Vanguard

Vanguard research

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Vanguard economic and market outlook for 2026

AI exuberance: Economic upside, stock market downside

Rapid evolution has increased the potential of artificial intelligence (AI) to become a transformative economic force, with promising implications for productivity across industries. Adoption is accelerating, and while today's AI leaders dominate headlines, tomorrow's winners may look very different. The outlook for markets is nuanced.

Higher growth is on the horizon

On the back of AI capital investment and a potential productivity surge, the US economy could eventually grow by 3%. Solid growth and still-sticky inflation will leave the US Federal Reserve with limited room to cut rates below our 3.5% estimate of the neutral rate, which would neither promote nor restrict economic activity. **Page 3**.

Equity markets may remain exuberant but face rising risks

In the near term, growth- and tech-heavy US equities could continue to play an outsized role in shaping sentiment across global capital markets. However, US-based AI scalers' track record of growing earnings year after year will come under renewed scrutiny as they embark on unprecedented AI capital investment. **Page 10**.

We favour fixed income and value stocks

We maintain our view that high-quality bonds offer compelling real returns. From a risk-return perspective, both US value-orientated and non-US developed-market equities provide more attractive prospects than US growth equities, especially if AI transforms the economy. These asset classes should benefit most over time as AI's boost to productivity broadens to consumers of the technology. **Page 15**.

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Vanguard's 2026 economic forecasts

Country/region	Growth	Core inflation	Unemployment rate	Policy rate (year-end)	Key risk to our view
US	2.25%	2.6%	4.2%	3.5%	AI optimism collapses and investment buildout stalls
Euro area	1.2%	1.8%	6.3%	2.0%	Inflation materially undershoots the 2% target
China	4.5%	1.0%	5.1%	1.2%	Technology innovation and investment accelerate

Any projections should be regarded as hypothetical in nature and do not reflect or guarantee future results.

Notes: Forecasts are as of 10 December 2025. For the US, growth is defined as the year-over-year change in fourth-quarter GDP. For the euro area and China, growth is defined as the annual change in GDP in the forecast year compared with the previous year. Core inflation excludes volatile food and energy prices. For the US and the euro area, core inflation is defined as the year-over-year change in the fourth quarter compared with the previous year. For China, core inflation is defined as the average annual change compared with the previous year. For the US, core inflation is based on the core Personal Consumption Expenditures Index. For the euro area and China, core inflation is based on the core Consumer Price Index. For US monetary policy, Vanguard's forecast refers to the top end of the Federal Open Market Committee's target range. The euro area's policy rate is the deposit facility. China's policy rate is the seven-day reverse repo rate. Unemployment rate refers to the fourth-quarter average in 2026.

Source: Vanguard.

Global outlook summary

Financial markets are exuberant - and there are some good reasons for that. Despite megatrend headwinds in 2025 like demographic slowdowns and rising tariffs, economies held firm. US corporate earnings growth and fundamentals stayed strong, powered by artificial intelligence (AI) investment and other positive technology shocks.

Our data-driven megatrends framework shows these supply-side forces will shift again in 2026. How well AI investment will counteract negative shocks shapes our economic outlook. Over the next five years, we see an 80% chance that economic growth diverges from consensus expectations. These projections shape our investment outlook and offer somewhat unconventional, yet increasingly compelling, investment opportunities for increasingly frothy financial markets.

Higher economic growth is on the horizon, particularly for the US

We anticipate that AI will stand out among other megatrends, given its capacity to transform the labour market and drive productivity. AI investment's outsized contribution to economic growth represents the key risk factor in 2026.

The ongoing wave of AI-driven physical investment is expected to be a powerful force, reminiscent of past periods of major capital expansion such as the development of railways in the mid-19th century and the late-1990s information and telecommunications surge. Our analysis suggests that this investment cycle is still underway, supporting our projection of up to a 60% chance that the US economy will achieve 3% real GDP growth in the coming years, a rate materially above most professional and central bank forecasts.

But this future is not quite now. In 2026, the US is positioned for a more modest acceleration in growth to about 2.25%, supported by AI investment and fiscal thrust from the One Big Beautiful Bill Act. The first half of the year may be softer given the lingering effects of the stagflationary megatrend shocks of tariffs and demographics, as well as yet-to-materialise broad-based gains in worker productivity. The labour markets, which cooled markedly in 2025, should stabilise by the end of 2026, helping the unemployment rate to stay below 4.5%.

Economic growth is expected to keep US inflation somewhat persistent, remaining above 2% by the end of 2026. This combination of solid growth and still-sticky inflation suggests that the US Federal Reserve (Fed) will have limited scope to cut rates below our estimated neutral rate of 3.5%. Our Fed forecast is a bit more hawkish than the bond market's expectations.

Given similar AI-related dynamics, our forecast for China's economic growth is also above consensus expectations in 2026. Despite ongoing external and structural challenges, real GDP growth is more likely to register 5% than 4%.

Conversely, our risk assessment for the euro area is more consensus-like given the lack of strong AI dynamics. We anticipate growth to hover near 1% in 2026, as the drag from higher US tariffs is offset by increased defence and infrastructure spending. Inflation should stay close to the 2% target, allowing the European Central Bank (ECB) to maintain its current policy stance throughout the year.

A differentiated investment playbook

Our capital markets outlook differs across markets, asset classes and investment time horizons. Overall, our medium-term outlook for multi-asset portfolios remains constructive, with positive after-inflation returns likely to continue. In 2026, US technology stocks could well maintain their momentum given the rate of investment and anticipated earnings growth.

But let us be clear: risks are growing amid this exuberance, even if it appears "rational" by some metrics. More compelling investment opportunities are emerging elsewhere even for those investors most bullish on AI's prospects. Our conviction in this view is growing, and it is informed by investment returns in previous technology cycles.

Our capital markets projections show that the strongest risk-return profiles across public investments over the coming five to 10 years are, in order:

1. High-quality fixed income

2. US value-orientated equities

3. Non-US developed-market equities

We maintain our secular view that high-quality bonds offer compelling real returns given higher neutral rates. Returns should average near current portfolio income levels, representing a comfortable margin over the rate of expected future inflation. That's the primary reason why bonds are back, regardless of what central banks do in 2026. Importantly, fixed income should also provide diversification if AI disappoints and fails to usher in higher economic growth, a scenario with odds that we calculate to be 25%–30%.

The history of investing during technology cycles reveals some counterintuitive investment opportunities.

We remain most guarded in our assessment of tech-heavy US growth stocks, which have outperformed most other investments by an astounding margin over the last few years. Yet as we will show in this outlook, our *muted* expected returns for the technology sector are entirely consistent with our more *bullish* prospects for an AI-led US economic boom.

The heady expectations for US technology stocks are unlikely to be met for at least two reasons. The first is the already-high earnings expectations, and the second is the typical underestimation of creative destruction from new entrants into the sector, which erodes aggregate profitability. Volatility in this sector, and hence the US stock market overall, is very likely to increase. Indeed, our muted US equity forecast of -0.1% to 0.9% average annualised returns (in CHF) over the next 10 years is nearly singlehandedly driven by our risk-return assessment of large-cap technology companies.

The history of investing during technology cycles reveals some counterintuitive, yet increasingly compelling, investment opportunities *regardless of whether AI proves transformative or not*. Both US value-orientated and non-US developed markets equities should benefit most over time as AI's eventual boost to growth broadens to consumers of AI. Economic transformations are often accompanied by such equity market shifts over the full technology cycle.

Overall, these three investment opportunities are both offensive and defensive. This risk assessment holds no matter whether today's AI exuberance ultimately proves rational or not.

IMPORTANT: The projections and other information generated by the Vanguard Capital Markets Model® (VCMM) regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results and are not guarantees of future results. Distribution of return outcomes from the VCMM are derived from 10,000 simulations for each modelled asset class. Simulations are as at 31 October 2025. Results from the model may vary with each use and over time. For more information, please see page 25.

OUR OUTLOOK FOR AI

AI-enabling investment: Early stages with ample room to grow

AI has rapidly evolved from a technological breakthrough to a transformative economic force, reshaping expectations for productivity, growth and competitiveness across industries. Much like electricity, railways and the internet before it, AI is driving a structural shift that demands significant capital investment to retool the economy for a new era. This is not a passing trend - but rather the foundation for the next wave of economic progress.

Today, the AI capital investment cycle remains in its early stages, mirroring the trajectory of historic buildouts. Unlike popular narratives that frame AI investment to this point as a tech-sector phenomenon, it has been broad based, touching nearly every corner of the economy. Yet the road ahead looks different. The next phase will hinge on "AI scalers" that are aiming to achieve a quantum leap in generative AI capabilities[1]. These deep-pocketed AI scalers appear capable of following through on their historic $2.1 trillion capital investment commitments into 2027.

