of the Federal Reserve System, "FRB/US in Python," webpage, last updated February 12, 2025; Flint Brayton and Peter Tinsley, A Guide to FRB/US: A Macroeconomic Model of the United States, Federal Reserve Board, 1997

	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4

SOURCE: RAND macroeconomic simulations of the 10 year time horizon from 2025-2035. Our simulations implement a set of shocks that begin in the first quarter of 2025 and last for a fixed duration: the specific set of shocks and their durations depend on the scenario. Details are presented in Appendix B. In all scenarios we adjust Total Factor Productivity so that the net change in output associated with replacing human labor is zero.[41]
NOTE: [a]New Jobs for Humans indicates whether human labor displaced by AI are able to find other jobs in new industries in this scenario.
[b]Pricing of AI indicates whether or not the AI is priced monopolistically.
[c]The interest rate shown is the projected average rate of interest on the existing federal debt in 2035.
[d]The Inflation Rate is the projected core consumer price inflation rate in 2035. The reported growth rate of real GDP, nominal GDP, and federal revenues from personal income taxes and corporate income taxes are projected values in 2035.

The key implications of model results from these scenarios are:

- Nominal GDP is substantially lower if AI systems lead to substantive deflation, but real GDP growth rate is similar.
- Lower nominal GDP would also lower federal revenues by about a quarter if AI leads to substantive deflation. This makes it much harder to service the national debt because interest payments are based on the debt in nominal dollars.
- Because federal revenue disproportionately comes from individual and payroll taxes, scenarios where people are able to find other jobs after being displaced by AI result in substantially higher revenue.
- Highly concentrated AI systems result in much higher inflation and interest rates, particularly if individuals cannot find employment after being displaced.

Narratively, the shock to either the employment or labor force participation rate leads the Federal Reserve, based on its mandate to sustain maximum employment, to take steps to lower interest rates which can spur investment and economic growth. We did not assume any fiscal response to the employment shock. If investors see higher returns by investing in firms because the risk adjusted returns for investing in firms is higher than alternatives (possibly because firms are able to receive monopolistic returns), then the economy continues to grow. However, if AI systems are predominately either open weight or the market is highly competitive, there could be substantial deflation that leads to a much lower nominal GDP. Because debt grows based on the deficit and interest rates, rather than inflation, a lower nominal GDP makes debt service more difficult.

These summary statistics obscure significant time-variant effects on the macroeconomic variables considered. We present some shorter term results in Table B.1 in Appendix B, which show that in the short term, before . All of the simulations are path dependent, and because FRB/US is a DSGE model, all variables will tend towards an equilibrium that may not represent

[41] It is important to note that this increase in productivity is the mechanism to keep the economy's output the same while eliminating ten percent of employment. It does not represent productivity growth from AI complementing the existing workforce except in so far as complementarity is the mechanism by which jobs are replaced.

reality. For example, the model assumes that unemployed persons will receive sufficient transfer payments to continue consuming (an average of sixty percent of their prior rate) – particularly in Scenario 4, this may not be the case. An alternative modeling approach could examine the path dependence and a broad suite of policy interventions. Additionally, future work could include structural changes to the model to explore alternate formulations of the relationship between capital and labor.

Additionally, the result that nominal GDP is higher with monopolies controlling AI systems may seem counter intuitive because monopolies typically result in less output than with a high degree of competition. However, this result looks at nominal output and therefore hinges on pricing rather than the degree of competition. In each case, by assumption, AI produces the same quantity as human labor, and so real output is essentially identical before and after the introduction of the labor replacing AI system. The nominal output will be a function of the pricing, so the nominal output when accessing AI is priced at-cost would be lower than with monopolistic priced AI systems. Over time, as humans either find new work or do not find new work, the economic output may change, but the nominal output will depend on the pricing and, whether there is deflation. Likewise, if AI systems increase productivity, output could also increase. This is discussed in more detail in Appendix B.

