Goldman Sachs Research

ISSUE 142 | September 11, 2025 | 4:00 PM EDT

TOP of MIND

DATA (UN)RELIABILITY

Substantial downward revisions to May and June US payrolls data, the subsequent dismissal of the BLS Commissioner, and a large downward revision to the level of employment in the BLS' annual benchmark review have fueled concerns about US economic data quality. But such concerns aren't new or unique to the US. So, how concerned should we really be about the quality of global economic data? Former BLS Commissioner Erica Groshen, Laffer Associates' Arthur Laffer, Harvard's Alberto Cavallo, and GS' Joseph Briggs and Ronnie Walker all see some reasons for concern, but Briggs stresses that global economic data mostly remain reliable. Will that remain the case? Groshen and Cavallo worry about the future of US data, partly owing to the Trump Administration's recent actions, while Laffer argues such actions should help ensure data reliability ahead. We explore what's at stake if trust in economic data is lost, concluding that the economic costs could be significant, TIPS would be directly impacted, and the Dollar could weaken further.

"Rather than flaws in the statistical system, two large revisions in the same direction—as occurred for May and June payrolls data—instead suggest that underlying economic conditions may be shifting.

- Erica Groshen

Periodic shakeups are healthy, helping to ensure our official statistics remain accurate and our decisions well-informed.

- Arthur Laffer

Once the door is open for people to start questioning whether the heads of statistical agencies are motivated by anything other than a desire to measure the truth, it is very difficult to close it, even as leadership shifts.

- Alberto Cavallo"

WHAT'S INSIDE

Allison Nathan | allison.nathan@gs.com Jenny Grimberg | jenny.grimberg@gs.com Ashley Rhodes | ashley.rhodes@gs.com

Macro news and views

We provide a brief snapshot on the most important economies for the global markets

US

Latest GS proprietary datapoints/major changes in views

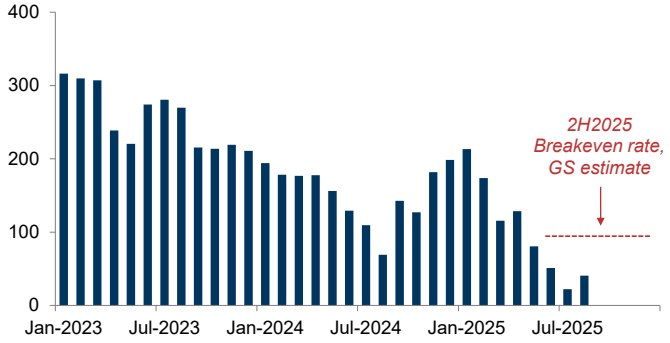
- No major changes in views.

Datapoints/trends we're focused on

- Labor market, which has softened materially, with underlying job growth likely to remain below the 80k "breakeven" rate that would keep unemployment stable.
- Fed policy; we expect three 25bp rate cuts this year in September, October, and December followed by two more 25bp cuts in 2026 for a terminal rate range of 3-3.25%.
- Growth; we expect the economy to gradually reaccelerate toward potential in 2026 as the tariff drag abates, fiscal policy turns more expansionary, and the Fed eases.
- Inflation, which we expect tariffs will continue to boost.

A softening US labor market

GS estimate of underlying trend job growth, thousands, per month



*Note: Data is our estimate of the underlying trend of job growth, equal to 0.75*3-month average payroll growth + 0.25*9-month average payroll-adjusted household employment growth. We adjust for the undercounting of immigration.*

Source: Goldman Sachs GIR.

Japan

Latest GS proprietary datapoints/major changes in views

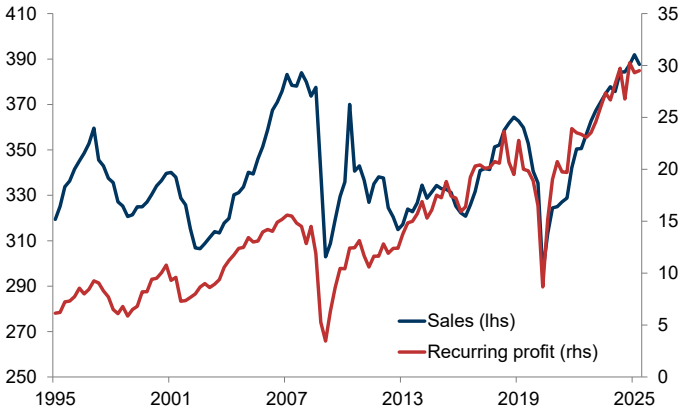
- No major changes in views.

Datapoints/trends we're focused on

- Japanese politics; Prime Minister Ishiba's resignation has created a new source of political uncertainty and a potential route to more expansionary fiscal policy.
- BoJ policy; we continue to expect the BoJ to deliver its next rate hike in January 2026, although the timing of the next hike remains uncertain.
- Growth; recent GDP data confirm the firmness of domestic demand, which should support growth of 1.4% yoy in 2025.
- Still rising corporate sales & recurring profits.

Corporate sales and recurring profits: still on the rise

Corporate sales and recurring profits, ¥tn



Source: Ministry of Finance, Goldman Sachs GIR.

Europe

Latest GS proprietary datapoints/major changes in views

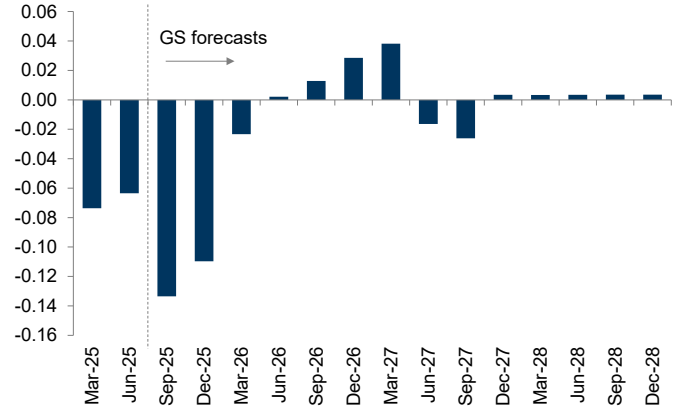
- No major changes in views.

Datapoints/trends we're focused on

- ECB policy; we believe the ECB's cutting cycle is now finished, although the risks around our 2% baseline forecast for the deposit rate remain to the downside.
- Euro area growth, which we expect to pick up next year as trade-related growth headwinds recede and fiscal spending increases.
- Euro area inflation, which we expect to return to target in 2027 despite a likely small undershoot in 2026.
- Renewed fiscal pressures in both France and the UK.

Euro area: a diminishing trade drag

Effect of trade tensions on QoQ Euro area real GDP growth, pp



Source: Goldman Sachs GIR.

Emerging Markets (EM)

Latest GS proprietary datapoints/major changes in views

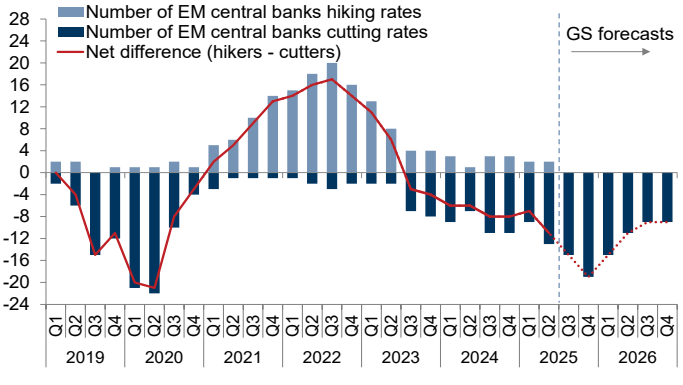
- No major changes in views.

Datapoints/trends we're focused on

- China's economy, which remains bifurcated, with strong exports and high-tech developments but a weak property market and private demand.
- EM growth; while EM growth has held up better than expected this year despite US tariffs, we continue to expect a slowdown over the remainder of the year.
- EM rate cuts, which we expect to broaden in coming quarters, with several economies in LatAm and CEEMEA joining the broader easing cycle.

EM easing cycle: a further broadening

Number of EM central banks hiking and cutting rates*



**Includes 24 emerging market economies in GS coverage.*

Source: Haver Analytics, Goldman Sachs GIR.

Data (un)reliability

Substantial downward revisions to May and June US payrolls data and the subsequent dismissal of Bureau of Labor Statistics (BLS) Commissioner Erika McEntarfer, followed by a large downward revision to the level of employment in the BLS' recent annual benchmark review, have fueled concerns about US economic data quality. Yet such concerns aren't new or unique to the US—Europe, China, and EMs more broadly have all experienced data problems in recent years (see pg. 14). So, how concerned should policymakers, investors, and the public really be about the quality of global economic data, and what's at stake if growing concerns prove warranted?

We first explore the issues currently plaguing economic data. Former BLS Commissioner Erica Groshen, Harvard Business School professor and co-founder of the Billion Prices Project Alberto Cavallo, and GS senior economists Joseph Briggs and Ronnie Walker highlight two major issues. First, a long-term decline in response rates to household and business surveys—which lay at the heart of how statistical agencies produce economic data—that has only worsened since the pandemic. And second, funding cuts to federal statistical agencies, which Groshen, Cavallo, and Briggs argue have hampered agencies' ability to modernize processes and methodologies.

But Arthur Laffer, Founder and Chairman of Laffer Associates, is less concerned about these issues. He argues that improved data production processes can easily resolve the problem of lower survey responsiveness and believes that US statistical agencies have more than enough money and staff to address current data challenges. Instead, he worries about statistical agencies' use of seasonal adjustment methodologies, which he says are highly sensitive to events like the pandemic that produce significant data disruptions.

That said, Laffer, Groshen, and Cavallo all agree that political manipulation of US economic data is not a problem, with Groshen explaining that BLS data production is a "factory-like process" that entails limited involvement from the BLS commissioner and Laffer seeing no reason why statistical agency staff would intentionally misrepresent data.

So, are concerns about the quality of US economic data today warranted? Despite the substantial focus on the recent payroll revisions, Groshen emphasizes that "revisions are features, not bugs, of the statistical system" and argues that the recent revisions warrant scrutinizing underlying economic conditions more than the data itself given that large negative revisions tend to occur around economic turning points. Walker also points out that economic data is almost always revised extensively and finds that nearly as many US indicators have experienced smaller revisions as larger revisions compared to pre-pandemic norms in recent years.

But they both see reasons for concern. Groshen notes that data granularity has declined, which she warns is "threatening the depth of insights available to policymakers and the public". And Walker finds that standard errors for some indicators have risen, and US data has become noisier, mirroring what Briggs finds has been happening to global economic data more broadly. This leads them to conclude that data quality has deteriorated somewhat in the US and other major developed economies in recent years, even as Briggs stresses that global economic data mostly remain reliable and economic statistics useful.