However, investment of this magnitude will increasingly involve a wide variety of financing channels, including leases, public and private credit, and various types of equity offerings. This phase of the investment cycle, which is likely to play out over the next three to five years, will be a double-edged sword. On one hand, it will spur the economy to swap out old tools for new ones, which economists call "capital deepening." But it will also present an increasingly narrow investment landscape, where investors will find it difficult to avoid risk tied to the success of this vintage of AI investment.

Deep-pocketed AI scalers appear capable of following through on their historic $2.1 trillion investment commitments.

A general-purpose technology needs capital deepening

Since the emergence of ChatGPT in late 2022, AI investment has contributed roughly $250 billion to US GDP[2]. While this nominal sum might sound large, historical comparisons offer perspective. As a share of GDP, the current AI capital investment cycle appears to be tracking past capital buildouts closely.

From the railways in the 19th century to post-World War II industrial expansion to the internet and personal computer in the 1990s, the advent of a general-purpose technology (GPT) has been followed by the economy engaging in capital deepening that requires significant upfront investment in the new tools.

We expect AI to be no exception. Our analysis of benchmark periods suggests that these historic buildouts have crescendoed over a multi-year period, typically peaking in a four- to six-year window. By this measure, the current AI cycle would appear to be in the still-early stages, at 30%–40% of past peaks.

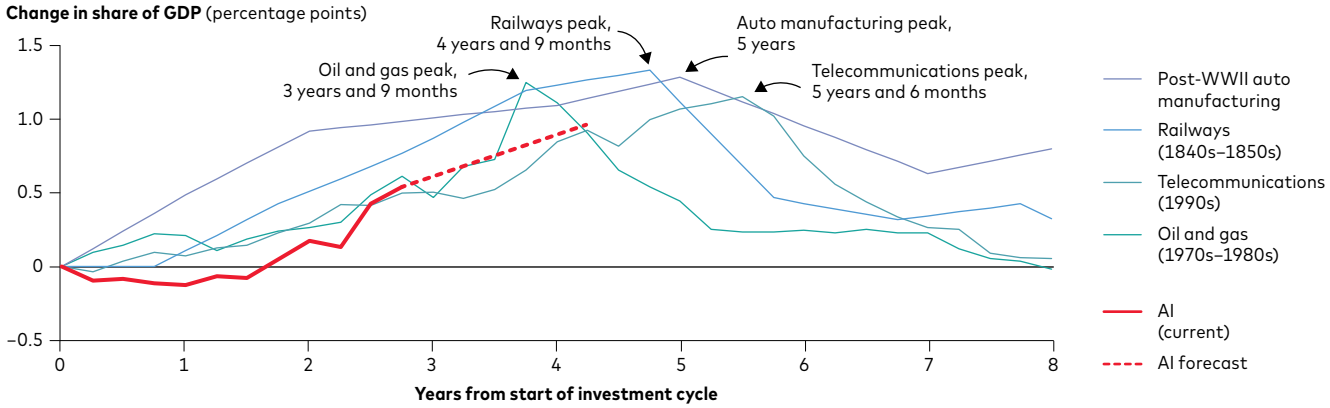
1 In this outlook, we define AI scalers as S&P 500 companies in the Software & Services, Technology Hardware & Equipment, Semiconductors & Semiconductor Equipment and Electric Utilities industry groups. Economically, this definition captures the broader corporate ecosystem involved in AI-enabling capital investment and includes key companies that investors commonly associate with AI scaling, such as Amazon, Alphabet (Google), Tesla, Apple, Oracle, Microsoft, Nvidia and Meta.

2 We define AI investment as investment in software, information processing equipment, communication structures, data centre structures, electric power structures and equipment, and semiconductors as defined by the Bureau of Economic Analysis.

Prior buildouts have also reimagined corporation structures, leading to new standards and regulations and redrawing competitive landscapes for many (and, at times, most) industries. The telecommunications and internet buildout saw the passages of the Telecommunications Act of 1996 and the Digital Millennium Copyright Act as just two examples that served to deregulate telecoms markets, promote competition and provide new legal protections for the digital age[3].

Although broader-architecture developments are difficult to measure in real time, we would assess them to be still forming for AI, evidenced by the current critical debates related to regulatory and governance standards and still-evolving competitive and industry dynamics[4].

The investment cycle is tracking historic capital buildouts



Notes: This chart shows the change in the total size of different investment cycles as a share of real GDP. The period starting points are: Q1 1850 for railways, Q1 1946 for post-WWII auto manufacturing, Q1 1980 for oil and gas, Q2 1995 for telecommunications and Q3 2022 for AI (current).

Sources: Vanguard calculations, based on data from the Bureau of Economic Analysis, as at 31 October 2025. Railway data are sourced from Pereira et al. (2014).

3 For more information, see Federal Communications Commission (2013) and US Copyright Office (2025).

4 For more information, see Congressional Research Service (2025).

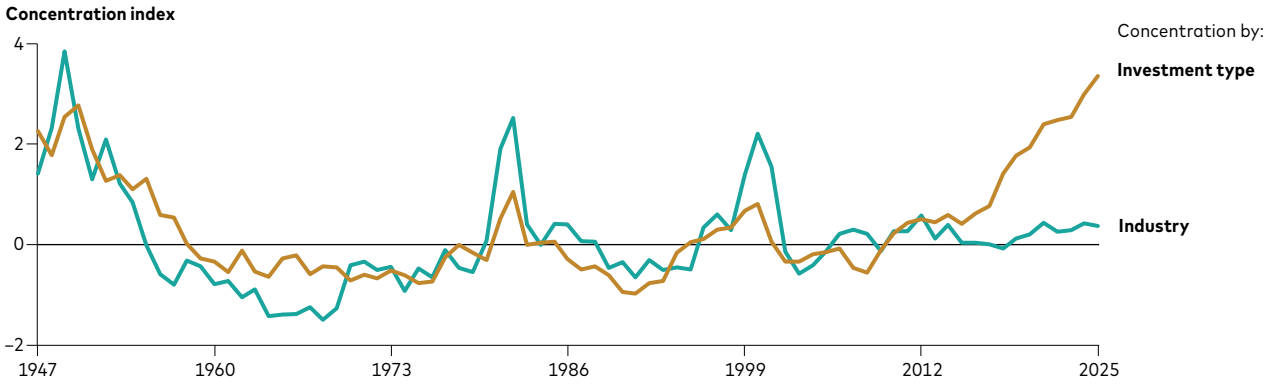
The current investment cycle has had broad-based support from the economy

Despite the spotlight on AI, investment overall has been broad based thus far, finding participation across many sectors in the economy. This contrasts with the peaks of prior historic capital buildouts, when investment was dominated by a cluster of players and/or sectors.

This balanced sectoral footprint points to more phases to come. While the tech sector is leading the way, its share remains well below past levels. In previous buildouts, dominant sectors often accounted for double-digit shares of total investment as their contributions to the buildout intensified. Today, the information and data processing sector accounts for just 7% of nonresidential investment in the US economy.

Since roughly 2017, capital expenditure has been largely driven by intangible investments in software, computers and related equipment. Today, roughly 25 cents of every dollar invested goes to these intangible categories. As the capital deepening needed to support AI accelerates and matures, namely, greater tangible investment in data centres, energy production and semiconductor manufacturing, we expect investments to broaden out beyond intangibles concentrated on software applications.

The AI capital buildout has been wide-ranging



Notes: This concentration index measures degree of concentration by investment type and industry. The index is calculated as the sum of squared shares of nonresidential investment, normalised by standard deviation.

Source: Vanguard calculations, based on data from the Bureau of Economic Analysis, as at 31 October 2025.

Tech dominates the current cycle but has a smaller share of total investment compared with the leading industries in earlier eras

Top five industries by share of total investment at peak of investment concentration

1949	1982	2000	Current
Farming 12%	Oil and gas 11%	Telecommunications 11%	Information and data processing 7%
Electric power 7%	Telecommunications 8%	Real estate 7%	Electric power 6%
Railways 6%	Real estate 6%	Computers and electronics 6%	Chemical products 5%
Telecommunications 6%	Electric power 5%	Banking 6%	Real estate 5%
Oil and gas 5%	Banking 4%	Electric power 4%	Miscellaneous 5%

Source: Vanguard calculations, based on data from the Bureau of Economic Analysis, as at 31 October 2025.

While the next phase appears dependent on AI scalers, it has further legs

The next phase of the buildout looks increasingly dependent on AI scalers in a few distinct ways to provide the computing power, data storage and frontier models needed for large-scale applications. The first dependency is magnitude. Tracking past capital deepening cycles would require that AI scalers follow through on the $2.1 trillion capital investment commitments expected to date[5]. AI scalers' data centre investment represents a decisive swing factor in the next phase of the AI capital investment cycle.

The second dimension is the type of investment. With AI data centre buildouts likely to constitute the bulk of AI-related capital investment, we expect a more narrow set of sectors in the economy to participate in the coming phase - supplying the AI chips, skilled and specialised labour required for building and outfitting, utilities (to generate power) and real estate closer to existing electric grids.