Transition Scenarios Focused on High Paying Jobs

The simulation scenarios assumed the 10 percent of the workforce replaced by AI came from across the income distribution. As an alternative, we also consider the scenarios where the 10 percent of the affected workforce are from the highest paid segment of the population. This could occur if the highest paid knowledge work is automated first or if AI assistant systems disproportionately benefit less experienced workers in the highest paid fields. In practice this would like a radiologist being fully replaced by AI systems[42] or an AI assistant system allowing a junior attorney to perform all the tasks of a senior partner. Unless the computational costs are substantially higher than for other jobs, AI systems that replace the highest paid jobs have the potential to produce more profit per unit for a monopolist.[43] Thus, it is worth considering the consequences of labor-replacing AI that first targets high income jobs and then lower income jobs with monopolistic AI models and at-cost AI capabilities.

In 2022, the 10 percent highest earning adults brought home 49.4 percent of all pre-tax national income and contributed 72 percent of federal revenue from individual taxes (which is 34

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[42] Notably, AI researcher Geoff Hinton's 2016 prediction that AI systems would replace radiologists within five years has failed to manifest even nine years later. See Stempniak, Marty. "NY Times revisits Nobel Prize winner's prediction AI will render radiologists obsolete." Radiology Business. May 15, 2015. Available as of October 1st, 2025 at https://radiologybusiness.com/topics/artificial-intelligence/ny-times-revisits-nobel-prize-winners-prediction-ai-will-render-radiologists-obsolete.

[43] In practice, the higher paid jobs may be harder to automate with AI, but for the purposes of this thought experiment, we will focus on the highest paid jobs because that provides an indication of the largest possible effect.

percent of all federal revenue).[44] The payroll tax revenue is not as concentrated, though it is also not evenly distributed across the income distribution. So, a shock to the wage and salary income for these high earners would also be a shock to federal revenues with roughly a quarter of all federal revenue[45] being directly vulnerable. That type of shock would be slightly larger than the dip in federal revenues associated with a recession (as can be seen in Figure 1) and the associated change to consumption and effects on the broader economy would be a further shock to federal revenues.

- If these jobs are automated using models that are priced monopolistically, those firms would be able to extract economic profits such that corporate income taxes could offset as much as half of that income[46] depending on the cost savings associated with AI. So here the dip in revenues would likely be smaller than that seen in a typical recession.
- If these jobs are automated by models provided at-cost, there would likely not be significant profits and therefore the loss in federal revenue would not be offset. In this case, there would be a significant loss in federal corporate tax income on top of the loss in individual income. The end result would be a significantly larger drop in federal revenues than a typical recession.

The other sectors of the economy would be disrupted by the loss in demand associated with the highest earners diminished ability to consume (though capital income is a significant portion of total income for high earners). So, because of the relatively high level of income inequality in the United States, an income shock to the highest earners associated with AI would significantly disrupt the U.S. economy as a whole and also federal revenue. Importantly, there could be a significant disruption to the economy and federal revenue whether or not new jobs or industries are created to employ this population if there is a gap in their earnings and consumption. Some of the consumption from this population could be offset by their wealth but that assumes that wealth is sufficiently liquid to be converted for consumption.

Conclusions

The introduction of AI systems that replace human labor would be disruptive along many dimensions, including to federal revenue. Depending on how AI systems are developed, the effects on tax revenue could be minimal (or even positive) or could substantially erode the tax base. Because federal revenues disproportionately come from labor income and income in the United States is relatively concentrated, labor-replacing AI could be a significant shock to the economy and federal revenues. We conclude this report with a discussion of possible indicators

[44] Internal Revenue Service, "Table 4.1" SOI Tax Stats—Individual statistical tables by tax rate and income percentile. March 26, 2025. Available as of October 1, 2025, at https://www.irs.gov/statistics/soi-tax-stats-individual-statistical-tables-by-tax-rate-and-income-percentile.

[45] While the top 10 percent of income account for 34 percent of all federal revenue, a portion of that is capital income and so the labor share of federal revenue from the top 10 percent amounts to about 25 percent.

[46] The top marginal tax rate for individuals is about twice that of the marginal tax rate for corporations.

that describe which scenario might be most likely and policy responses to mitigate the possible downsides.

Scenario Indicators

In a 2021 study, William Nordhaus applied the tools of economic analysis to the concept of the Singularity, the hypothetical point in time when AI becomes sufficiently self-improving to make exponential growth in its capability and he noted several indicators about whether AI systems were approaching the Singularity:

> "1. Elasticity of substitution between capital and labor greater than one
>
> 2. Rising productivity growth
>
> 3. Rising share of capital
>
> 4. Accelerating growth in capital-output ratio
>
> 5. Rising share of information capital
>
> 6. Rising productivity growth hidden because of mismeasurement."