The key question, though, is whether that will remain the case. Groshen and Cavallo worry about the future of US data, with Groshen arguing that the ongoing budget and staff reductions will increasingly impede statistical agencies' ability to continue producing high-quality, reliable data. And she fears that the Trump Administration's efforts to convert certain BLS roles traditionally held by civil servants into political appointments could come at the detriment of the US statistical system.

Cavallo goes even further, finding it difficult to avoid comparing President Trump's recent dismissal of the BLS Commissioner and nomination of E.J. Antoni to the post to developments in Argentina nearly two decades ago, when then President Nestor Kirchner's removal of statistical agency leadership owing to disappointing inflation data fueled a period of widespread mistrust in Argentina's official economic statistics that lasted for over a decade.

Laffer sees it differently. He praises Trump for "taking bold action" by shaking up the US statistical system, which he argues was necessary in light of the pandemic disruptions and the large payroll revisions. Such a shakeup, he says, should help ensure the accuracy and reliability of US economic data ahead.

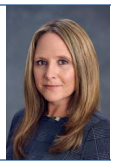
But should economic data become less reliable, GS Chief Asia Pacific Economist Andrew Tilton offers lessons learned from China, often the subject of client questions about data quality, on how to gain more confidence in the data. He presents a three-step solution: clean the available data, use alternative statistics like private-sector data, and build a mosaic of the most reliable data. Cavallo, an expert in the private data space, agrees that such data can be valuable while cautioning that it can and should not fully substitute for official data given its own limitations.

Finally, we explore what's at stake should a loss of trust in economic data occur. Groshen, Cavallo, and Briggs agree that the economic costs could be significant, taking the form of slower growth and reduced investment as policymakers and investors contend with more uncertainty around the true health of the economy. And Cavallo warns that recovering lost trust takes a long time—many years in the case of Argentina. So, these effects could prove long-lasting.

For markets, GS Head of US Rates Strategy William Marshall argues that few corners of the market would feel the impact as directly as Treasury Inflation Protected Securities (TIPS), whose value is directly tied to official inflation data. He contends that less trust in the data could erode these bonds' perceived usefulness as a hedge for inflation risks and risk assets. And GS Head of G10 FX Strategy Michael Cahill argues that growing concerns about US data reliability provide yet another reason to be bearish the Dollar—which has already sharply declined this year—by giving global investors even more reason to diversify away from US assets.

Allison Nathan, Editor

Email: allison.nathan@gs.com
Tel: 212-357-7504
Goldman Sachs & Co. LLC



Interview with Erica Groshen

Erica Groshen is former Commissioner of the Bureau of Labor Statistics (BLS) (2013-17). She is currently Senior Economics Advisor at the Cornell University School of Industrial and Labor Relations and Research Fellow at the Upjohn Institute for Employment Research. Below, she outlines the BLS' mounting challenges and what they could mean for data reliability ahead.

The views stated herein are those of the interviewee and do not necessarily reflect those of Goldman Sachs.

Allison Nathan: You previously served as BLS Commissioner. Walk us through how the BLS collects data for the key economic indicators it reports and how that process has evolved.

Erica Groshen: The BLS tailors each program according to the measurement objectives and sample population, but the general approach centers on modern survey methodology that defines the survey universe, designs an appropriate—often stratified—sample, and recruits survey participants. Survey responses are then run through models that output final numbers indicative of the broader universe. Survey testing ensures robust questions, and monthly data collection cycles are routine and highly structured, often completed within days to maintain timeliness.

The BLS has made some improvements to the process over the years. The Consumer Price Index (CPI) and other price programs have increasingly supplemented traditional company surveys with other data sources, including administrative and purchased datasets, which are relatively less expensive. On the employment side, the BLS has improved the sample universe construction for the payroll survey by leveraging state-curated establishment reports from the unemployment insurance system and has changed its imputation method for large employers who report late to reduce benchmark and monthly data revisions. The BLS has also expanded survey response options to try to stem a thirty-year trend of declining response rates on the back of survey fatigue, privacy concerns, a declining sense of civic responsibility, and increased skepticism of government. These changes haven't been silver bullets, but the BLS is doing everything it can to ensure that official data remains high quality and reliable.

Allison Nathan: What do you make of the particularly large revisions to the May and June employment figures?

Erica Groshen: It's important to understand that revisions are features, not bugs, of the statistical system. Producing statistics that never get revised is easy, but it requires sacrificing either quality or timeliness—you can have very early data that is lousy quality, or high-quality data that sometimes comes later than needed or wanted. Some BLS programs are designed to balance these tradeoffs, offering initial data quickly followed by revisions as more complete information becomes available. Users may find that frustrating, but any user is free to ignore the preliminary figures or the revised figures.

For the payroll survey specifically, employers have three months to submit data for any given reporting period. Around two-thirds of employers respond by the first reporting date, and around 94/95% respond by the third reporting date. So, revisions mostly reflect late submissions. For the late reporters, the BLS imputes data by applying the average change from timely respondents to the missing respondents under the assumption that late reporters behave similarly to earlier ones. However, if late reporting is concentrated among firms experiencing significant upheaval, this could introduce some bias, though this is relatively rare and late submissions usually balance out in aggregate. The revisions to May and June data were a rare exception, resulting in large, reinforcing revisions.

Allison Nathan: But should such large revisions lead us to question the reliability/potential biases of the data?

Erica Groshen: No. Rather than flaws in the statistical system, two large revisions in the same direction—as occurred for May and June payrolls data—instead suggest that underlying economic conditions may be shifting. Significant revisions—especially negative ones—often occur around economic turning points, such as the onset of an economic slowdown or recession, because the companies hit first tend to delay reporting. So, the recent revisions warrant more scrutiny of economic conditions rather than of the data itself.

Allison Nathan: Would a shift away from monthly to quarterly reporting for some indicators to try to avoid large revisions be a good idea?

Erica Groshen: No. When I was BLS Commissioner, the only pressure I ever experienced was to produce the data faster, not slower. The monthly indicators—like the employment report and CPI—are among the world's most closely watched economic statistics for a reason. If accuracy were the only priority, users could simply wait for later data and ignore the initial release, but the reality is that these early releases contain valuable information for policymakers, businesses, and the public. They rely on timely information to make decisions, and delaying releases would deprive them of crucial insights into the state of the economy.

Allison Nathan: What would you say to those who worry about political influences on the data?

Erica Groshen: As we've discussed, BLS data production is a highly automated, factory-like process. Raw data from employers run through estimation routines that produce the final tables without personal judgment or interference. All BLS staff are career civil servants, with the sole exception of the commissioner who is appointed by the president for a four-year fixed term. But the commissioner has minimal involvement with the data production process. When I was Commissioner, I didn't see the numbers due to be reported on Friday until the prior Tuesday night or Wednesday morning. And I only saw the final tables. So, the commissioner has no way of altering the figures or even accessing the underlying data or models necessary to do so. Such intervention would require

fundamentally changing BLS procedures and systems, which are purposefully built to safeguard against such manipulation.

Allison Nathan: So, are concerns about data reliability in the wake of President Trump's recent dismissal of the BLS Commissioner and nomination of E.J. Antoni overblown?

Erica Groshen: Those concerns are unfounded as long as BLS processes don't change. And any attempt to do so would likely be immediately noticeable by slow or suspended data production, staff resignations, whistleblowers and/or leaks. BLS staff are deeply committed to data integrity and would quickly recognize and call out improper changes. However, over time, a new commissioner could replace the career civil servants and alter the BLS culture. The Trump Administration has already proposed policy changes that would convert certain civil service roles into political appointments that could be dismissed at will. While not yet implemented, such changes could erode civil service protections, posing a real long-term risk to the statistical system unless the statistical agencies are exempted.

Allison Nathan: More broadly, how do the ongoing staff and budget reductions at statistical agencies affect their ability to maintain the quality of official economic data?

Erica Groshen: The BLS has already lost at least 15–20% of its staff, and a hiring freeze remains in effect until at least October. Many of the layoffs have been senior leadership roles, with roughly a third of those positions now vacant. So, the BLS has lost a significant swath of very experienced, skilled people and I certainly worry about the impact of that on the agency. To maintain timely releases, staff are being reassigned and retrained and are often doubling up on roles. This affects resilience and quality control. While error rates haven't risen yet, the risk of a data mistake is increasing.

Though the top-line national indicators remain relatively robust, the real concern lies with more granular data that informs nuanced analyses at the sector, demographic, or regional level. Granularity in several price indices has already been reduced, and I expect that will happen more often. Nonresponse follow-up has also declined, which could eventually lead to shrinking sample sizes. These crucial details are beginning to erode as resources are stretched, threatening the depth of insights available to policymakers and the public.

While the BLS has worked admirably under these enormous strains, the situation is unsustainable over the long term. If nothing changes, the BLS will almost certainly have to reduce some of what it does and eliminate programs that people depend on. The cutbacks have also compromised the BLS' ability to modernize as resources must be spent on immediate priorities rather than research and development. So, this is a slow-moving trainwreck that the BLS knows how to address but simply lacks the funds.

Allison Nathan: How much additional funding would the BLS need, and how would it be deployed?

Erica Groshen: The required investment isn't enormous. With a modest budget increase—$40-50 million above the current $700 million—the BLS could launch initiatives to integrate administrative and private sector data with its surveys. This would reduce the burden on survey respondents, boost response rates, and enhance the timeliness and granularity of indicators. For example, incorporating data from unemployment insurance systems, job postings, and retail scanner systems would allow for richer, timelier statistics. This is all doable but would require rigorous work to validate new data sources and develop protocols that balance data quality, confidentiality, and reliability. The sea change of bringing statistical agencies into the 21st century has been delayed for far too long and is crucial to ensuring the reliability of economic data in the future.

Allison Nathan: What are the consequences of not being able to trust economic data?

Erica Groshen: Without reliable economic data, individuals, financial markets, and policymakers alike face more uncertainty. This can lead to increased market volatility, higher interest rates, reduced investment, and slower economic growth. Ultimately, we could end up with a country that just doesn't work as well because people are making lousy decisions based on flawed data. The US' international reputation as a safe and stable destination for investment could also suffer. So, we risk losing the advantages we've built over many decades by having trustworthy statistics. Countries where official data is not trusted struggle with attracting investment and maintaining credibility. We must consider whether we want to head down that path.

Allison Nathan: What role can/should the private sector play in improving the quality of economic data?

Erica Groshen: The private sector can and should play a pivotal role. As we've discussed, firm survey response rates have fallen, and financial companies have typically been especially lousy respondents. Company leaders should ensure that they are reporting their data and reward employees for doing so, as well as encourage their peers to participate. Companies could also standardize employee record-keeping to reduce the burden of responding to surveys as well as improve the value and comparability of national statistics. And crucially, they could lobby for the protection and modernization of our data infrastructure, which is a key part of our national infrastructure.