Overall, the implications for the economy and markets are clear: we are closer to the beginning than to the end of this AI investment cycle.

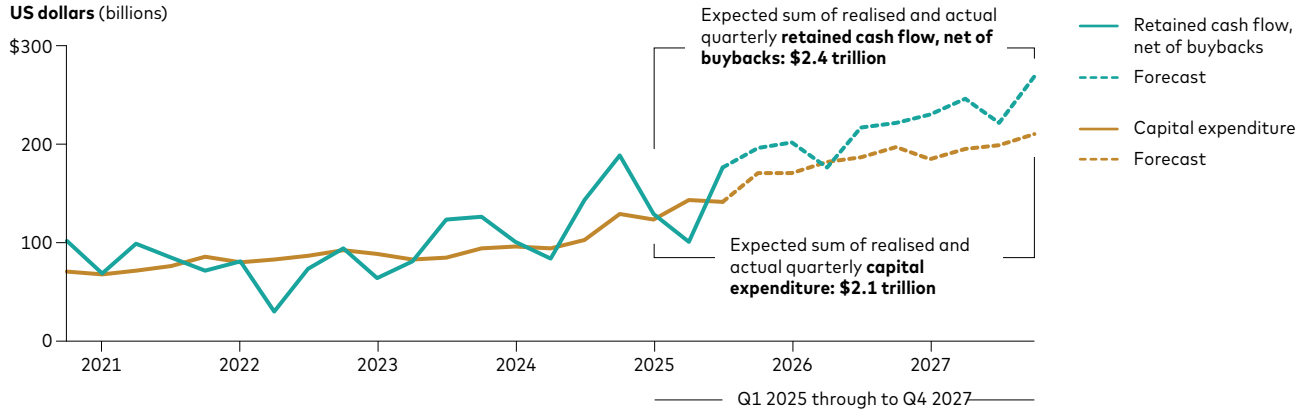
The last notable, and arguably most important, dependency of this AI capital investment cycle is the evolving corporate fundamentals of the AI scalers. As these companies look to outdo the historic buildouts, a natural question arises: are they overextending themselves to fund such large investments?

5 The $2.1 trillion figure is based on consensus estimates from Bloomberg for AI scalers. Capital commitments from well-known mega-cap tech firms - Amazon, Oracle, Meta, Alphabet (Google), Tesla, Microsoft, Nvidia and Apple - alone account for two-thirds of the total ($1.4 trillion out of $2.1 trillion).

Our baseline view is that the AI scalers do have the wherewithal to fund these investments, thanks to the combination of large cash stockpiles, strong balance sheets and business models that have provided unusually deep competitive moats and consistent earnings growth. Indeed, the market's consensus view is that AI scalers will remain profitable enough to more than cover the planned investment of $2.1 trillion between 2025 and 2027[6].

While these firms may have the ability to fund the next phase of this buildout, the historic size of such investment will increasingly favour their spreading the risk across various financing channels. In the second half of 2025 alone, we have witnessed growing popularity in leasing (often with a credit backstop/guarantee), tapping private and public credit markets (both in investment grade and high yield) and creative vendor financing that partly leverages the favourable valuation of certain firms central to AI capital investment. Conscious of the market's expectation to continue delivering on earnings growth - a multi-year trend - the AI scalers will become astute operators of their funding capacities, likely utilising most (if not all) available channels to maintain their earnings growth trajectories[7].

$2.1 trillion for AI capital investment: The AI scalers are good for it



Notes: This chart shows historical and consensus estimates for capital expenditure and retained cash flow minus buybacks for AI scalers (see footnote 1 for definition). The $2.1 trillion in capital expenditure represents the sum of realised and actual quarterly capital expenditure in the chart from the beginning of 2025 to the end of 2027.

Source: Bloomberg, as at 5 November 2025.

6 We use consensus forecasts of retained cash flow, net of projected buybacks, as a primary source of funding available for capital expenditure. The other source is existing cash on balance sheet. Combined, the expected sum is $2.4 trillion for 2025 to 2027.

7 On a market-cap-weighted basis, their interest expense/EBIT (earnings before interest and taxes) and debt-to-asset ratio are one-third and four-fifths, respectively, of the S&P 500 Index's.

AI and the economy: Productivity upside, but at an uneven pace

As to AI's economic impact, 2026 will see its productivity upside realised - albeit at an uneven pace across industries and economies. After decades of development, AI's mainstream arrival in late 2022 has felt sudden. 2023 and 2024 represented a period of experimentation, when businesses and consumers started exploring AI's capabilities and grew comfortable using it.

In 2025, the narrative shifted towards broader adoption, with key AI scalers leading the charge by deepening AI integration in their cloud platforms. 2026 will be a year of even broader adoption in which AI is embedded in workflows. It will also be a year of key assessment, when businesses and governments across the globe closely monitor AI's productivity impact and the evolving labour market.

As economy-wide assessment of AI kicks into higher gear, 2026 may also bring additional clarity to the direction of travel for foundational AI capability. The current paradigm of compute-heavy AI capability improvement could either find additional support - possibly ratcheting up the AI capital investment - or transition to an alternative paradigm if the hoped-for quantum leap in AI capability remains elusive.

AI adoption gains momentum across industries

Household AI adoption has followed the rapid pace of recent consumer technologies like the internet, smartphones and social media. The real surprise lies in the breakneck pace of AI adoption by businesses, which is rapidly reshaping workflows. Yet the journey towards full integration and higher long-term productivity growth is far from complete. Our task-based framework reveals that AI's productivity potential is surprisingly universal, even in industries traditionally seen as physical and less suited for AI. All industries spend considerable time on rules-based cognitive tasks, which current AI tools can dramatically accelerate and streamline. This integration can raise overall productivity by reallocating workers' time to higher-value tasks and by reducing the workforce needed to produce goods and services, with each development having distinct labour market implications.

Our task-based framework reveals that AI's productivity potential is surprisingly universal, even in industries traditionally seen as physical and less suited for AI.

Industry-level adoption rates vary widely, with information and professional/financial services leading the way, while transportation/warehousing and leisure/hospitality lag far behind. Until AI spreads more evenly across the economy, the overall productivity and investment implications will likely be concentrated yet significant. Recent quarters have shown early signs of a positive inflection in labour productivity, though official statistics remain inconclusive and will likely lag any turning point[8].

8 Official productivity statistics are often revised several times after their initial release. The 1990s productivity boom didn't appear in official statistics until years later in subsequent revisions.

Alternative indicators - such as rising capital investment per worker and resilient profit margins - are echoing signals that preceded the late-1990s productivity boom driven by information technology[9]. The potential for a new productivity boom is real but not guaranteed. If AI becomes a true GPT that diffuses throughout all sectors of the economy and spurs additional innovation, real GDP growth would average roughly 3% between 2028 and 2035, compared with the 2.4% average growth rate of the past five years.

Achieving this trajectory would require AI capabilities to augment roughly 30% of total working hours by 2035, up from our current estimate of 12% - which is feasible but far from certain. However, if AI progress stalls, the US risks a period of anaemic growth reminiscent of the decade following the 2008 global financial crisis.

Sporadic AI adoption today is likely to grow more uniform

AI adoption rates vary widely across industries, with leisure/hospitality among the lowest adopters and information among the highest.

By 2028, we expect the **percentage of work hours automated** to range from 7.5% to 15.0% across industries.

Notes: This chart is based on a comparison across nine broad industry categories. The top bar shows the percentage of firms within industry categories that are using AI. From least to greatest rate of AI adoption, these industries are transportation/warehousing, leisure/hospitality, manufacturing/construction, other services, wholesale/retail trade, health care/social assistance, educational services, professional/financial services and information. For the bottom bar, automatable working hours are defined as the time spent on tasks that current AI systems could perform at satisfactory proficiency with moderate human supervision. Adjustments are made for tasks that involve face-to-face customer interaction, people leadership and health care decisions.

Source: Vanguard calculations, based on data from O*NET Database, Macrobond, the US Census Bureau, and the Bureau of Labor Statistics, as at 31 August 2025.

9 Former Federal Reserve Chair Alan Greenspan relied on informal indicators including unit labour costs, inventory ratios, and IT adoption, to infer rising productivity before official data confirmed it. For more information, see Greenspan (2007).