None of these are perfect measures, but all are easily observable. In addition to these early warnings of the Singularity, there are additional potential measures that would indicate whether this is likely to occur in the near term, and, if so, which scenario could be most likely.

- **Pace of Algorithmic Advancement:** The transformer architecture using an attention mechanism has been the basis for the current wave of advancements in the large language model branch of AI. The pace of incremental improvements to this architecture and the invention of new approaches is an important factor for understanding the trajectory of advancements. In particular, the pace of algorithmic improvement is relevant for understanding the efficiency of the models. [47] The largest models require highly specialized hardware, but as models get smaller, they can move further to the edge such that some models can run on smartphones. This factor is particularly relevant for assessing the cost of inputs to AI models and also the likelihood that AI systems are priced at-cost.
- **Model Capabilities:** Related to model efficiency, another dimension of algorithmic advancement is on the breadth of model capabilities. In order to replace human labor as explored in this paper, the nature of tasks that AI systems can reliably perform will need to expand. Model performance on a range of benchmarks is one approach to evaluate this, but because the models may be trained on the benchmarks, this may not be a reliable approach.
- **Gap Between Open and Closed Models:** If there is a sizable gap in performance between closed-weight models and open weight models, the monopolistic pricing

[47] Price, Carter C., Brien Alkire, and Mohammad Ahmadi. "Algorithmic Advancement in Artificial Intelligence: A Survey of Advances with Projections for the Near Future," RAND Corporation, RR-A3485-1, 2025. As of July 25, 2025: https://www.rand.org/pubs/research_reports/RRA3485-1.html

scenarios more likely. This may vary sector-by-sector and so sector-level monitoring may be needed.

- **Pace of Advancement in Robotics:** As with algorithmic advancement, robotics will need to advance in performance, price per unit, and unit production for human labor to be fully automated.

Policy Responses

There are several policy interventions that could be considered to prepare for the possibility that AI dramatically disrupts the U.S. economy and the federal government:

- **Preparatory Debt Reduction:** Since shocks induced by AI could substantially disrupt federal revenues, steps could be taken now to reduce federal debt now so that the federal balance sheet can withstand larger shocks in the future.
- **Shift from Labor Taxes:** Because 83 percent of federal revenues are currently from either individual income taxes or payroll taxes, federal revenue is increasingly vulnerable to labor shocks. Changing the tax code to raise more revenue from corporations or through excise taxes would change the risk profile related to shocks in federal revenues.
- **Intentional Inflation:** Because some factors in the tax code are tied to nominal values, such as asset prices when calculating capital gains taxes, intentionally inducing inflation to maintain nominal prices could help preserve some revenue from capital gains taxes. However, this could adversely affect individuals with fixed incomes or stagnant wages and also the holders of assets without inflation protection (e.g., holders of fixed rate debt like fixed rate mortgages).
- **AI Excise Taxes:** The federal government could impose excise taxes targeted toward model inputs such as computer hardware and electrical power generation that would supplement tax revenue, particularly during the transition phase when AI begins replacing human labor. Similarly, AI queries or the computational time (or operations) for AI systems could be taxed.
- **Eliminate Tax Avoidance Schemes:** If AI systems are concentrated, the federal revenue could be significantly reduced if the system owners employ corporate tax avoidance schemes such as moving intellectual property to foreign subsidiaries. Eliminating these practices could result in higher federal revenues.
- **Universal Income:** To replace people's income and prevent the collapse of consumption capability for households that lose the ability to earn labor income, a universal income program could be put in place to ensure some floor on individual or household income.[48]
- **Government Ownership of Models:** Nationalizing AI monopolies would allow the federal government to collect additional revenue that could support policies like a universal income. However, this would be a substantial change to the economic system of the United States and may require changes to U.S. Code or even the Constitution.

[48] For example, Hasdell, Rebecca. "What We Know About Universal Basic Income A Cross-Synthesis of Reviews." Stanford Basic Income Lab. July 2020. Available as of October 1, 2025 at https://basicincome.stanford.edu/research/papers/what-we-know-about-universal-basic-income/

This list is non-exhaustive, and we did not evaluate these options to determine the viability or desirability of any policy option or combination of options.