Allison Nathan: What about Congress?

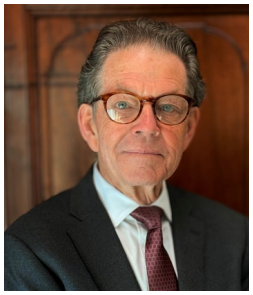
Erica Groshen: Congress should closely examine all nominees for BLS commissioner to ensure that they possess the necessary statistical expertise and understand the importance of data integrity. Congress can also relax hiring freezes, invest in modernization, and insulate statistical agencies from political interference. In particular, Congress could clarify the conditions under which the BLS commissioner can be removed and consider reorganizing the statistical system to enhance its independence, akin to the Federal Reserve.

While the potential erosion of our statistical system and the attacks on its integrity have been deeply concerning, the recent crisis has also sparked widespread protests and awareness of what we stand to lose, which is encouraging. When I served as BLS Commissioner, few understood the role. But now, the importance of having reliable economic data is front page news. And this challenging moment offers an opportunity to reconsider our approach, invest wisely, and inspire public and political support to strengthen and protect the trustworthiness of the systems upon which so much depends.

Interview with Arthur Laffer

Arthur Laffer is Founder and Chairman of Laffer Associates. Previously, he served as a member of President Reagan's Economic Policy Advisory Board (1981-89). Below, he argues that US economic data quality issues warrant a major shakeup of the statistical agencies and their data production processes.

The views stated herein are those of the interviewee and do not necessarily reflect those of Goldman Sachs.



Allison Nathan: How important is it to have high quality economic data?

Arthur Laffer: I have been steeped in economic data throughout my career—I served as the first chief economist of the Office of Management and Budget (OMB) and worked closely with Moses Abramovitz on his work exploring the economic history of data collection as well as with Julius Shiskin, who made significant contributions to the field of economic statistics, Geoffrey Moore, Arthur Burns, etc. So, my focus on data has spanned decades, culminating most recently in my book, *Taxes Have Consequences,* which is a complete history of the US income tax from 1913 to present day that relied heavily on historical data. And I have always emphasized the importance of high-quality data. The better the data, the better the decisions based on them, which is critical because those decisions often have tangible and significant consequences.

Allison Nathan: Are you concerned at all about the quality of US data today? If so, what are you most concerned about?

Arthur Laffer: I am concerned about data quality today, primarily owing to issues with seasonal adjustments brought on by the extreme complications of the Covid-19 pandemic. Any major disruptions like that undoubtedly blow up the data. This is especially the case when you rely on methods like ratio to moving-average seasonal adjustment—as the Bureau of Labor Statistics (BLS) does—which is highly sensitive to blips in the data. Aggregating micro-level, seasonally adjusted components into macro data only amplifies these challenges, resulting in significant discrepancies during extraordinary periods such as the pandemic.

> "I am concerned about data quality today, primarily owing to issues with seasonal adjustments brought on by the extreme complications of the Covid-19 pandemic."

These data blips can distort seasonal adjustments for years, which is precisely the situation we're now facing, as evidenced by the significant revisions to recent employment data. It's possible to correct these issues using alternative techniques such as least squares seasonal adjustment, which can help smooth individual data blips. But even so, I remain highly skeptical of seasonal adjustment methodologies.

Allison Nathan: Some argue that declining survey response rates have especially contributed to recent data quality issues. What's your view?

Arthur Laffer: Problems with survey response rates have always existed. Even as collection methods have evolved over the decades from door-to-door collection to phone calls to online reporting, etc., survey responsiveness has remained a challenge. But this problem can be overcome by refining data production methodologies. So, survey responsiveness is not my primary concern, and I don't believe the decline in response rates is materially contributing to recent data quality issues.

Allison Nathan: You say some of the data issues are solvable and can be addressed through various techniques. But many people have argued that the budget cuts and staffing shortages of recent years have made it more difficult for the statistical agencies to maintain high quality data. What's your view?

Arthur Laffer: I don't believe that for a second. The federal statistical agencies have plenty of money today, especially relative to budgets of the past. Attributing data issues to budget cuts in today's era of outrageous government spending just doesn't hold up. The BLS employs thousands of people, including plenty of PhD economists. What are the potentially hundreds of PhD economists doing if not addressing the current challenges? With even just 40 PhD economists I could do everything under the sun and more. So, this is not a budget or staffing problem.

> "Attributing data issues to budget cuts in today's era of outrageous government spending just doesn't hold up."

Allison Nathan: Some people view large data revisions as a sign that the statistical agencies may be influenced by political considerations. What's your view?

Arthur Laffer: I don't believe political considerations are playing any significant role in the data quality problems that exist today. Every administration I've worked with—starting as far back as the Johnson Administration—has blamed bad economic numbers on malicious intent. But I just don't see any reason why someone would intentionally fudge the numbers or put their thumb on a scale to influence the data in a way that they know is wrong. These are economists that hold themselves to a high standard and strive to be right.

I don't even know how this data *could* be used for political purposes. The idea that data revisions could impact elections or shift the political landscape seems far-fetched. More often than not, mistakes in data collection or calculation are just that—

mistakes. As the saying loosely goes, don't attribute to conspiracy that which can easily be explained by incompetence. The BLS makes its fair share of mistakes, but its staff are trying to do the best job they can. People aren't trained to be deceitful and deceptive. So, I don't attribute the current issues to malicious political manipulation of the data.

> "I just don't see any reason why someone would intentionally fudge the numbers or put their thumb on a scale to influence the data in a way that they know is wrong."

Allison Nathan: What do you make of the recent dismissal of the BLS Commissioner and President Trump's nomination of E.J. Antoni to the post?

Arthur Laffer: President Trump is decisive and unafraid to act when he perceives that there are flaws in the system, often moving swiftly and forcefully. While this approach may create some discomfort, it can drive positive change by shaking up entrenched processes and allowing for necessary reforms. Though this isn't necessarily my style of doing business, I recognize its effectiveness in enabling the system to correct mistakes. Periodic shakeups are healthy, helping to ensure our official statistics remain accurate and our decisions well-informed. And when confronted with significant data issues as we have seen in the post-pandemic era, a thorough reevaluation of our processes is absolutely warranted.

> "Periodic shakeups are healthy, helping to ensure our official statistics remain accurate and our decisions well-informed."

Now, whether sufficient evidence exists for a complete overhaul remains debatable and whether firing the BLS Commissioner was necessary isn't for me to say, but the large employment data revisions clearly indicate that some form of intervention was needed. The disruptions caused by COVID-19 alone should have put everyone on high alert for data problems ahead. Once-a-century events like the pandemic warrant a reevaluation of the whole data system. So, I laud President Trump for taking bold action here.

When it comes to E.J. Antoni, I know him well and even once tried to hire him for his data expertise. He is quite qualified to handle the job of BLS commissioner should he be confirmed to the post.

Allison Nathan: What should the next BLS commissioner do to ensure the accuracy and reliability of the official data going forward?

Arthur Laffer: Relying on established routines and allowing tradition to dictate operations can foster complacency which, in turn, leads systematic errors to build up. For that reason, the next commissioner should initiate a thorough review of current practices, evaluating new perspectives and exploring alternative methods for improvement.

And rather than dictating solutions from above, the commissioner should draw on solutions from within the BLS itself—a bureaucracy that has historically operated at a world-class level. Like any large institution, there are undoubtedly highly talented individuals whose contributions haven't been fully utilized. If I were leading the Bureau, my first step would be to seek out these voices and bring their ideas for improving data methodology and accuracy to the forefront. I don't know if that is already happening within the organization today. But I do know that the current system has produced some very large discrepancies. So, substantial change and innovation is clearly warranted.

> "The current system has produced some very large discrepancies. So, substantial change and innovation is clearly warranted."

Allison Nathan: The Administration has disbanded several advisory committees that were created to discuss the best approaches to data collection and analysis. Could that hurt attempts to shore up data quality?

Arthur Laffer: I'm not convinced that advisory committees are the solution here. Committees with dozens of members rarely produce innovative ideas. What's needed instead is a capable leader who is empowered to pursue new methods without having to go through the bureaucracies of a committee. E.J. Antoni is a good candidate for that, though he's not the only one. The BLS employs many exceptionally skilled people who, given the opportunity, could drive real improvements in its processes.

Allison Nathan: As we discuss the credibility of US data and institutions, concerns about Fed independence have also risen in recent months. Are such concerns warranted, or overblown?

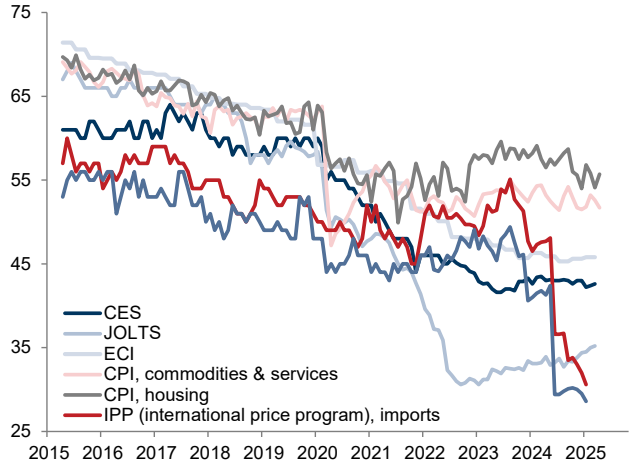
Arthur Laffer: The notion that the Fed should be independent is silly. Just as the Department of War, Treasury, or Health and Human Services operate under the authority of the administration, so too should the Fed and monetary policy. The president, Congress, and other elected officials bear the consequences of monetary policy—be it higher inflation or otherwise—and so should have the authority to influence it.

Efforts to insulate the Fed from political influence are often justified by fears that elected officials might pursue inflationary policies. However, this assumes that career economists at the Fed inherently make better decisions than elected officials, which isn't necessarily true. If an independent Fed always produced better outcomes, I'd support it wholeheartedly. But there's no reason to believe that those shielded from the consequences of their actions will do better than those held accountable for them. Ultimately, sound policy comes from aligning incentives and responsibility, not from some abstract notion of independence. So, I would like to see the Fed become more beholden to the electorate in the conduct of monetary policy.

A look at US...

Survey response rates have declined since the Covid-19 pandemic...