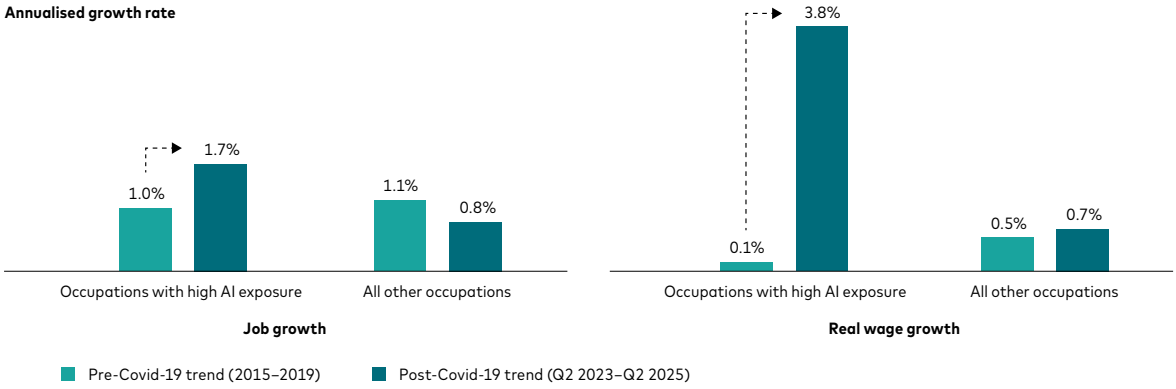
Automation fears outpace labour market reality

While AI may have started to change our workflows, its role in explaining the recent slowdown in job growth is overstated. Yes, specific occupations have faced job losses due to AI automation, which is a common outcome of technological disruption. However, if AI were causing widespread job cuts, that would appear in overall labour market trends.

Instead, the approximately 100 occupations most exposed to AI automation are actually outperforming the rest of the labour market in terms of job growth and real wage increases. This suggests that current AI systems are generally enhancing worker productivity and shifting workers' tasks towards higher-value activities[10].

Meanwhile, entry-level employment challenges reflect the disproportionate burden that a labour market with a low hiring rate can have on younger workers. This dynamic is observed across all occupations, even those largely unaffected by AI. While statistics abound about large language models beating humans in computer programming and other aptitude tests, these models still struggle with real-world scenarios that require nuanced decision-making[11]. Significant progress is needed before we see wider and measurable disruption in labour markets.

Data undercut dire predictions of AI labour disruption



Notes: The "Occupations with high AI exposure" category represents the roughly 140 occupations with the highest share of working hours that current AI systems could automate at satisfactory proficiency with moderate human supervision. Adjustments are made for tasks that involve face-to-face customer interaction, people leadership and health care decisions.

Source: Vanguard calculations, based on data from O*NET Database, Macrobond, the US Census Bureau and the Bureau of Labor Statistics, as at 31 August 2025.

10 For more information, see Autor and Thompson (2025).

11 For more information, see Maslej et al. (2025).

China and US lead the AI race

The global landscape of AI adoption and investment is highly uneven, with the US and China leading the charge. In Europe, meanwhile, investment remains concentrated in "old-world" industries like automobiles and pharmaceuticals, rather than innovations for the future such as software, semiconductors and AI. Expectations for European productivity growth are much lower, reflecting slower AI adoption, less dynamic capital markets and more rigid labour and product markets.

Factors such as demographics, fiscal constraints and fragmented digital infrastructure further hinder Europe's ability to capitalise on technological advancements. From our perspective, if accelerated AI adoption and meaningful institutional reforms happen in Europe, these developments could catalyse a stronger productivity trajectory and materially reshape the region's medium-term growth outlook.

China, on the other hand, is set to adopt AI at an even faster pace than the US. The Chinese government is aggressively funding AI infrastructure, focusing on both hardware and applications. China's digital payments, e-commerce and mobile ecosystems are already world-leading, providing fertile ground for rapid AI deployment. Also leading the world in international AI-related patent filings and research publications, China may see a faster initial boost to productivity as AI scales in manufacturing, logistics and digital services.

The emergence of DeepSeek and the global competition for industry leadership may lead to a more frontloaded AI investment cycle in China. However, China may hit a productivity ceiling in regard to AI sooner than the US, stemming from a higher share of less AI-exposed sectors - which are typically physically intensive - in its economy.

For example, while agriculture, manufacturing and construction account for only 19% of total employment in the US, these industries make up 50% of all jobs in China. Conversely, finance and professional services, which are more exposed to AI-driven task automation, constitute 14% of total employment in the US but less than 3% in China. In addition, Chinese AI gains could be limited by demographic headwinds - namely, a working-age population that will shrink by 30% over the next 25 years.

Similarly, Japan also has a rapidly ageing population. The adverse effects of shrinking workforce demographics are considerably greater in China and Japan relative to the US. Accordingly, AI alone will likely be insufficient to keep the Chinese and Japanese economies growing at the pace of recent trends - absent dramatic structural changes related to internal labour market mobility or industry composition.

AI and tech innovation remain geographically concentrated

Top five corporate R&D spenders by sector and country/region

US	Euro area	UK	China	Japan	Australia
Software	Automotive	Pharmaceutical	Technology	Automotive	Pharmaceutical
Software	Automotive	Pharmaceutical	Software	Automotive	Technology
Technology	Automotive	Finance	Software	Telecommunications	Finance
Software	Automotive	Finance	Construction	Leisure goods	Finance
Technology	Automotive	Finance	Automotive	Pharmaceutical	Travel

Notes: This table is based on the 2024 EU Industrial R&D Investment Scoreboard, which analysed the world's top 2,000 research and development (R&D) investors, headquartered across 40 countries. The table depicts the top five corporate R&D spenders by sector within six countries/regions, allocated geographically by the location of company headquarters.

Source: Vanguard calculations, based on data from the European Commission, as at 31 December 2024.

The race is on: Leadership in AI-based economy

Since the onset of the information and communication technology revolution in the 1970s, the US has held a dominant technological position globally, powered by a vastly innovative ecosystem that has spawned transformative start-ups and technologies. But early leaders in tech revolutions rarely maintain their dominance indefinitely - a testament to the force of "creative destruction" that has propelled American tech preeminence.

Take the dot-com boom of the 1990s, for example. Many of the Nasdaq darlings from that decade faded into obscurity after 2000, even as continued adoption of the internet and personal computers kept productivity elevated. Similarly, most of today's key AI scalers were either unknown or nonexistent during the 1990s.

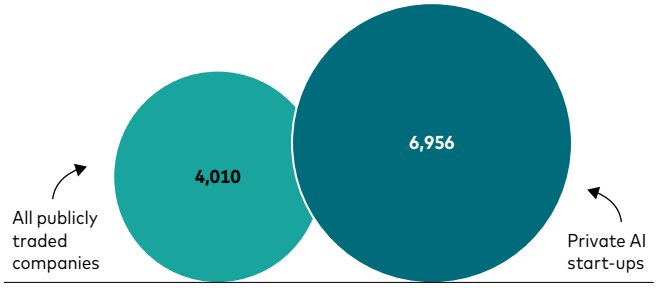
The latest example is Nvidia. As recently as 2013, it was only the 380th-largest company in the S&P 500 index, accounting for just 0.05% of the index by market capitalisation. But in 2025, it became the first company in history to reach a $5 trillion market capitalisation.

These patterns reflect a broader truth: As a new GPT diffuses into the economy more broadly, *any* firm may find its old business model disrupted by the reality of the new economy. And those who usher in the GPT are not exceptions.

Indeed, as AI becomes more embedded across sectors beyond IT - from professional services and logistics to health care and education - the entrepreneurial frontier will expand beyond core AI developers to include suppliers, enablers and adopters of AI applications. Whereas the early phase of the AI era has been led by AI scalers focused on foundational models and infrastructure, the next wave of innovation may come from companies finding efficiencies to current AI bottlenecks, building domain-specific AI applications or solving complex last-mile challenges.

Eventually, firms that can harness AI-driven intelligence into scalable, real-world productivity gains are likely to carry the mantle of AI leadership. It is anyone's guess whether that leadership will remain with today's AI scalers, transition to a new generation of companies rising from the plethora of AI start-ups and new entrants, or be shared among some combination of the two groups. While the US and China may continue to lead in foundational AI capabilities, the broader economic impact - and the next generation of breakout entrepreneurs - could emerge from a much wider set of geographies and industries.

AI start-ups outnumber public companies in the US



Note: The "Private AI start-ups" category includes only those that received at least $1.5 million in private investment.

Source: Vanguard calculations, based on data from the World Bank and Stanford University's *The AI Index 2025 Annual Report* (Maslej et al., 2025), as at 31 December 2024.

Bullish on bonds but less so on US stocks

Our capital markets projections show that the strongest risk-return profiles across public investments over the coming five to 10 years are, in order: 1) high-quality fixed income, 2) US value-orientated equities, and 3) non-US developed markets equities.

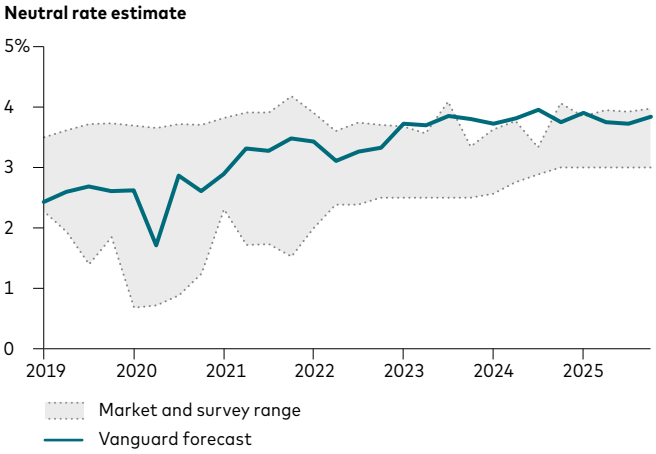
Bonds: Higher neutral rate will continue to provide support

We maintain our secular view that high-quality bonds offer compelling real returns given higher neutral rates. Projected at around 1% over the coming decade, returns on global bonds should exceed the returns of the past decade by around 2%, exceeding the rate of expected future inflation[12]. That's the primary reason why bonds are back, no matter what central banks do in 2026.