Future work

To make this research question tractable, we made several strong assumptions that could be relaxed in future work.

- We focused on federal revenue, but that is only one factor of interest. Notably, federal costs for social safety net programs would likely increase with large scale unemployment. Additionally, there would likely be broad social changes from these types of AI systems.
- We did not explore policy interventions and their implications. Policymakers will need to understand the tradeoffs associated with any policy response.
- This work also assumed the existence of labor-replacing AI systems, but we did not consider different paths to these systems. We did not assess whether or how the sequencing and timing of when AI systems replace human labor affect the outcomes or recommendations. Similarly, some fields of intellectual labor may be slower for AI to replace because of the reliance on tacit knowledge or other factors. An assessment of the transition period could help design better policies for different paths.

Appendix A. A Framework for Assessing the Compute Demands for a Task

This appendix contains a more formal discussion of the assumptions made in the body of the study and their implications. Because we are interested in the revenue effects of AI and many taxes depend on nominal prices (e.g., capital gains taxes use nominal asset prices to determine the cost basis), we are not considering adjustments for inflation (or deflation).

Prices with AI

First, we will examine how AI might affect the size of the economy as measured by GDP. Let us assume that highly capable AI systems are substitutes for labor rather than complements. An initial effect of these highly capable AI systems could be a significant reduction in the prices for the services that are automated using AI. However, the specific price level will depend on the degree of market concentration and on the price of the inputs to the models.

Consider three prices for a task:

- p_I: the price of the inputs to the task to be done by AI,[49]
- p_M: the profit-maximizing price for a monopolist, and
- p_H: the price for a human to do the task.

Assuming identical outputs of identical quality, the extent to which human labor will be replaced is dependent on the relative price. In practice, this assumption may not hold because AI may be faster, or humans may be biased towards (or against) interacting with humans for certain tasks. The implication is that there will be some factors other than price that factor into the decision about whether and how to deploy AI tools.[50]

We assume that the marginal cost for AI to perform an appropriate task is equal to the price of the inputs. In practice, this means that the quantity supplied to the market is constrained only by demand, assuming that there are adequate computational resources available. For knowledge work, this assumption may be reasonable, particularly if smaller models can do the bulk of the tasks. For physical work, p_I could be substantially higher than simple knowledge tasks because robots may be required.

For tasks where systems based on open weight AI are appropriate, the price for the task will be the minimum of p_H and p_I. For tasks where a closed-weight model is dominant, the price for the task will be the minimum of p_H and p_M, so long as p_M is greater than p_I. If p_M is less than p_I,

[49] The price for the inputs will primarily be the cost of the electricity to power the chips and the amortized cost of the chips and other hardware.

[50] Price and Sandler, forthcoming.

then humans will continue to perform the task. There could be intermediate outcomes where some subset of tasks is automated, but those dynamics are beyond the scope of this analysis.

Market Size

So, we can imagine three market outcomes for a given market for task j depending on how the status quo (SQ) compares to the world with highly capable AI:

- Larger market ($P_{j,AI} * Q_{J,AI} > P_{J,SQ} * Q_{J,SQ}$): This would occur if the quantity of the service consumed is sufficiently higher than the current quantity to overcome the reduction in market prices. This type of effect requires there to be substantial unmet demand in the status quo and likely for $P_{j,AI}$ to be larger than the price of inputs.
- Smaller market ($P_{J,AI} * Q_{J,AI} < P_{J,SQ} * Q_{J,SQ}$): Here the decline in the market price shrinks the value of the market despite any increase in the quantity consumed. This might occur for tasks where there is a substantial decline in the price (say for those areas where open models are sufficient) or where the demand curve flattens.
- No change ($P_{J,AI} * Q_{J,AI} = P_{J,SQ} * Q_{J,SQ}$): This would likely primarily occur in markets where AI is not used but could also occur if the increase in quantity consumed is linearly offset by the decrease in price.

Alternatively, if we assume that humans find additional tasks with a market value, it is possible that there would be markets for a new set of tasks, K, that would be created by the introduction of AI such that ($P_{k,AI} * Q_{k,AI} > P_{k,SQ} * Q_{k,\,SQ} = 0$).