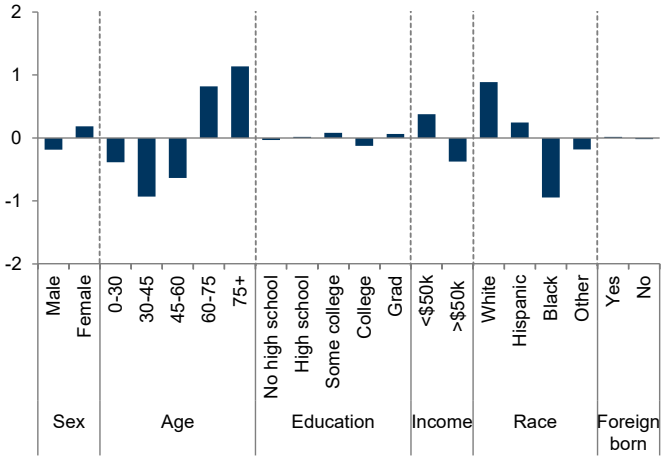
Response rates for selected US surveys, %



Source: Goldman Sachs GIR.

...and survey responses have become slightly more skewed toward older and lower socioeconomic individuals relative to population trends

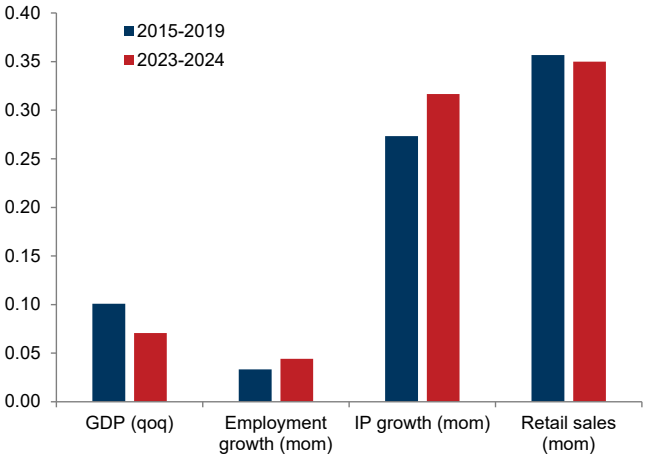
US net shift in respondent shares vs. population shares, 2024 vs. 2015-2019 average, pp



Source: Goldman Sachs GIR.

While data revisions have not systematically increased for key economic indicators...

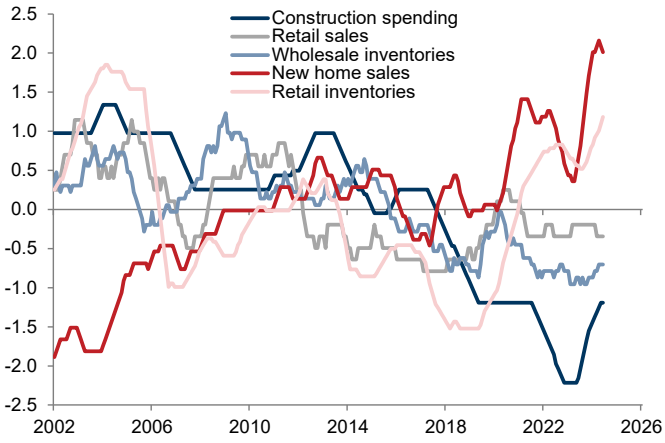
Data revisions for key economic indicators, pp



Source: Bloomberg, Goldman Sachs GIR.

...standard errors for some US data releases, particularly new home sales and retail inventories, have increased significantly, though standard errors for other measures have declined

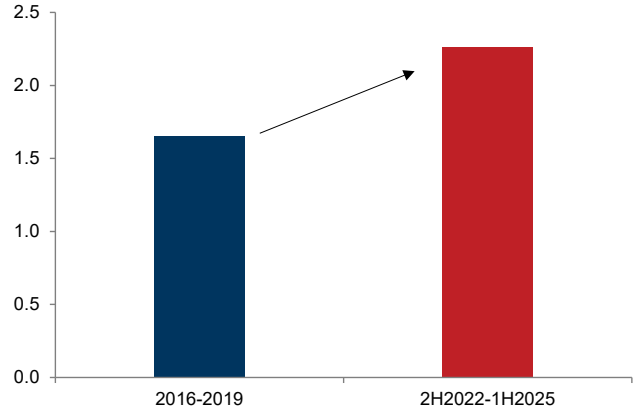
Relative standard errors, z-scores



Source: Goldman Sachs GIR.

Household and payrolls survey employment growth estimates have diverged, suggesting quality deterioration for either or both measures

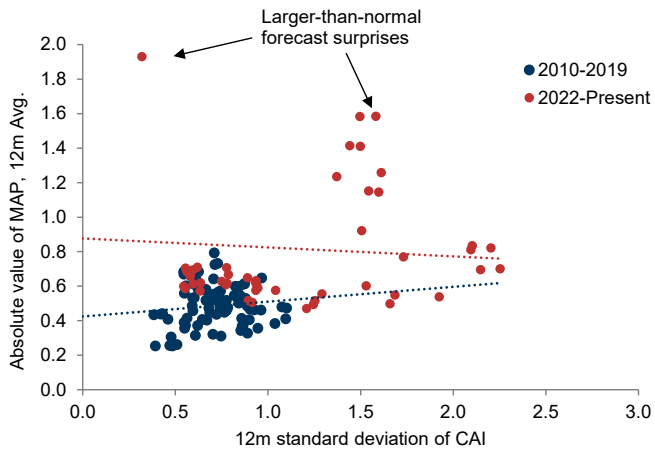
Mean absolute discrepancy between MoM annual rate payrolls and household survey employment growth, pp



Source: Haver Analytics, Goldman Sachs GIR.

Forecast surprises also appear larger than normal, even after controlling for volatility in the underlying growth trend, which suggests some increase in data noise

12m standard deviation of GS CAI (x-axis) vs. absolute value of GS MAP surprise index (y-axis, 12m avg.)

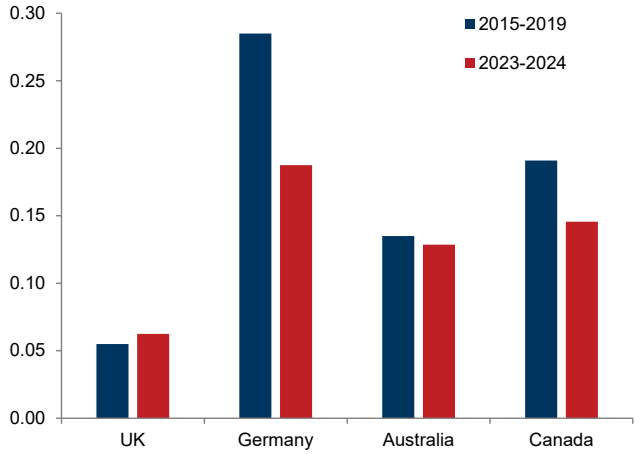


Source: Goldman Sachs GIR.

...and global data reliability

Data revisions globally have not systemically increased for key indicators...

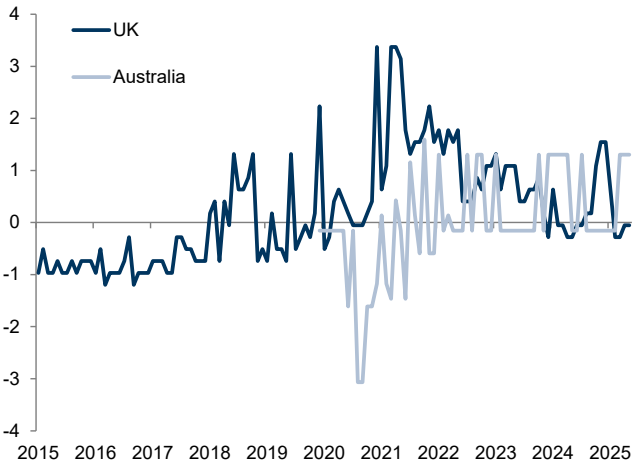
Revisions to QoQ GDP data, pp



Source: Bloomberg, Goldman Sachs GIR.

...but standard errors for retail sales growth data in the UK and Australia have risen in recent years...

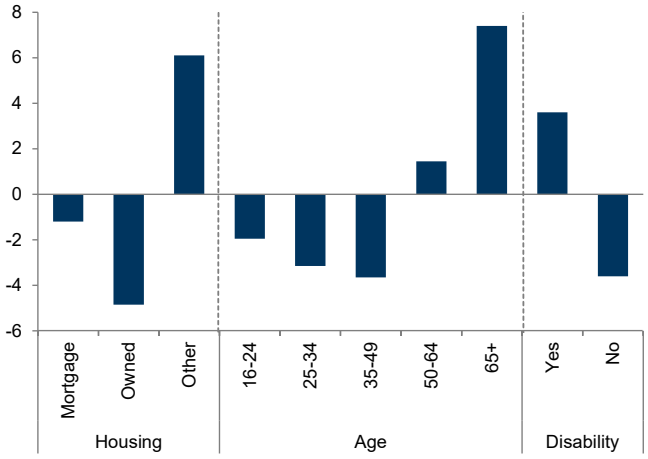
Retail sales errors, z-scores*



*z-scores calculated using data since 2010 for the UK and 2021 for Australia.
Source: Goldman Sachs GIR.

...and much like in the US, survey responses in the UK have become skewed toward older households

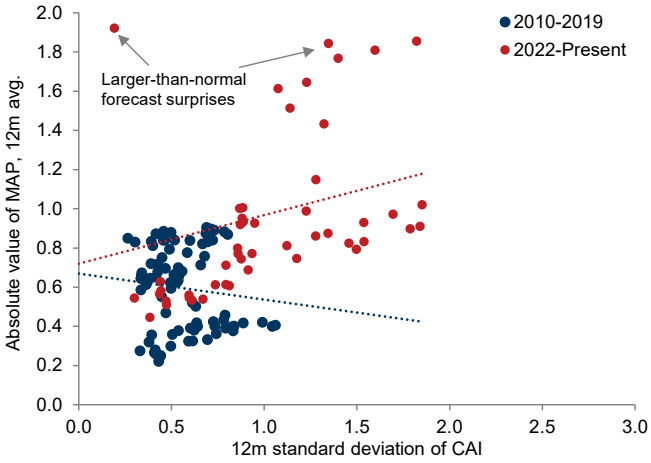
UK net shift in respondent shares, 2023-25 avg. vs. 2019, pp



Source: Goldman Sachs GIR.

Forecast surprises have also increased more than underlying activity volatility—suggesting more data noise—in Europe...

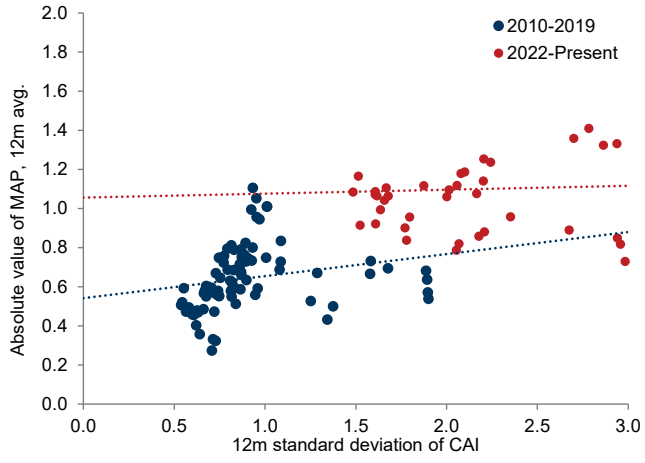
Euro area 12m standard deviation of GS CAI (x-axis) vs. absolute value of GS MAP surprise index (12m avg., y-axis)



Source: Goldman Sachs GIR.