Within fixed income, we stress the importance of quality in credit. While supply/demand mismatches could keep spreads tight, having tested historic levels many times in 2025, the prospect of further tightening is low. And this presents a one-sided risk profile, to the downside, since current valuations offer limited compensation for risks associated with the AI investment cycle[13].

Last, but not least, high-quality fixed income provides diversification in light of the material downside risk in 2026 and beyond that an AI-driven productivity boost is not realised.

Bonds are back: Compelling real return profile given higher neutral rate



Any projections should be regarded as hypothetical in nature and do not reflect or guarantee future results.

Notes: The neutral rate is the rate of interest that would neither stimulate nor restrict an economy. It depends on economic variables and, as such, can only be estimated. This chart compares a range of market and survey estimates of the neutral rate with those of Vanguard Investment Strategy Group. Underlying survey and market measures include the Federal Open Market Committee's longer-run policy rate; Survey of Market Participants' longer-run policy rate; 5-year, 5-year forward overnight index swap; and Laubach-Williams model estimate plus 2% inflation.

Source: Vanguard calculations, based on data from Bloomberg and the Federal Reserve Bank of New York, as at 13 November 2025.

12 Global bonds represented by the Bloomberg Global Aggregate CHF Hedged.

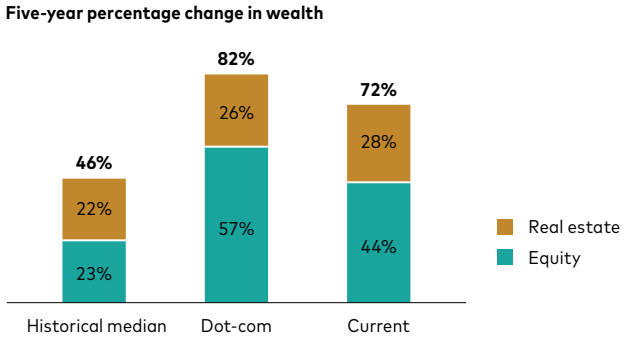
13 As capital-intensive AI projects proliferate, the potential rises for credit stress, especially among lower-rated issuers.

Equities: Between near-term strength and long-term complexity

For equities in 2026, we expect a continuation of the recent past, where returns are solid, driven by rising earnings growth. And the risk may skew to the upside. Consider the odds of stronger-than-expected AI capital investment, faster AI diffusion across a broad swathe of sectors and a strong wealth effect (owing to a multi-year boom in the stock market and rising home prices) fuelling US consumption.

These factors can easily push the US economy beyond our forecast of 2.25% growth - towards 3% - and support a double-digit return for US equities. Even at current stretched valuations, such momentum would not be unprecedented, especially if AI scalers continue to grow earnings[14]. The 1970s strength of the blue-chip companies known as the Nifty 50 and the dot-com rally in 1998 saw both strong real corporate earnings growth and rapid valuation multiple expansion.

US consumers have benefitted from rising equity and real estate wealth over the past five years

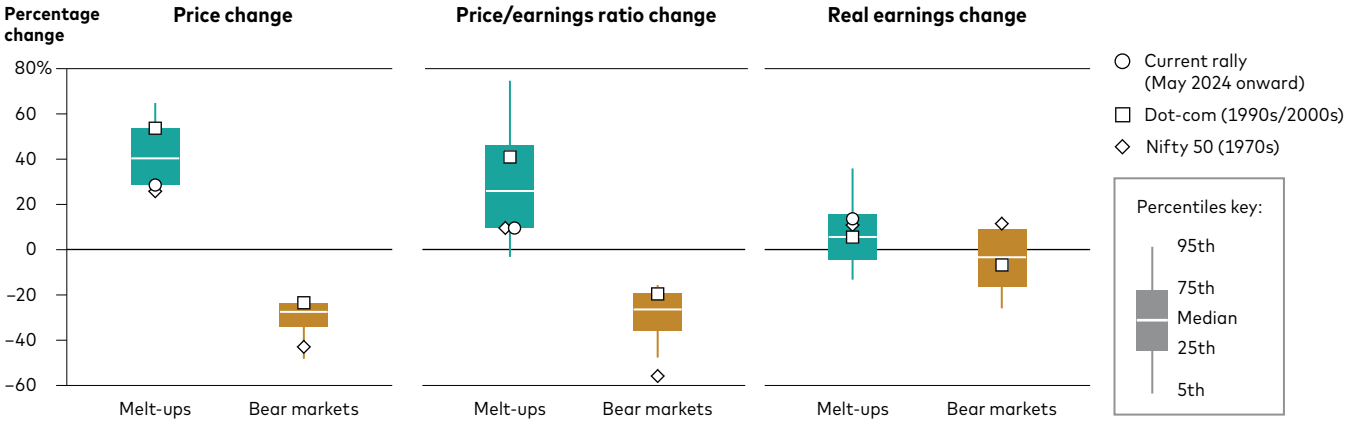


Past performance is not a reliable indicator of future results.

Notes: The historical median period is from the third quarter of 1994 to the third quarter of 2025. The dot-com period is from the first quarter of 1995 to the first quarter of 2000. The current period is from the third quarter of 2020 to the third quarter of 2025. Due to rounding, the sum of real estate and equity does not equal the total for the historical median period or the dot-com period.

Source: Vanguard calculations, based on data from the Federal Reserve, as at 30 September 2025.

The anatomy of US stock market "melt-ups" and bear markets



Past performance is not a reliable indicator of future results.

Notes: These charts show the historical decomposition of US equity market melt-ups and bear markets. Melt-ups are defined as non-overlapping periods in which the index increased by at least 20% within 18 months or less, and bear markets are defined as non-overlapping periods in which the index decreased by at least 20% within 18 months or less. The equity market is defined as the S&P 500 Index in US dollars. The price/earnings (P/E) ratio change shows the change in the adjusted P/E ratio. The real earnings change shows the change in trailing weighted earnings per share in real terms using the US Consumer Price Index. The analysis covers the period from 1 January 1954 to 29 August 2025.

Source: Vanguard calculations, based on data from Bloomberg, as at 30 September 2025.

14 For US equities, the cyclically adjusted price/earnings (CAPE) ratio was about 37 as at 19 November 2025, which is in the top 10% of valuation since 1988.

US equity return prospects, by three AI scenarios

Scenario	Probability	Earnings growth	P/E multiples	10-year stock return projection (USD, annualised)
1 AI's transformation is stronger than expected (upside)	10%	8%+	Remain at present levels or even rise	8% to 10%
2 AI emerges as general-purpose technology and generates 3% trend US growth (Vanguard medium-run baseline)	60%	6% to 8%	Fall slightly as AI competition unfolds	5% to 7%
3 AI disappoints and exuberance is irrational rather than justified (downside)	30%	3% to 5%	Fall markedly, with irrational exuberance when not falling	–2% to 2%
On the whole (probability-weighted)	**100%**	**6% to 7%**		**4% to 5%**

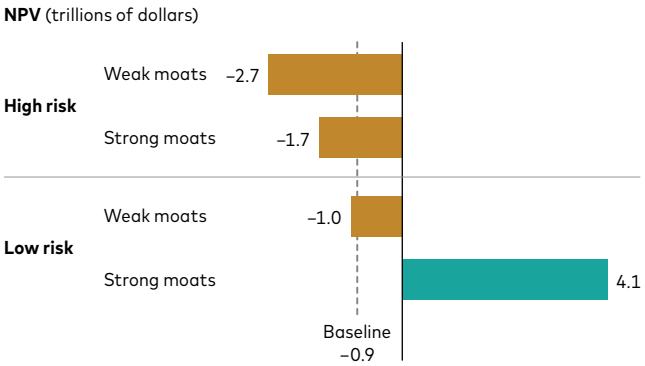
Source: Vanguard calculations in USD, as at 30 September 2025.

However, our conviction is growing stronger that long-term prospects for US equities are subdued - around 0% to 1% (in CHF) annualised returns over the next 10 years[15]. Our *muted* long-term return projection for US equities is entirely consistent with our more *bullish* prospects for an AI-led US economic boom.

There are two main reasons we foresee muted long-term returns. Firstly, the market may be underpricing the potential for forthcoming AI capital investment to underdeliver, especially given its arms-race dynamics and the sheer scale of capital involved. Such adverse capital investment behaviour is often associated with lower profits until winners emerge. And the danger for any of today's AI scalers is that they emerge from this vast buildout phase overextended, triggering a less optimistic profit trajectory.