So, the size of the economy in the status quo is $Y_{SQ} = \sum_{j \in J} P_{j,SQ} \cdot Q_{j,SQ}$, and the size of the economy with AI will be $Y_{AI} = \sum_{j \in J} P_{j,AI} \cdot Q_{j,AI} + \sum_{k \in K} P_{k,SQ} \cdot Q_{k,SQ}$.

So, $Y_{AI} > Y_{SQ}$ will require some combination of conditions.

- The volume of consumption with AI needs to be larger than the status quo consumption So, $Q_{j,AI} > Q_{j,SQ}$ for some j in J. On average, the quantity consumed would need to increase by $Q_{j,AI} > \frac{P_{j,SQ}}{P_{j,AI}} \cdot Q_{j,SQ}$. Because $P_{j,AI}$ is lower for open models than closed models, we should expect closed models to result in a higher nominal GDP than with open models barring general equilibrium effects such as higher volumes of consumption in other tasks.
- The size of the value from tasks performed by humans grows by more than what was lost by the price decrease caused by AI uptake.

Barriers to Entry and Business Models

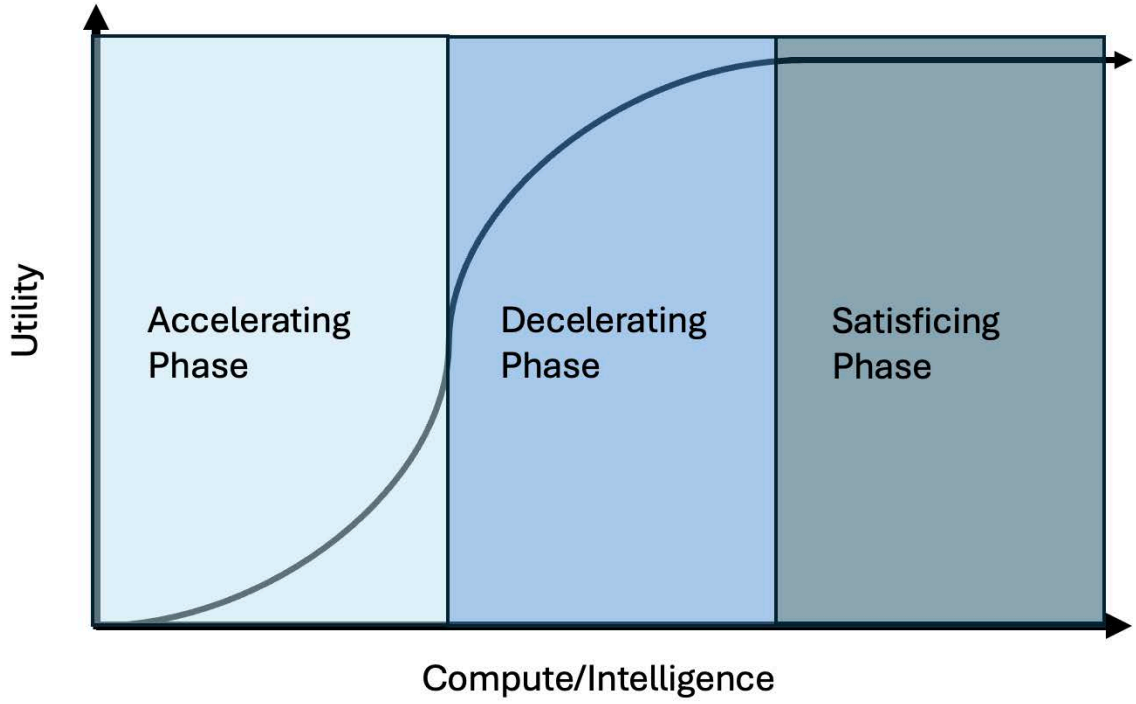
Next, we will explore the conditions under which we would expect a market to be dominated by a single model or open models.[51]

[51] We will be ignoring the question of what constitutes a market. Specifically, we are agnostic in this study about whether there is a single market for LLMs or many sub-markets for tailored models.