...the UK...

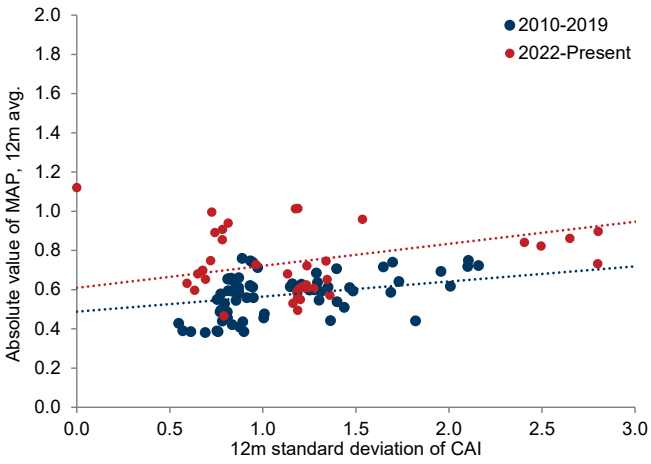
UK 12m standard deviation of GS CAI (x-axis) vs. absolute value of GS MAP surprise index (12m avg., y-axis)



Source: Goldman Sachs GIR.

...and Japan

Japan 12m standard deviation of GS CAI (x-axis) vs. absolute value of GS MAP surprise index (12m avg., y-axis)



Source: Goldman Sachs GIR.

Special thanks to the Global Economics Research team for charts.

Interview with Alberto Cavallo

Alberto Cavallo is Thomas S. Murphy Professor of Business Administration at Harvard Business School and co-founder of the Billion Prices Project and PriceStats. Below, he warns that declining survey response rates, funding cuts, and the potential for political interference threaten the reliability of US economic data, which could have costly consequences.

The views stated herein are those of the interviewee and do not necessarily reflect those of Goldman Sachs.

Jenny Grimberg: You served on the Technical Advisory Committee of the Bureau of Labor Statistics (BLS). What do you view as the most significant challenge in ensuring the reliability of US economic data?

Alberto Cavallo: Aside from political interference, low survey response rates are a major problem, not just in the US but globally. Statistical agencies collect important economic data largely through surveys of firms and households. But informational request overload, technological issues, privacy concerns, and an increasing mistrust of statistics and statistical agencies have led to a decline in survey response rates, particularly for the establishment surveys that collect data from businesses and organizations. This issue has plagued the statistical agencies for over a decade but has worsened since the pandemic. Case in point: response rates for the US Current Employment Statistics (CES) survey, which feeds into the monthly employment report, fell from around 60% pre-pandemic to just over 40% last year.

The BLS and other statistical agencies have attempted to address this issue through simplifying the surveys, giving more response options, and using other measures but have been unable to reverse the structural decline in response rates. And shrinking budgets have impaired agencies' ability to innovate their way out of these problems. So, the recent funding cuts to statistical agencies are exacerbating the major long-term challenge of declining response rates.

> "Low survey response rates are a major problem, not just in the US but globally."

Jenny Grimberg: The BLS' recent announcement that it has stopped collecting price data in some cities due to staffing shortages has also raised concern. Is concern warranted?

Alberto Cavallo: The BLS has indeed suspended some data collection for the Consumer Price Index (CPI) in select cities. Normally, the agency collects CPI data by gathering prices from thousands of retail and service establishments across 75 urban areas. If data collectors can't find a particular product in a certain city or are no longer collecting data in that city, they may substitute the price of the product in a different city. This process is known as "imputation", and the BLS has been using it more frequently lately.

But this isn't that concerning when it is about goods, because many retail chains have uniform pricing policies, so the price of a particular good at a chain store in New York, for example, is the same as in Boston. So, imputation yields the same result and isn't biasing the CPI. This is also an easily fixable problem—simply raising the BLS' budget would allow it to resume data collection in every city. So, I don't view this issue as particularly worrisome.

Jenny Grimberg: The recent large revisions to payroll growth have received a lot of attention. What do you make of them?

Alberto Cavallo: The BLS revises employment data on a regular basis, and the magnitude of the recent revisions isn't unprecedented. Ultimately, such revisions reflect the structural issues with survey response rates that we've discussed as well as the fact that survey data often arrives with a delay. So, any concerns about BLS bias today are not justified—it remains one of the best statistical agencies in the world.

Jenny Grimberg: But given the structural issues facing US agencies, should the US statistical system still be considered the global gold standard?

Alberto Cavallo: Yes. I regularly attend statistical meetings and observe first-hand that statistical agencies around the world closely follow and consult with US agencies, which are highly regarded internationally for their reliability and accuracy. There are, of course, always opportunities to improve. For example, I have long advocated for US agencies to build innovation centers to develop new technologies that help address the data collection challenges they face. Unfortunately, the agencies are far away from having the resources necessary to do so given the current funding environment. And making it easier to respond to surveys is only half the battle—businesses and households must be convinced of the importance of doing so and the trust that people have lost in statistical agencies must be rebuilt. The government's actions will play a key role in determining how people regard the US statistical system going forward.

Jenny Grimberg: The Trump Administration has disbanded several of the statistical agencies' advisory committees, including the one you served on. What impact could that have?

Alberto Cavallo: The BLS Technical Advisory Committee that I served on for over seven years brought together academics, private sector experts, and BLS staff to discuss and advise on proposed changes to the agency's data collection and analysis. I viewed it as helpful for increasing the transparency and credibility of the BLS' methods as well as bringing in new ideas at minimal cost. While the disbanding of such committees may not affect US data quality in the short term, the long-term impacts could be more significant as the BLS and other agencies may find it more difficult to incorporate new methods and ideas into their work, exacerbating the challenge of producing high quality economic data.

Jenny Grimberg: President Trump also recently dismissed the BLS Commissioner and nominated E.J. Antoni to the post. How do you view these developments?

Alberto Cavallo: I find them very troubling. It's difficult to avoid a comparison to the experience of my home country, Argentina, nearly two decades ago when the President, dismayed at rising inflation, removed statistical agency leadership. Some statistics stopped being reported and official data no longer seemed to align with perceptions. That was a very chaotic period that destroyed trust in Argentina's official statistics for over a decade. I worry that the Trump Administration's actions could similarly affect the credibility of the BLS and the data it produces. While the US is in a better position today than Argentina was given that the BLS still employs many highly-qualified statisticians and has more institutional checks and balances, the current situation is still very concerning.

Jenny Grimberg: But the BLS commissioner is just one person in an agency of thousands. So, might such concerns be overblown?

Alberto Cavallo: It's true that the commissioner has little influence over the data; hundreds of people work in the production of BLS statistics, and the commissioner doesn't have a direct role in producing them. But a politically-minded commissioner would still be concerning given their authority over personnel decisions and the agency's overall direction. During the episode in Argentina, the leadership of the statistical agencies as well as the department heads were replaced, which created problems because even as lower-level statisticians continued their work, the data ultimately rolled up to the statisticians at the top who then aggregated it, ultimately producing questionable numbers. So, the replacement of more of the BLS' leadership would be incredibly concerning.

That said, I am somewhat comforted today by the wealth of private sector statistics in the US, which can be used to verify the accuracy of official data. When the troubling developments began in Argentina, my work with online price data, which eventually led to the Billion Prices Project and PriceStats, helped provide evidence that the government was manipulating the inflation numbers. Today, many such initiatives exist, so official statistics can much more easily be checked and flagged. Many more people are also well-versed in the intricacies of US data than Argentine data, which adds another layer of checks. So, I am relatively optimistic that any data oddities would be quickly detected.

Jenny Grimberg: But doesn't private sector data have its own limitations?

Alberto Cavallo: Yes—private sector data has advantages and disadvantages just like any other statistic. Private sector data benefits from higher-frequency and near real-time insights and can facilitate international comparisons by applying the same data collection methodologies and calculations across countries. But such data often has coverage gaps, partly because private sector data providers simply don't have the same ability as the government does to run large surveys like those used in employment data.

The incentive structure for private data providers is also different. Unlike the statistical agencies, the private sector focuses on producing statistics that financial market participants find useful. Inflation and employment data fall squarely into this category, but inequality statistics, for example, may not. And private firms only produce such data in select economies or sectors where someone is willing to pay for it. Private firms also utilize proprietary methods that they are oftentimes reluctant to share; as long as the statistics are solid and produce the insights that investors need, private firms have little incentive to be transparent. So, private sector data cannot and should not fully replace official data. Rather, the two should be thought of as complementary, with both playing an important role in the overall data ecosystem.

> "The US could end up paying a significant cost if its economic data is no longer reliable or accurate."

Jenny Grimberg: Ultimately, how costly is unreliable/inaccurate data from an economic perspective?

Alberto Cavallo: A lack of trustworthy data can be tremendously costly in the long run. Trust in economic data is crucial for an economy's well-being. Without good data, policymakers would have difficulty gauging the economy's health and making informed and effective policy choices. Investors are also less willing to invest in countries with untrustworthy statistics, as the Argentina experience demonstrated. Although lower inflation data in Argentina could have reduced interest payments on inflation-adjusted bonds, the government quickly learned that investors were no longer willing to buy new bonds or invest in the country more broadly.

And when reliable official statistics are unavailable, people tend to assume the worst. Our research in Argentina showed that people believed the official inflation index when it rose, but not when it fell—even if our independent inflation measures also reflected a dip—because they didn't trust numbers showing any sort of improvement. So, instead of lowering inflation expectations, as the government may have hoped, the manipulation of the data exacerbated them.

Importantly, recovering lost trust takes a long time. And once the door is open for people to start questioning whether the heads of statistical agencies are motivated by anything other than a desire to measure the truth, it is very difficult to close it, even as leadership shifts. In Argentina's case, it took many years to restore credibility in the official data.

Ultimately, the costs of unreliable data are real and tangible. Inflation data, for example, is used to adjust Social Security payments, make business decisions, and set wages and prices. So, the US could end up paying a significant cost if its economic data is no longer reliable or accurate. I hope that won't ultimately prove to be the case. But given everything we've discussed, I worry.

Q&A on US data revisions

Ronnie Walker answers key questions about US economic data revisions and what that could mean for data reliability ahead

Q: How is US economic data produced?