Our analysis suggests that, in aggregate, the net present value (NPV) of AI investments is far from certain - and could even be negative. At the same time, the necessity for ongoing, massive capital expenditures - particularly for scarce resources like chips and data centres - could erode profit margins and make it more difficult for AI scalers to deliver the earnings growth that the market has come to expect.

Positive NPV for AI spending only for companies with strong moats and cheap capital



Notes: This chart aims to estimate the net NPV of AI-related investment. It assumes investment, including R&D spending and capital expenditure, by AI and AI-related companies of $3.1 trillion from 2025–2027. AI and AI-related companies include Amazon, Meta, Alphabet (Google), Tesla and other companies involved with semiconductors and semiconductor equipment, software, tech hardware and electrical utilities. Earnings before interest and taxes (EBIT) assumes revenue equal to the incremental real GDP in the megatrends "AI wins" relative to "deficits dominate" scenarios (Davis, 2025); a seven-year straight-line depreciation schedule for current and expected capital expenditure; and an earnings before interest, taxes, depreciation, and amortisation margin of 37% (75th percentile of the S&P 500). We also assume that 40% of value creation is captured by shareholders. Expected EBIT over the next 25 years is discounted back at a baseline rate of 15%. "Strong moats" refer to business value capture of 70%, and "Weak moats" refer to business value capture of 20%. "Low risk" refers to a discount rate of 10%, and "High risk" refers to a discount rate of 25%.

Source: Vanguard calculations, based on data from Bloomberg, as at 25 October 2025.

15 US equities represented by the MSCI US Broad Market Index.

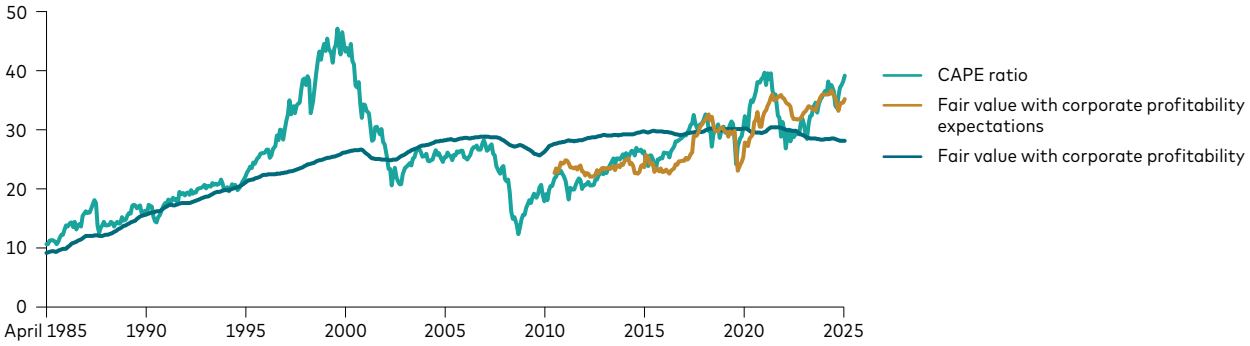
Secondly, beyond financial execution, the rapidly evolving technological landscape means AI scalers face the constant threat of "creative disruption." History suggests that the companies earning excess profits at the frontier of new technologies are unlikely to all do so in the future.

Indeed, some of the winners of the next decade may be small, unknown companies in today's market that can build new businesses on the infrastructure laid by today's AI scalers[16]. New and nimble competitors could leverage the very infrastructure being built now to reshape the market, as seen in the "DeepSeek moment" of early 2025. The ability of incumbents to transform investment into lasting advantages is far from assured, further heightening uncertainty around future returns.

Taken together, these assessments inform our constructive outlook for non-AI scalers - specifically US value stocks and developed markets ex-US equities with 10-year return projections of roughly 3% and 2.5% (in CHF), respectively[17]. Both segments offer much more attractive valuations and have yet to fully price in the potential long-term benefits of AI adoption. As AI diffuses across all sectors of the economy, value-orientated sectors such as industrials, financials and select consumer segments may be better positioned to realise efficiency gains and grow earnings, making them potentially more attractive in the medium term.

These segments also can serve as a partial hedge should the AI scaler-driven US stock market boom come to a sudden end, with an extended drawdown or a bear market. Taking healthy yield, reasonable valuation and the diversification benefits together, US value and developed markets ex-US equities jointly make up a critical building block for investors with long-term horizons.

The case for valuations rests on sustained profitability and earnings growth



Notes: This chart shows the cyclically adjusted price/earnings (CAPE) ratio for the MSCI USA Index along with two estimates for fair value. "Fair value with corporate profitability" is based on inflation, after-tax cost of debt, and the retention ratio (return on equity (ROE) x earnings retention rate). "Fair value with corporate profitability expectations" also includes consensus estimates for earnings-per-share growth and ROE over the next two years.

Source: Vanguard calculations, based on data from Bloomberg and Refinitiv, as at 30 September 2025.

16 This story should sound familiar. Many of today's AI scalers - including Alphabet (Google), Amazon, Meta and Apple - have built their business models atop the internet and mobile infrastructure created in the late 1990s and early 2000s.

17 US value stocks represented by a market capitalisation weighted portfolio of stocks with a price/book ratio in the lowest one-third of the Russell 1000 Index. Developed markets ex-US equities represented by the MSCI World ex USA Index.

United States: Capital spending anchors growth outlook

Strong capital investment has been the backbone of US growth in 2025, and that momentum is set to carry forward. We expect capital expenditures to remain a defining force in 2026, anchoring economic resilience and driving GDP growth above 2%.

In the past year, investment spending overall has more than doubled its recent pace, providing a meaningful backstop to the economy amid high uncertainty. Spending related to the buildout of AI, in particular, has seen a surge that we expect will continue. Over the next year, we estimate that AI spending will provide another $450 billion in investment, supporting overall non-residential investment growth of 7%.

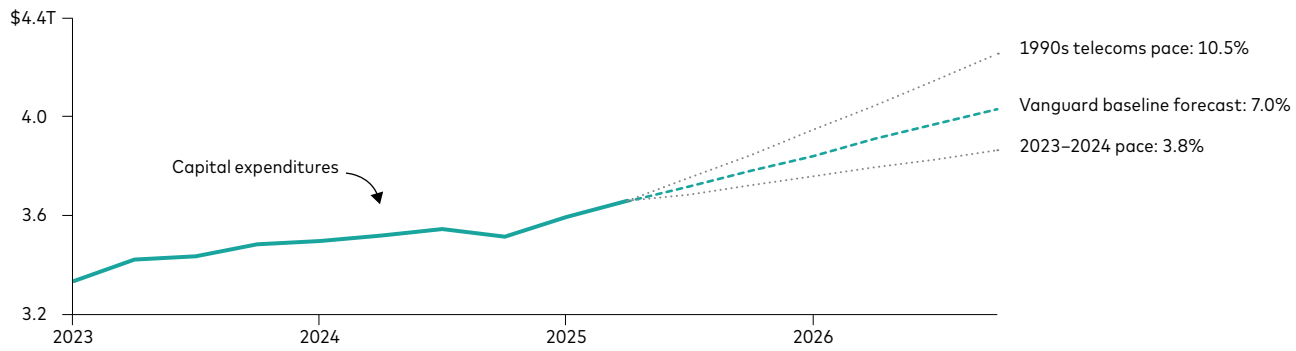
While tariffs and trade policy adjustments have produced a "stagflationary impulse" to the economy, the effects have been muted by import frontloading and delayed transmission of higher import prices to consumers. These dynamics push some of the expected drag into 2026, with the degree and pace at which that occurs being key factors in our outlook. However, we also expect the drag to be partly offset by a moderate fiscal boost from the One Big Beautiful Bill Act, in addition to a stronger pace of capital expenditures.

Labour market conditions have evolved rapidly in the past year, as evidenced by the marked slowdown in job creation from a pace of roughly 150,000 per month to 30,000. Despite this reduction, we assess that labour conditions remain resilient, though supply-side realities are shaping the path forward.

Immigration and demographic trends account for roughly 70% of the slowdown in job growth compared with last year, signalling a transition to a regime of lower labour supply growth and reduced hiring needs. We estimate that in order to keep unemployment steady, employers will need to add approximately 60,000 positions per month. Against this backdrop, we expect the unemployment rate to moderate to around 4.2% by the end of 2026.

Inflation dynamics will hinge on tariff pass-through and whether the disinflation in services sectors will be challenged by stronger investment-led demand. Core inflation is likely to remain above 2.5% due to tariff impacts that, along with firmer labour market conditions, should see the Fed adopt a less risk-management-orientated policy stance and cut rates only once in the first half of 2026.

AI is set to support the pace of capital spending growth



Any projections should be regarded as hypothetical in nature and do not reflect or guarantee future results.