All other things being equal, the quantity of a task performed would be expected to be greater with adequate AI because the price would be lower than when done by humans. However, in reality, if there were a loss of income due to unemployment, the demand would also be expected to decrease and so the equilibrium level of consumption may not be higher than the status quo. The net effect would depend on the price of a basket of goods and services relative to other income sources, and the nature of the goods and services being consumed. We can categorize AI based on the nature of the demand and computational intensity of the products:

- **Satisficing tasks** are those where an individual needs the work done to a certain level and any additional effort is unnecessary. These tasks would include filing taxes or completing paperwork. In these cases, we would expect there to be some minimum level of effort to be required to complete the task adequately, but additional effort provides no additional utility. We can define Qs to be the quantity produced that satisfies the demand.
- **Decelerating tasks** are those where the marginal compute increases the economic value by less than the cost of the additional compute. Many optimization tasks may fall into this category; for example, if a simple algorithm finds a route that takes 30 minutes, but the route produced by a complex algorithm is 29 minutes, that additional minute in transit time saved may not be worth the additional computational costs.
- **Accelerating tasks** are those where the marginal compute increases the economic value by more than the cost of the additional compute. If two AI systems are competing in a winner takes all environment, the additional compute to have a higher performing model would be worth it so long as the cost for the additional compute remains below the value of the market.

Figure 4. Illustrative Relationship Between AI Inputs and the Utility of Outputs



This framework has implications for the structure of different markets. First, we do not expect a single AI model to dominate all tasks because (1) different types of models are better suited for different types of tasks and (2) for satisficing tasks a general model is likely to be more computationally expensive during inference than a narrow model. So, we would expect the market for satisficing tasks to be dominated by the lowest cost narrow AI model. For decelerating tasks, we may expect multiple AI models to exist at different price points or calibrated to different tastes, some of which may be a general model and others which could be a narrow model. For accelerating tasks, we would expect the market to be dominated by the highest performing model, which may be a general model, though not necessarily. Thus, there is not an inherent reason for the market for AI systems to be a natural monopoly across all tasks, but within a given type of task it may be.

Finally, for two AI models with identical performance, we would expect the model with the lowest price to dominate. We would expect for that to be the open model, except when the closed model can provide some value above the price difference such as bundling with other valuable services, subsidization from another business line that benefits from the information gleaned by the data collected from providing the closed model at or below cost, or some other mechanism to make the closed model price competitive.

Appendix B. Model Description

This Appendix contains descriptions of the simulation model that we used to model scenarios where ten percent of the workforce is replaced by AI systems. As noted above, while the specific value of ten percent is arbitrary, it is sufficiently large that the model will provide meaningfully different results but not so large that model assumptions will be violated.

We used a Dynamic Stochastic General Equilibrium (DSGE) model based on the FRB/US model developed by the Federal Reserve Board and modified as part of the RAND Budget Model Initiative.

The FRB/US model was designed to simulate trends in the U.S. economy. FRB/US captures the relationships between over 200 economic indicators by fitting regressions based on quarterly historical data going back to 1962.[52] The model then uses these relationships, along with a threshold-based response by the Federal Reserve to set monetary policy at each quarter, to simulate how the economic indicators will develop in the future. The model allows the user to define shocks to a subset of these economic indicators; a shock is defined both by the magnitude of the impact to an indicator as well as the duration of the impact. Following a shock, the model uses fiscal and monetary policy responses to get the economy back to the long-term target of a stable economy.[53] Additional details about the modifications to the FRB/US model made as part of the RAND Budget Model Initiative can be found in Nygaard, Price, and Suresh (2025).

In this paper, we consider a 10-year time horizon for the simulations, with shocks starting in the first quarter of 2025 and lasting for specified durations. We used a set of shocks to correspond to each of the scenarios described in the body of the report. The specific scenarios and the shocks used in are described below, followed by short and long term simulation results from each of these scenarios in Table B.1.

- Scenario 1-Monopoly Priced AI Systems and New Tasks for Humans: Business as Usual
  - Unemployment increases as AI replaces labor, but humans find new jobs over time.
    - We model this as a negative shock to employment across all sectors. In our model, the base level of unemployment in 2025 is 4.2 percent, and is projected to remain at this level. We increase the unemployment rate to 14.2 percent and set this increase to last for 5 years; after 5 years, we assume that humans can find new jobs, and unemployment returns to its baseline.