A: The fundamental building blocks for most top-tier economic indicators in the US are voluntary surveys of households and businesses conducted by government agencies. Most surveys target a representative sample, while some use a stratified strategy with censuses of certain subsegments. Entities selected for a survey receive invitations, often via mail or email, with instructions and credentials to complete the survey. In some cases, administrative government or private sector data augment the survey results.

With rare exceptions, economic data is revised extensively. Most monthly reports contain revisions to figures for the preceding two months, and some contain revisions that go back further. Quarterly GDP data is revised almost monthly, and other quarterly series also contain revisions to back data. As if this were not enough, most series undergo annual revisions that extend back several years.

Q: Why is the data revised so much?

A: The main reason why data is revised so much is that it is initially generated from samples, sometimes with incomplete information concerning the period in question.[1] For example, the first estimate of retail sales for a given month draws from a sample of sometimes-partial month sales results for about 5,000 retailers, a comparatively small sample for the country as a whole. In subsequent months, earlier respondents can update their results based on the full month of sales and a much larger sample closer to 13,000 contributes to a "final" figure. However, even this "final" label is a misnomer: the data is revised annually to incorporate results from retailers that were not part of the sample. Such revisions are often called "benchmark" revisions because they align the data to a specific period for which more comprehensive data is available and are intended to bring the data closer to being a census, which surveys every member of the population rather than just a sample.

Q: Has US data quality deteriorated?

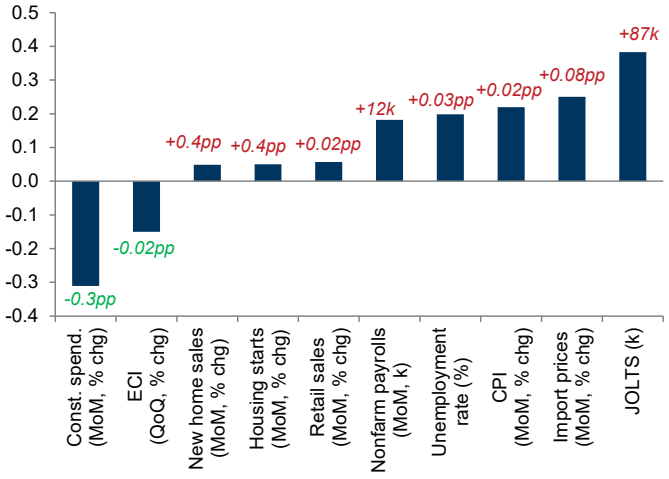
A: Our analysis of the evolution of data reliability across more than thirty economic indicators based on several dimensions—including response rates, standard errors, and magnitude of revisions—suggests that US data quality has generally degraded over the last decade. In particular, response rates have declined for nearly every top-tier government statistical survey—including the surveys that underpin nonfarm payrolls (18pp decline vs. the 2015-2019 average), the unemployment rate (-16pp), the CPI (-10pp), the employment cost index (-20pp), and job openings (-30pp)—a trend that accelerated during the pandemic.

Q: How do lower response rates impact the quality of economic indicators?

A: We see three main channels through which lower response rates can impact economic indicators. First, a lower response rate reduces the sample size, which can increase month-to-month volatility and boost standard errors—which measure the expected variability between a sample estimate and the true value of a population—thereby widening the confidence interval (CI) around point estimates. Standard errors are 26% higher on average today than in 2015-2019 and have increased for eight out of ten government surveys we reviewed. The increase appears most consequential for JOLTS and the employment report; for example, the 87k reported increase in the standard error of JOLTS now translates to a 90% CI of ~700k around the latest job openings reading.

Reported standard errors have increased for most major indicators

Change in reported standard error relative to typical pre-pandemic consensus forecast surprises, 2023-Present vs. 2015-2019, standard deviations



Source: Goldman Sachs GIR.

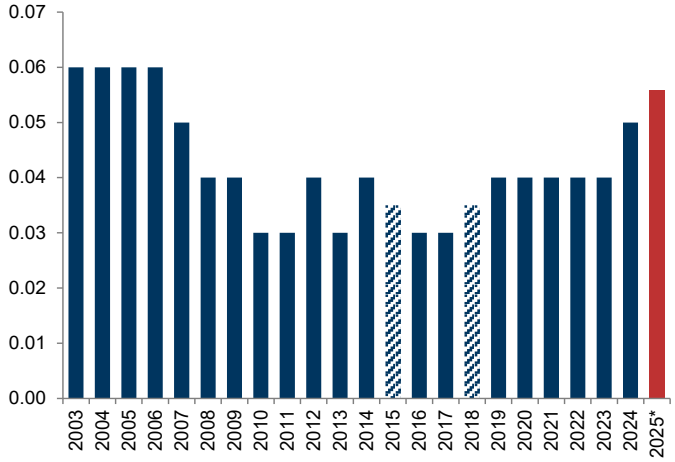
For some indicators, these standard errors may stabilize at their current elevated levels or even reverse their rise. For example, the standard error of JOLTS job openings has recently stabilized after a decade of consistent increases, reflecting a slight rebound in the JOLTS response rate so far this year. For many government surveys, most of the decline in response rates appears to reflect weaker initiation rates (i.e., the inability of data collectors to secure survey participation from new establishments rather than no longer receiving responses from establishments that had previously responded). And initiation rates show some evidence of stabilization for some surveys (or rebound in the case of JOLTS) over the past year, which suggests that their response rates could stabilize.

However, for other indicators, standard errors appear likely to rise further. We estimate that the recent reduction in CPI price collection following budget cuts at the BLS will push its monthly standard error to almost double its 2015-2019 average and its 90% CI to almost 20bp from 10bp on average in 2015-2019, and the impacts of the federal hiring freeze and broader budgetary constraints could push standard errors higher.

[1] Economic data is also often revised because seasonal factors are recalculated to incorporate new data as well as methodological improvements.

Resource constraints have reduced the number of prices collected for the CPI and increased its standard error

Headline CPI, median monthly standard error, pp

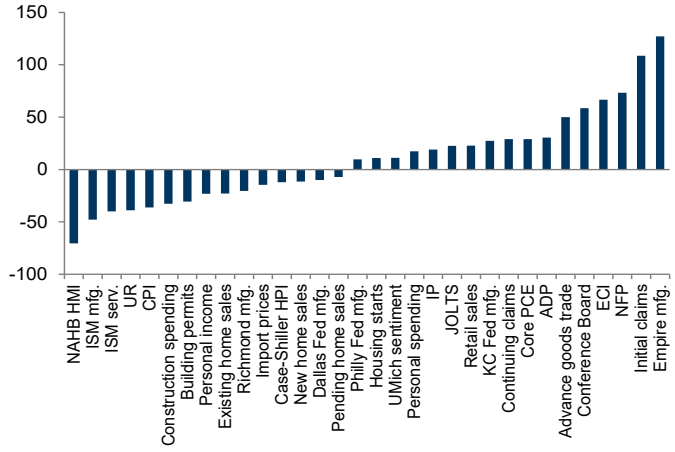


**GS estimate. Assumes an 18% decline in collected prices and no increase in the underlying standard deviation of collected prices.*
Note: Dashed bars indicate interpolated value.
Source: Department of Labor, Goldman Sachs GIR.

The second channel through which lower response rates and a smaller sample size can impact data quality is the potential for larger-than-usual data revisions, as incremental responses can have a greater influence on updated estimates. Partly for that reason, lower survey response rates have likely contributed to recent greater revisions in JOLTS job openings, retail sales growth, and nonfarm payroll growth. However, we find that nearly as many indicators have experienced *smaller* revisions (15) as larger revisions (17) in recent years.

Nearly as many indicators have experienced smaller absolute revisions as larger revisions in recent years

Change in mean absolute revision, 2022-2024 vs. 2015-2019, % change



Source: Haver Analytics, Goldman Sachs GIR.

However, lower response rates aren't the only potential source of elevated revisions. Both jobless claims, which are based on administrative data, and the Empire manufacturing index, which is a survey for which the underlying (non-seasonally adjusted) source data is not typically revised, have undergone particularly large revisions in recent years due to the correction of pandemic-introduced seasonal distortions, which had erroneously impacted initial prints and were only fixed over time as it became apparent that a genuine shift in seasonal patterns had not occurred across the early pandemic years.

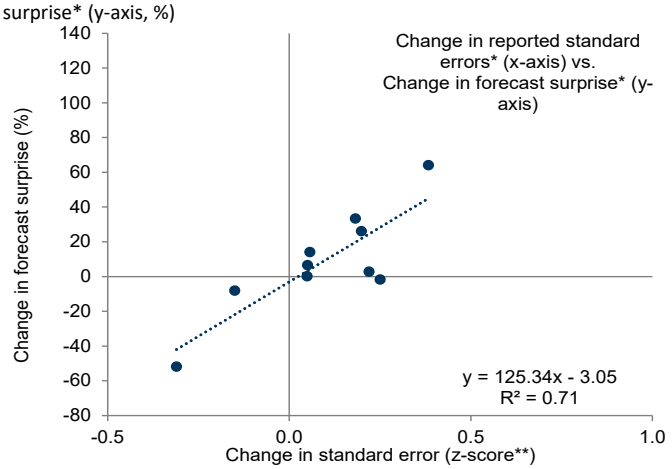
The third channel is through nonresponse bias (i.e. a declining response rate can bias medium-term trends if the probability of nonresponse is correlated with respondents' answers). We have found that nonresponse bias may have modestly boosted the reported level of job openings, and other studies have suggested that nonresponse has impacted other data.[2] However, we do not have reason to think that the broader set of data has been biased by nonresponse.

Q: What impact has the decline in data quality had?

A: The decline in data quality has resulted in noisier data releases and a less reliable signal from any singular data print. Over the past few years, economic indicators that have experienced larger declines in quality—proxied by, for example, the change in reported standard errors or the magnitude of revisions—have surprised more relative to consensus forecasts.

Surprises to consensus forecasts have increased more for indicators that have experienced greater declines in quality

Change in reported standard errors* (x-axis, z-score) vs. change in forecast surprise* (y-axis, %)



**2023-2025 vs. 2015-2019.*
***Scaled to standard deviation of 2015-2019 surprises vs. BBG consensus median.*
Source: Haver Analytics, Goldman Sachs GIR.

Q: How can data watchers troubleshoot the decline in US data quality?

A: The decline in survey response rates has increased the relative value of averaging across indicators (akin to the methodology of our Current Activity Indicators (CAIs)) as well as of administrative and alternative data (e.g., web-based measures of job openings) that are immune from declining response rates and often calculated from much larger samples. However, those series often face the same issues as statistical agencies—misprints, poor collection rates, large revisions—as well as other problems, and are often best thought of as complements and cross-checks to official government statistics. The same could be said for business surveys, whose response rates have remained stable, but have become poor indicators of realized activity over the last five years.