Note: The forecasted baseline year-over-year growth in capital expenditures for early 2025 through to 2026 is higher than the average pace set in recent years (2023–2024) but lower than the pace set during the telecoms boom years of 1995–1999.

Source: Vanguard calculations, based on data from the Bureau of Economic Analysis, as at 30 June 2025.

Euro area: Fiscal easing to offset drag from higher tariffs

The euro area has experienced a soft landing. Annual inflation will end 2025 close to 2%, after peaking above 10% in late 2022. Meanwhile, the economy is growing close to potential, and the unemployment rate is at its lowest level since the creation of the euro in 1999. The European Central Bank (ECB) halted its easing cycle in June 2025, leaving the deposit facility rate in neutral territory at 2% - where it wouldn't be expected to either restrict or stimulate the economy - down from a peak of 4% in 2024.

The growth outlook for 2026 will be shaped by two opposing dynamics. The first is the drag from higher US tariffs, with the effective tariff rate having increased by around 15 percentage points (ppts) over the past year. We estimate this will subtract around 0.3 ppts from euro area GDP in 2026.

The second is the tailwind from looser fiscal policy, led by Germany's infrastructure package along with greater defence spending across the European Union (EU). We estimate that Germany's fiscal loosening will boost German GDP by 0.5 ppts in 2026 and euro area GDP by 0.2 ppts. We anticipate a further 0.2 percentage-point lift to euro area GDP from increased defence spending by other EU nations. Overall, we expect the euro area economy to grow by 1.2% in 2026, close to our estimate of potential.

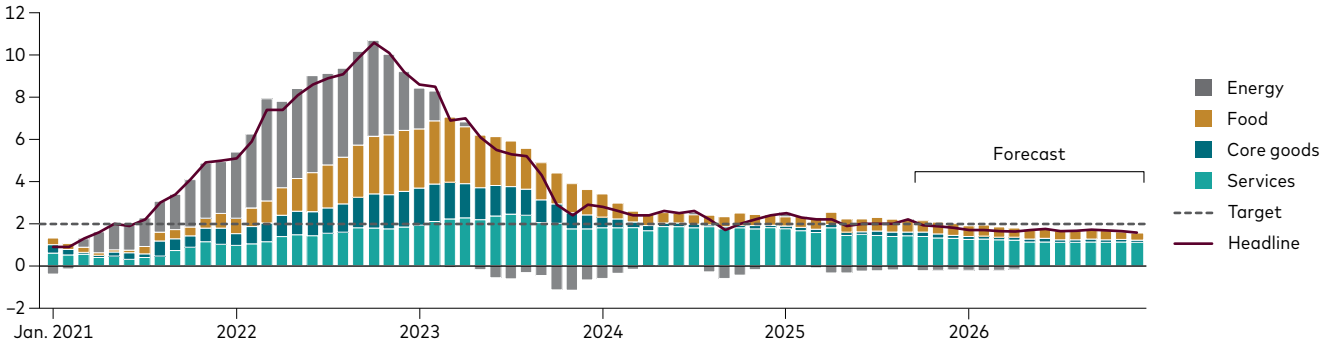
In contrast to the US, we do not expect a strong AI-driven investment impulse in 2026. Europe is behind the curve on both AI innovation and its infrastructure buildout. Capital expenditure commitments from the European technology sector over the next two years are around $250 billion to $300 billion, compared with more than $2 trillion in the US. As such, we expect real private investment growth of just 2% in the euro area in 2026, compared with 7% in the US.

For euro area inflation, we view risks as skewed towards an undershoot of the ECB's 2% target - with contributing factors including lower energy prices, the strength of the euro, slowing wage growth and weak domestic demand. Accordingly, if the ECB were to change its monetary policy stance in 2026, we think it would be more likely to lower rather than raise interest rates.

Regarding the fiscal outlook, we are most concerned about France. With its decision to freeze pension reform until 2027, we don't see a clear path for fiscal consolidation in the near term. With projected budget deficits of 5%–6% of GDP, we expect political and fiscal uncertainty to pin back the French economy in 2026.

Euro area inflation is expected to undershoot the ECB's 2% target in 2026

Contribution to annual headline inflation (percentage points)



Any projections should be regarded as hypothetical in nature and do not reflect or guarantee future results.

Notes: This chart shows year-over-year headline inflation for the euro area on a monthly basis and broken down by the four main components of energy, food, core goods and services. The food category includes food, alcohol and tobacco inflation. From October 2025 onwards, data are based on Vanguard forecasts.

Source: Vanguard calculations, based on data from Bloomberg and Eurostat, as at 21 October 2025.

United Kingdom: Slowing inflation allows for further rate cuts

The UK economy has grown close to its potential over the past year, with economic activity balanced across consumer spending, government spending and business investment. The resilience of activity is encouraging given the uncertain global trade environment and weakening labour market.

The November Budget is modestly positive for growth in 2026 as day-to-day government spending will increase, while most of the £26 billion worth of tax increases will come into effect only from 2028 onwards. We forecast UK GDP growth of 1% in 2026.

Annual headline inflation is expected to end 2025 at 3.8%, almost double that of the euro area and the target set by the Bank of England (BoE), both of which are 2%. With core inflation stuck at 3.5%–4% for the past 18 months, household inflation expectations have started to creep up again, posing a key risk for monetary policymakers.

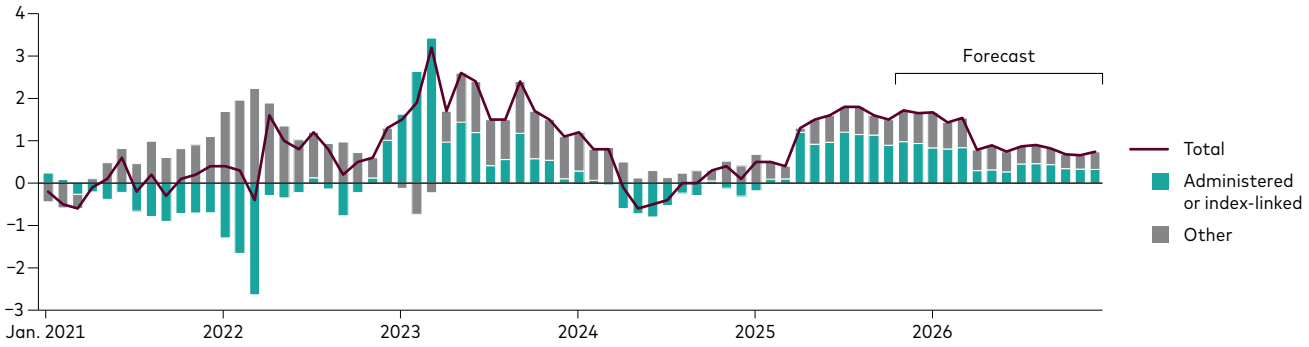
However, our analysis shows that over 60% of the UK inflation gap with the euro area can be explained by the contributions of administered or index-linked prices, including electricity, water and telecoms bills. An additional 35% of the gap can be attributed to UK-specific dynamics in the rental market, package holidays and food prices.

We forecast the total UK inflation gap with the euro area will narrow significantly in 2026 as the Budget announced a removal of green levies on household energy bills, and challenging year-earlier comparisons for some of these components unwind. We anticipate annual headline inflation to end 2026 at 2.2%. If we are right, this mechanical disinflationary process should also exert downward pressure on inflation expectations and future wage settlements.

The improving inflation outlook, coupled with a stable economy, should allow the BoE to feel comfortable enough to continue easing monetary policy. We forecast that the bank rate will be lowered to 3.25% by the end of 2026.

The gap between UK and euro area inflation will narrow in 2026

UK-less-euro-area contributions to headline inflation (percentage points)



Any projections should be regarded as hypothetical in nature and do not reflect or guarantee future results.

Notes: This chart shows UK-minus-euro-area contributions to headline inflation, broken down by changes in administered or index-linked prices versus other prices. Administered and index-linked components include tobacco, alcohol, energy, water, transportation services, communications, education and vehicle excise duty components of the CPI baskets. From November 2025 onwards, data are based on Vanguard forecasts.

Source: Vanguard calculations, based on data from Bloomberg and the Office for National Statistics, as at 19 November 2025.

China: Emerging opportunities amid challenges

China aims to double real GDP by 2035 from 2020 levels, implying 4.7% average annual real growth. Its 15th Five-Year Plan also seeks to raise per capita GDP to that of moderately developed countries by 2035, requiring compound annual growth of approximately 6.5% in US dollar terms. Achieving these targets will require strong nominal GDP growth and a broadly stable renminbi over the next decade.

The path presents both opportunities and challenges. Compared to our 2020 estimates, we project slightly higher potential growth. Productivity and human capital gains will stem from advancements in AI, broader technology investments and continued progress in education and expanding the talent pool. Such momentum in innovation and skill enhancement will position China well to capture new growth opportunities.