[52] These models have been thoroughly tested by the Federal Reserve and been found to have high predictive accuracy. They are not re-estimated with each new quarter of data – the most recent update was in 2017. https://www.federalreserve.gov/econres/us-models-about.htm

[53] FRB/US allows many different options for the long-term target, including stabilizing the debt-to-GDP ratio or stabilizing the surplus-to-GDP ratio.

  - Total factor productivity increases as AI replaces the labor of the 10 percent of the workforce that was displaced, and this workforce then begins to produce in new jobs.
    - We model this as an 11 percent increase in Total Factor Productivity so that the net change in output associated with replacing human labor is zero. We set this shock to last for 10 years. It is important to note that this increase in productivity is the mechanism to keep the economy's output the same while eliminating ten percent of employment. It does not represent productivity growth from AI complementing the existing workforce except in so far as complementarity is the mechanism by which jobs are replaced.

- Scenario 2- Monopoly Priced AI Systems and No New Tasks for Humans: Hyper-concentration
  - Labor force participation rate declines as some humans are permanently pushed out of the labor market.
    - We model this as a negative shock to the labor force participation rate (LFPR). In our model, the base LFPR in 2025 is 62.7 percent, and is projected to remain at this level. We decrease the LFPR to 52.7 percent and set this decrease to last for 10 years.
  - Total factor productivity increases as AI replaces the labor of the 10 percent of the workforce that was displaced. Because the model assumes both capital and labor are required for production, and because total production does not change, we scale up total factor productivity.
    - We model this as a 5 percent increase in total factor productivity so that the net change in output associated with replacing human labor is zero. We set this shock to last for 10 years.
    - We account for this increase in total factor productivity by doing out-of-model corrections for revenue attributed to corporations and to persons. That is, we adjust the government revenue from persons down by 10 percent and reallocate half of this adjustment to government revenue from capital, as this is the amount that was attributed to labor by the model's assumption that capital and labor are both required for production.

- Scenario 3- At-Cost AI Systems and New Tasks for Humans: Price Shocks
  - Unemployment increases as AI replaces labor, but humans find new jobs over time.
    - As in scenario 1, we increase the unemployment rate to 14.2 percent and set this increase to last for 5 years; after 5 years, we assume that humans can find new jobs, and unemployment returns to its baseline.
  - Total factor productivity increases as AI replaces the labor of the 10 percent of the workforce that was displaced, and this workforce then begins to produce in new jobs.
    - As in scenario 1, we model this as an 11 percent increase in total factor productivity. We set this shock to last for 10 years. As in scenario 2, we do an out of model adjustment to reallocate 5% of the government revenue from labor to government revenue from capital, as this is the amount that was attributed to labor by the model's assumption that capital and labor are both required for production.

  - Prices on consumer goods and services decrease, as AI systems producing these goods and services are owned by the population at large.
    - We model this as decreasing the inflation rate on personal consumption excluding food and energy from a baseline value of 2 percent to -2 percent for the 10-year time horizon. This is consistent with the pace of deflation caused by industrialization from 1866 to 1897 as measured in Beckworth (2008);[54] we expect AI in this scenario could have a similarly disruptive effect on prices.

- Scenario 4-At-Cost AI Systems and No New Tasks for Humans: System Breaks
  - Labor force participation rate declines as some humans are permanently pushed out of the labor market.
    - As in Scenario 2, we decrease the LFPR to 52.7 percent and set this decrease to last for 10 years.
  - Total factor productivity increases as AI replaces the labor of the 10 percent of the workforce that was displaced.
    - As in Scenario 2, we model this as a 5 percent increase in total factor productivity. We set this shock to last for 10 years.
    - We account for this increase in total factor productivity by doing out-of-model corrections for revenue attributed to corporations and to persons. We adjust the government revenue from persons down by 10 percent, as this is the amount that was attributed to labor by the model's assumption that capital and labor are both required for production. However here, because the AI systems are provided at-cost, the increased productivity does not get taxed as corporate income.
  - Prices on consumer goods and services decrease, as AI systems producing these goods and services are owned by the population at large.
    - As in Scenario 3, we model this as decreasing the inflation rate on personal consumption excluding food and energy from a baseline value of 2 percent to -2 percent for the 10-year time horizon.