Ronnie Walker, Senior US Economist

Email: ronnie.walker@gs.com *Goldman Sachs & Co. LLC*
Tel: 917-343-4543

[2] For example, see Kristin Butcher, Lucas Cain, Camilo García-Jimeno, and Ryan Perry, "Immigration and the Labor Market in the Post-Pandemic Recovery," Chicago Fed Working Paper, 2023.

Data production challenges, globally

Country	Agency	Data Release	Issue	Official Quote/Description
US	Bureau of Labor Statistics	Consumer Price Index	Coverage reduction	"To align survey workload with resource levels, BLS suspended data collection for portions of the Consumer Price Index (CPI) sample in select areas across the country starting in April. In April, BLS suspended CPI data collection entirely in Lincoln, NE and Provo, UT. In June, BLS suspended collection entirely in Buffalo, NY. Roughly 15 percent of the sample in the other 72 areas also was suspended from collection, on average. Collection suspension affects both the Commodity and Services Pricing survey and the Housing survey. As a result, the number of collected prices and the number of collected rents used to calculate the CPI has temporarily been reduced."
US	Bureau of Labor Statistics	Current Population Survey Database	Production error	"BLS identified an error in the rounding of median hourly earnings data and associated standard errors in the Current Population Survey database. A total of 162 series were affected. The estimates were rounded to the nearest integer, instead of 2 decimal places (or to the nearest dollar, instead of to the nearest cent). This problem only occurred with the annual averages for 2021."
US	Bureau of Labor Statistics	Current Employment Statistics	Major revisions	"Revisions for May and June were larger than normal. The change in total nonfarm payroll employment for May was revised down by 125,000, from +144,000 to +19,000, and the change for June was revised down by 133,000, from +147,000 to +14,000." (from July Employment Report) "The change in total nonfarm payroll employment for June was revised down by 27,000, from +14,000 to -13,000, and the change for July was revised up by 6,000, from +73,000 to +79,000. With these revisions, employment in June and July combined is 21,000 lower than previously reported." (from August Employment report) "The preliminary estimate of the Current Employment Statistics (CES) national benchmark revision to total nonfarm employment for March 2025 is -911,000 (-0.6 percent)... The annual benchmark revisions over the last 10 years have an absolute average of 0.2 percent of total nonfarm employment." (from Preliminary Benchmark Summary)
US	Census Bureau and Bureau of Labor Statistics	Current Population Survey	Coverage reduction	"The Bureau of Labor Statistics (BLS) and the Census Bureau have paused plans to reduce the Current Population Survey (CPS) sample in January 2025, due to a provision in the recently passed continuing resolution that allows BLS to spend CPS funds at a faster rate. We will continue to monitor the budget situation and will keep the public updated about potential impacts to the CPS sample."
US	University of Michigan	Consumer Survey	Production error	"There was a minor technical error in the generation of the weights used to compute aggregate estimates for January 2025. We have since corrected the weights. Overall, the differences between the estimates originally released and the revised estimates are almost negligible."
UK	Office for National Statistics	Producer Prices Index (PPI) and Construction Price Deflators	Production error	"During work to improve the systems used to create the Producer Price Index (PPI) and the Services Producer Price Indices (SPPI), our quality assurance identified a problem with the chain-linking methods used to calculate these indices... This problem affects the years from 2008 onwards. However, the main impact on annual producer price inflation rates is seen in 2022 and 2023. As a consequence, we are pausing the publication of PPI and SPPI data, which was next due on 26 March, while we rectify this issue. As construction price deflators are partly derived from PPIs and SPPIs, these indices are also affected and publication of them will also be paused. We are planning to recommence publication in the summer and will keep users informed of progress."
UK	Office for National Statistics	UK Labor Survey	Suspended data series	"As we have previously highlighted, falling response rates for household surveys are affecting national statistics institutes internationally. In October 2023, the Office for National Statistics (ONS) suspended publication of the Labour Force Survey (LFS) when its response rates led to increased data uncertainty."
UK	Office for National Statistics	UK Trade Statistics	Production error	“Due to the identification of a further error in UK trade statistics, relating to international trade in services data for 2023, the Office for National Statistics has made the decision to delay the UK Trade: January 2025 release, which was scheduled for Friday March 14.” (from the FT)
UK	Office for National Statistics	Consumer Price Inflation	Production error	"An error in car tax data provided by the British government caused the consumer price inflation rate to be overstated by 0.1 percentage points for the year to April [2025]." (from Reuters)
Germany	Destatis	Consumer Spending	Suspended data series	Since May the Federal Statistical Office (Destatis) has not updated time-series data for retail and wholesale sales, as well as revenue from the services sector, hospitality, car dealers, and garages.
Sweden	Statistics Sweden	Unemployment Rate	Production error	In November 2019, Statistics Sweden, which has blamed a subcontractor for the issues, was forced to drastically cut its estimate for unemployment in September. The jobless rate for that month was revised to 6.6% from 7.4%, and the agency has restated nearly all its data since July 2018.
China	National Bureau of Statistics	Broad	Suspended data series	"Land sales measures, foreign investment data and unemployment indicators [including youth unemployment] have gone dark in recent years. Data on cremations and a business confidence index have been cut off. Even official soy sauce production reports are gone. In all, Chinese officials have stopped publishing hundreds of data points once used by researchers and investors." (from WSJ)

Source: BLS, Reuters, WSJ, ONS, FT, UMich, Goldman Sachs GIR.

Special thanks to the Global Economics Research team for table.

Ranking changes in US data reliability

Indicator	Units	MAP Score	Data Type	Rank: Change in Quality *(lower #=greater decline quality)*					Response Rate (%)		Standard Error		Standard Deviation		Forecast Surprises^	
				Revision	Sampling	Std. Err.	Noise	Average	Latest*	Historical**	Latest*	Historical**	Latest*	Historical**	Latest*	Historical**
JOLTS	k	-	Survey	13	1	1	6	5.3	33	63	214.4	127.6	882.4	741.8	371.7	226.5
NFP	Chg, k	5	Survey	3	3	6	13	6.3	43	60	80	68	79.4	71.3	84.6	63.4
ADP	Chg, k	3	Admin.	4	16	13	2	8.8	-	-	-	-	98.4	50.4	81.2	43.7
Retail Sales	Chg, %	4	Survey	9	7	9	11	9.0	57	67	0.3	0.28	0.6	0.5	0.4	0.4
Core PCE	Chg, %	-	Mixed	8	16	5	7	9.0	-	-	-	-	0.1	0.1	0.1	0.1
Advance Goods Trade	$bn	-	Admin.	7	16	13	1	9.3	-	-	-	-	20.3	5.9	14.1	3.1
Empire Mfg.	Index	2	Survey	2	16	13	8	9.8	50	50	-	-	14.6	12.0	16.6	7.8
Philly Fed Mfg.	Index	4	Survey	19	10	13	5	11.8	-	45	-	-	16.0	11.7	14.4	8.2
Personal Spending	Chg, %	1	Mixed	12	11	12	12	11.8	-	-	-	-	0.3	0.3	0.2	0.1
IP	Chg, %	2	Mixed	15	9	7	21	13.0	-	-	-	-	0.5	0.5	0.3	0.3
Pending Home Sales	Chg, %	2	Mixed	21	16	13	3	13.3	-	-	-	-	4.3	2.4	4.1	2.0
Import Prices	Chg, %	-	Mixed	24	4	1	26	13.8	45	55	0.15	0.07	0.4	0.6	0.3	0.3
S&P Global Mfg.	Index	-	Survey	11	14	13	19	14.3	75	80	-	-	1.7	1.7	-	-
Housing Starts	Chg, %	1	Mixed	17	15	10	16	14.5	-	-	7.5	7.1	9.5	9.0	8.0	7.5
Initial Claims	k	2	Admin.	1	16	13	29	14.8	-	-	-	-	13	26	10.9	11.6
CPI	Chg, %	-	Mixed	33	8	3	20	16.0	54	65	0.05	0.03	0.2	0.2	0.1	0.1
ECI	Chg, %	-	Survey	6	2	33	24	16.3	46	66	0.10	0.12	0.08	0.12	0.11	0.12
NAHB HMI	Index	1	Survey	28	16	13	9	16.5	13	13	-	-	6.1	5.5	3.6	2.7
New Home Sales	Chg, %	2	Survey	22	16	11	18	16.8	-	-	9.6	9.3	8.3	7.9	7.8	7.7
Continuing Claims	k	1	Admin.	5	16	13	34	17.0	-	-	-	-	81	237	28.0	31.7
Existing Home Sales	Chg, %	2	Mixed	26	16	13	15	17.5	-	-	-	-	4.4	4.1	3.4	3.0
Personal Income	Chg, %	-	Mixed	29	30	7	4	17.5	-	-	-	-	0.3	0.2	0.3	0.2
Case-Shiller HPI	Chg, %	-	Admin.	25	16	13	17	17.8	-	-	-	-	0.4	0.3	0.2	0.2
Unemp. Rate	%	5	Survey	31	5	4	32	18.0	70	85	0.13	0.10	0.3	0.6	0.1	0.1
S&P Global Serv.	Index	-	Survey	16	29	13	14	18.0	75	85	-	-	2.5	2	-	-
UMich Sentiment	Index	1	Survey	18	33	13	10	18.5	-	-	-	-	7.3	3.8	-	-
Building Permits	Chg, %	-	Survey	27	12	13	22	18.5	66	70	-	-	4.4	5.3	3.9	5.2
Dallas Fed Mfg.	Index	-	Survey	20	13	13	28	18.5	71	-	-	-	10.0	18.3	8.0	7.5
ISM Serv.	Index	3	Survey	30	16	13	23	20.5	-	-	-	-	1.8	2.2	2.1	1.9
Conference Board	Index	3	Survey	10	32	13	30	21.3	-	-	-	-	6.5	15.0	5.2	5.0

**2023-present, when available. **2015-2019, when available. ^Reports' standard deviation.*

Notes: For each ranked category, we use a combination of percent changes and changes in the relevant statistics relative to typical forecast surprises. To rank indicators that mix administrative and survey data, we use the values of their respective source data divided by two. We do not use response rates for UMich or Conference Board, both of which switched to online surveys in the last five years. Standard errors are not applicable to surveys like the building permit survey that do not use probability samples. For construction spending, we report the response rate for private nonresidential construction. For retail sales, we are reporting the response rate for ARTS (the source data). CPI response rate is a weighted average of the C&S and Housing survey response rates. The sample size of price indices reflects the number of intended price quotes instead of the number of establishments or households.

Source: Bloomberg, Department of Labor, Department of Commerce, Federal Reserve, Institute for Supply Management, S&P Global Market Intelligence, National Association of Realtors (NAR), National Association of Homebuilders (NAHB), University of Michigan, The Conference Board, Goldman Sachs GIR.