However, capital input growth is moderating. Overcapacity concerns suggest that gains from rising investment in high-tech and strategic sectors may not fully offset the downturn in property investment. Labour input growth is also slowing due to a declining birth rate and an ageing population. We expect the renminbi to remain broadly stable, supported by China's central role in global supply chains, a push for renminbi internationalisation and capital control measures.

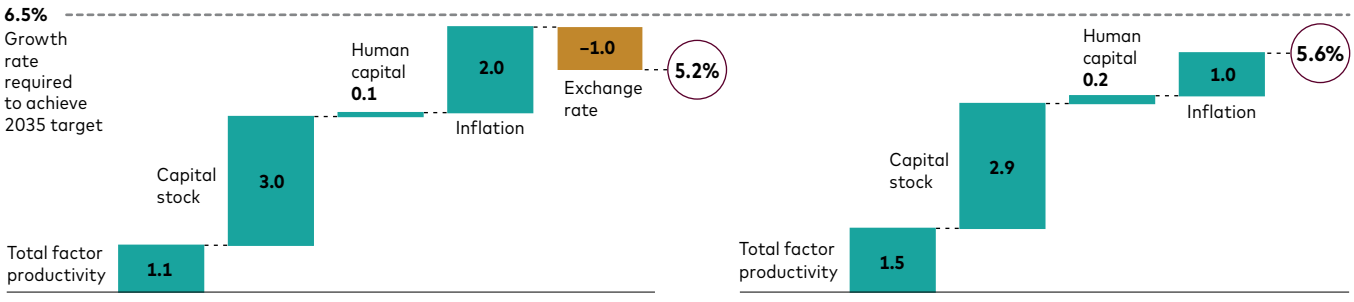
We maintain caution about China's ability to meet its 2035 targets. We project trend growth to fall to around 4.2% in the coming decade, from 4.5%–5.0% in 2020–2025 and about 7.5% in 2010–2020. Meanwhile, developments related to US trade and technological competition will likely weigh on business sentiment. Domestically, prolonged supply-demand imbalances raise the risk of China slipping into persistent deflation.

We expect GDP growth to slow to 4.5% in 2026, reflecting payback from export frontloading and the waning impact of a consumer goods trade-in programme. Domestic demand is likely to remain weak, as declining property values outweigh any wealth effects from a stock market rally. Despite efforts to curb excessive price competition, robust production and fragile consumption suggest deflationary pressures will remain entrenched.

Promoting productivity remains key, not only in advanced manufacturing, but also in the services sector. This type of more balanced policy approach will be essential to unlocking the full potential of AI and lifting China's long-term growth trajectory.

The challenging path toward China's 2035 growth target

Nominal GDP growth per capita breakdown, 2026–2035



Any projections should be regarded as hypothetical in nature and do not reflect or guarantee future results.

Notes: China's goal is to raise per capita GDP to the level of moderately developed countries by 2035, estimated at $25,000–$30,000 in US dollars, which implies a compound annual growth rate of around 6.5%. Vanguard forecasts are based on the potential growth rate estimated using a Cobb-Douglas production function. Vanguard's previous forecast was formulated in 2020, when China's prior Five-Year Plan was also announced. For the updated forecast, we expect the currency exchange rate to remain largely unchanged from current levels, making its impact minimal.

Source: Vanguard calculations, based on data from the National Bureau of Statistics of China, Penn World Table, the International Monetary Fund and CEIC, as at 1 November 2025.

Japan: Policy will continue to normalise amid resilient growth

Japan's economy remains on a steady path towards normalisation after a long period of stagnation. This is occurring despite elevated tariff-related uncertainty and political turbulence both domestically and globally in 2025. Domestic demand remains resilient, with private consumption continuing to recover even amid persistent inflationary pressures.

Corporate profits remain at historically high levels, and business sentiment is improving, partly bolstered by the US-Japan tariff agreement, which was finalised in September and has significantly reduced uncertainty. As a result, firms are sustaining robust capital expenditure plans. Structural trends - including labour-saving investments in digitalisation, software and automation - are expected to persist, supporting a further increase in capital expenditure.

We forecast solid growth of 1% in real GDP in 2026. We expect private consumption to remain firm, underpinned by strong wage growth and the positive effects of permanent income tax cuts. Capital expenditure should continue its upwards momentum, supported by elevated corporate earnings. Exports are also likely to post moderate growth in 2026, aided by a resilient US economy and a weak yen, with the impact of US tariff hikes proving limited thus far.

While we expect the impact of earlier cost shocks such as elevated import prices and food costs to fade, underlying inflationary pressures remain intact. These are driven by persistent structural labour shortages, which fuel wage growth and reinforce a virtuous cycle of wages and prices.

The Bank of Japan (BoJ) has adopted a cautious stance, pausing rate hikes as it assesses evolving inflation dynamics, foreign exchange volatility and broader economic fundamentals. However, with trade-related uncertainty receding and inflation momentum proving robust, we expect the BoJ to continue its policy normalisation, gradually hiking its policy rate to 1% by the end of 2026.

Despite the BoJ's retreat from active involvement in the government bond market, we expect debt to remain sustainable. Although interest payments will likely rise in line with higher policy rates, we don't anticipate that will significantly raise the debt-to-GDP ratio, as government debt generally has been declining and we would expect a rise in bond yields to be accompanied by stronger nominal GDP growth. Moreover, household and corporate balance sheets have strengthened over the past three decades, and the private sector's savings rate has been well higher than the government's debt ratio, enhancing resilience to rising interest rates.

Private sector savings remain sufficient to finance public sector deficit

Source: Vanguard calculations, based on data from Japan's Cabinet Office, the World Bank, CEIC and the Economic and Social Research Institute, as at 31 December 2023.

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About the Vanguard Capital Markets Model

IMPORTANT: The projections and other information generated by the Vanguard Capital Markets Model (VCMM) regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results and are not guarantees of future results. VCMM results will vary with each use and over time.

The VCMM projections are based on a statistical analysis of historical data. Future returns may behave differently from the historical patterns captured in the VCMM. More importantly, the VCMM may be underestimating extreme negative scenarios unobserved in the historical period on which the model estimation is based.

The Vanguard Capital Markets Model® is a proprietary financial simulation tool developed and maintained by Vanguard's primary investment research and advice teams. The model forecasts distributions of future returns for a wide array of broad asset classes. Those asset classes include US and international equity markets, several maturities of the US Treasury and corporate fixed income markets, international fixed income markets, US money markets, US municipal bonds, commodities, and certain alternative investment strategies. The theoretical and empirical foundation for the Vanguard Capital Markets Model is that the returns of various asset classes reflect the compensation investors require for bearing different types of systematic risk (beta). At the core of the model are estimates of the dynamic statistical relationship between risk factors and asset returns, obtained from statistical analysis based on available monthly financial and economic data from as early as 1960. Using a system of estimated equations, the model then applies a Monte Carlo simulation method to project the estimated interrelationships among risk factors and asset classes as well as uncertainty and randomness over time. The model generates a large set of simulated outcomes for each asset class over time. Forecasts represent the distribution of geometric returns over different time horizons. Results produced by the tool will vary with each use and over time.

The primary value of the VCMM is in its application to analysing potential client portfolios. VCMM asset-class forecasts—comprising distributions of expected returns, volatilities, and correlations—are key to the evaluation of potential downside risks, various risk-return trade-offs, and the diversification benefits of various asset classes. Although central tendencies are generated in any return distribution, Vanguard stresses that focusing on the full range of potential outcomes for the assets considered, such as the data presented in this paper, is the most effective way to use VCMM output.

The VCMM seeks to represent the uncertainty in the forecast by generating a wide range of potential outcomes. It is important to recognise that the VCMM does not impose "normality" on the return distributions, but rather is influenced by the so-called fat tails and skewness in the empirical distribution of modeled asset-class returns. Within the range of outcomes, individual experiences can be quite different, underscoring the varied nature of potential future paths. Indeed, this is a key reason why we approach asset-return outlooks in a distributional framework.

Notes on risk

All investing is subject to risk, including the possible loss of the money you invest. Diversification does not ensure a profit or protect against a loss. Be aware that fluctuations in the financial markets and other factors may cause declines in the value of your account. There is no guarantee that any particular asset allocation or mix of funds will meet your investment objectives or provide you with a given level of income. Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

US government backing of Treasury or agency securities applies only to the underlying securities and does not prevent share-price fluctuations. Unlike stocks and bonds, US Treasury bills are guaranteed as to the timely payment of principal and interest. Funds that concentrate on a relatively narrow market sector face the risk of higher share-price volatility. Investments in stocks and bonds issued by non-US companies are subject to risks including country/regional risk and currency risk. These risks are especially high in emerging markets.

Bond funds are subject to the risk that an issuer will fail to make payments on time, and that bond prices will decline because of rising interest rates or negative perceptions of an issuer's ability to make payments. High-yield bonds generally have medium- and lower-range credit-quality ratings and are therefore subject to a higher level of credit risk than bonds with higher credit-quality ratings.

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