Table B.1. Simulation Results for a 10 Percent Employment Shock

	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
New Jobs for Humans?[a]		Yes	No	Yes	No
Pricing of AI[b]?		Monopolistic	Monopolistic	At-cost	At-cost
Annual Real GDP Growth					
2027	2.1%	2.2%	2.1%	2.3%	2.3%
2030	1.9%	2.0%	1.9%	2.2%	2.1%
2035	1.8%	2.0%	1.8%	1.9%	1.7%
Nominal GDP 2035 ($ Trillions					

[54] Beckworth, David. "Aggregate Supply-Driven Deflation and Its Implications for Macroeconomic Stability." Cato Journal 28(3). Fall 2008.

		Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	2027	32.5	32.5	32.7	30.8	30.9
	2030	36.5	36.2	37.6	32.1	32.1
	2035	43.9	43.0	48.3	32.4	33.2
Federal Revenue Personal Income (% of GDP)						
	2027	13.0%	12.9%	11.8%	13.6%	12.4%
	2030	15.1%	15.0%	13.7%	16.5%	15.4%
	2035	14.0%	14.2%	12.5%	15.6%	14.5%
Real Federal Revenue Personal Income ($ Trillions)						
	2027	3.2	3.2	2.9	3.5	3.2
	2030	3.9	4.0	3.5	4.6	4.2
	2035	4.0	4.2	3.5	4.7	4.2
Federal Revenue Corporate Income (% of GDP)						
	2027	2.7%	3.4%	3.3%	2.6%	2.3%
	2030	2.7%	3.7%	3.1%	2.3%	1.4%
	2035	2.8%	3.6%	3.0%	1.9%	0.7%
Real Federal Revenue Corporate Income ($ Trillions)						
	2027	0.66	0.85	0.80	0.66	0.59
	2030	0.69	0.96	0.80	0.64	0.39
	2035	0.80	1.05	0.86	0.57	0.21
Interest Rate[c]						
	2027	3.8%	3.7%	3.8%	2.8%	2.8%
	2030	3.5%	3.4%	3.9%	1.7%	1.8%
	2035	3.5%	3.4%	4.1%	1.5%	1.4%
Inflation Rate[d]						
	2027	2.0%	1.8%	2.4%	-2.0%	-2.0%
	2030	2.0%	1.4%	3.0%	-2.0%	-2.0%
	2035	2.0%	1.7%	3.5%	-2.0%	-2.0%

SOURCE: RAND macroeconomic simulations of the 10 year time horizon from 2025-2035. Our simulations implement a set of shocks that begin in the first quarter of 2025 and last for a fixed duration: the specific set of shocks and their durations depend on the scenario. Details are presented in Appendix B. In all scenarios we adjust Total Factor Productivity so that the net change in output associated with replacing human labor is zero.[55]
NOTE: [a]New Jobs for Humans indicates whether human labor displaced by AI are able to find other jobs in new industries in this scenario.

[55] It is important to note that this increase in productivity is the mechanism to keep the economy's output the same while eliminating ten percent of employment. It does not represent productivity growth from AI complementing the existing workforce except in so far as complementarity is the mechanism by which jobs are replaced.

	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4

[b]Pricing of AI indicates whether or not the AI is priced monopolistically.

[c]The interest rate shown is the projected average rate of interest on the existing federal debt. [d]The Inflation Rate is the projected core consumer price inflation rate.

Limitations

The FRB/US model on which our model is based is primarily designed to inform monetary policy through simulation of the effect of the Federal Reserve's actions. As the Federal Reserve's main policy lever is to set the federal funds rate, FRB/US tends to emphasize this channel. The model is not designed to accommodate extreme shocks; not only are we constrained in the size of shocks we can consider, but we are also constrained by the fixed nature of the relationships between economic indicators. For example, we would expect that in extreme departures from the state of the world as we currently know it, firms and individuals may not behave in the same way that they currently do. That is to say, for very large changes from the prior equilibrium, this model may not be able to appropriately model the behavior. Finally, this model assumes all firms and persons are homogenous, and distributional impacts are therefore difficult to disentangle.

Abbreviations

AI	artificial intelligence
DSGE	Dynamic Stochastic General Equilibrium
GDP	gross domestic product
IRS	Internal Revenue Service
LLM	large language model
SOI	Statistics of Income

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