Special thanks to Senior US Economist Ronnie Walker for table.

Global data: still reliable, for now

Joseph Briggs argues that global economic data mostly remain reliable, but that further deterioration in data quality could be costly

While US data quality has received significant attention recently (see pgs. 12-13), concerns around data quality are a global trend. In addition to the well-documented US data quality issues, the UK's Office for National Statistics (ONS) erred in constructing its inflation and trade statistics and had to suspend publication of its Labour Force Survey in 2023 due to quality concerns, Germany suspended several data series in 2024, and China has halted the publication of hundreds of statistics with little explanation. The apparent deterioration in data quality and availability has prompted many global central bank officials—including from the BoE, Fed, ECB, RBNZ, and RBI—to voice concerns about the trustworthiness and timeliness of data.

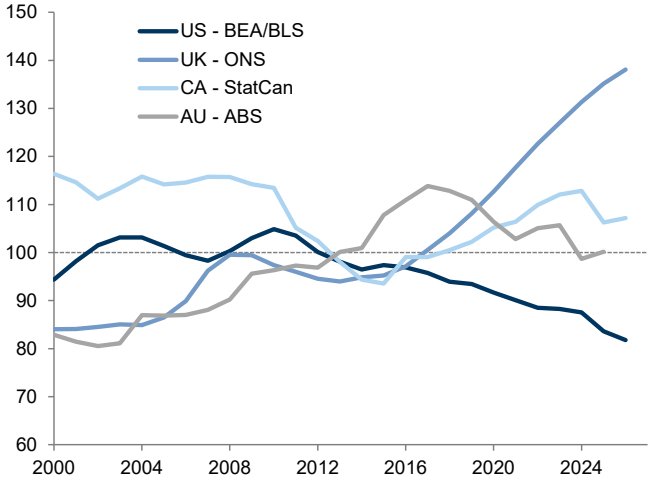
Three sources of concern

Recent concerns around data quality stem from three sources. First, post-pandemic economic and policy volatility has fueled unusual and outsized swings in activity and inflation that have added noise to economic data via residual seasonality and made it harder to assess underlying economic dynamics.

Second, statistical agency funding has largely stagnated over the last decade, limiting statistical agencies' ability to adapt their methodologies. Real statistical funding has mostly moved sideways in Australia and Canada and has declined in the US. And while statistical funding has increased in the UK, organizational and mandate changes—most notably, the ONS was brought under the umbrella of the UK Statistics Authority in 2008—have likely contributed to data quality issues.

Real economic statistics funding has stagnated in Australia and Canada and declined in the US

Real statistical agency funding, index, 100=2010-2015 average

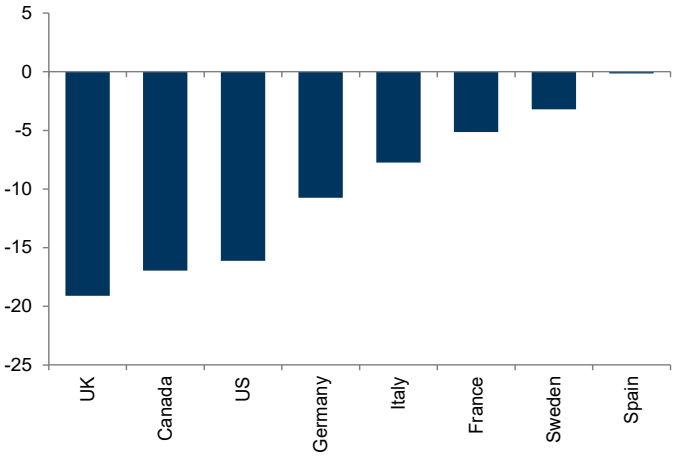


Source: Goldman Sachs GIR.

Third, a long-run decline in survey response rates accelerated since the start of the pandemic. In particular, household labor force survey response rates have dropped sharply, raising concerns about both sampling variability and representativeness.

Household survey response rates have dropped sharply

Change in labor force survey response rates, latest vs. 2018-2019 average, pp



Source: Goldman Sachs GIR.

Has data quality actually decreased?

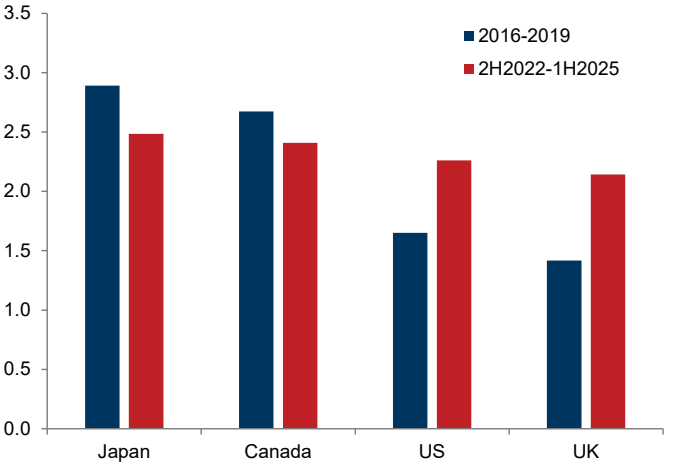
Despite these concerning patterns, evidence of systematic deterioration in global economic data is mixed and does not suggest that economic data has become too unreliable. Most notably, data revisions for several key DM indicators—including GDP, industrial production, and retail sales—were generally *smaller* in 2023-2024 than in 2015-2019, suggesting that data quality concerns may be somewhat overstated.

That said, other patterns point to some decline in data quality. First, reported standard errors have risen for some indicators. For example, standard errors for month-on-month growth in retail sales in the UK and Australia have risen since 2020.

Second, the decline in survey response rates would be most concerning if "non-random" response bias—where survey respondents differ from the general population in ways that cannot be corrected by adjusting sampling weights—were driving the decline. And, indeed, an analysis of detailed micro data finds that household survey responses have shifted toward older and lower socioeconomic status individuals in the UK (but to a lesser extent in the US), raising some concerns that the drop in response rates is not uniform across the population.

Household and payroll survey employment growth estimates have diverged in the US and UK

Mean absolute discrepancy between MoM annual rate payrolls and household survey employment growth, pp



Source: Haver Analytics, Goldman Sachs GIR.

Third, household and payroll surveys measure changes in employment in different ways, so a divergence between these measures would likely suggest quality deterioration for either or both measures. An increase in household and payroll survey employment growth discrepancies in both the UK and US over the last three years relative to the three years prior to the pandemic therefore warrants some concern.

Fourth, forecast surprises (measured as the 12-month moving average of our MAP surprise index) have increased more than underlying activity volatility (measured as the 12-month moving standard deviation in our current activity indicator (CAI)).

These patterns suggest that data quality has deteriorated modestly across DMs but do not suggest that economic data has become very unreliable, and certainly not to an extent that would call into question the usefulness of economic statistics. That said, data quality has worsened more clearly in the UK, prompting a government probe into the effectiveness and delivery of official economic data.

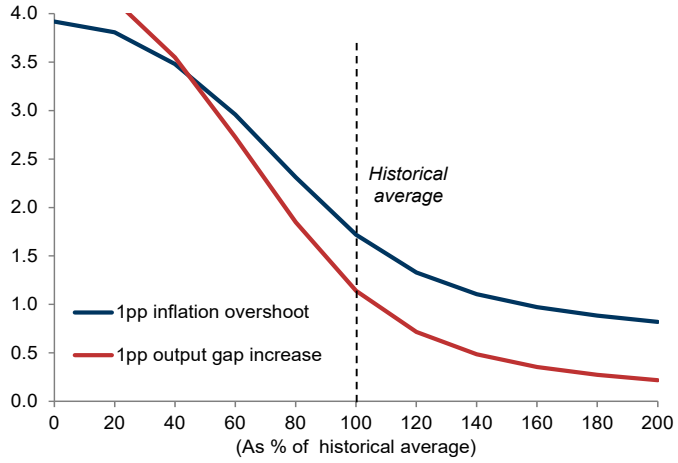
Potential for problematic policy response

Even if actual data deterioration is not a major problem, the *perception* of a decline could make central banks more likely to discount economic data surprises when setting policy.

The difficulty of accurately assessing the underlying state of the economy in real time is a longstanding challenge for central banks given the inherent uncertainty.[1] And the need to filter the signal from the noise in economic data is well understood by policymakers, with former Fed Vice Chair Alan Blinder noting in 1998 that "a little stodginess at the central bank is entirely appropriate" due to data uncertainty.

Our model predicts policy responsiveness could decline by 50% in response to a 40% increase in data noise

Interest rate response to data surprise by noise level, pp



Source: Goldman Sachs GIR.

Indeed, we estimate that when accounting for the noise content of real-time information in assessing the underlying state of the economy, optimal policy responsiveness is close to those implied by standard Taylor rule estimates and far below the level implied in the absence of noise.[2] These patterns suggest that the Fed has historically applied an appropriate amount of discretion to noisy data. And should data noise increase modestly, as is the case today, we estimate that policy responsiveness would change fairly little, although the reaction to inflation and output gap overshoots would decline by 50% in the event that data noise increases by 40%.

Overall, this suggests that central banks interpret real-time economic data with an appropriate amount of prudence, although a much more significant decline in confidence in economic data could result in more sluggish central bank reactions over the long run.

That said, we expect central banks will remain attentive to surprises that suggest their near-term policy stance may not be appropriate, particularly when facing asymmetric risks to the economy. In the current context, such considerations suggest that the Fed will remain particularly responsive to negative activity or labor market surprises, especially after having been misled by stronger initial labor market data that was revised down. This also may help explain why several central banks (including the BoC and RBA) have recently been willing to look through weakness in noisy activity signals and have placed more weight on inflation upside when remaining on hold.

Potential costs of worsening data quality

While the decline in global data quality looks less concerning for now, we see two potential costs if data quality worsens. First and most importantly, the economic costs would be large if noisy data leads to a policy mistake. Using the Federal Reserve's FRB/US model, we estimate that a 25bp "policy mistake" that is subsequently reversed the next quarter would lead to a 0.1% loss in GDP over the following two years. While not extremely large, a 0.1% loss in GDP far exceeds the budget of economic statistic agencies in most economies (the BLS and BEA had a combined budget of just over $800mn in 2024, or 0.003% of US GDP).

Second, we find that (on the margin) high quality economic data supports a well-functioning financial sector and demand for domestic assets. In particular, data quality is correlated with financial sector size even after controlling for other explanatory factors. And data quality concerns driven by the firing of statistical agency heads leads currencies to depreciate by 1% on average in the following week.

Taken together, our results suggest that global economic data mostly remain reliable, but highlight the significant benefits of accurate, timely, and credible economic data for formulating economic forecasts and policy.

Joseph Briggs, Senior Global Economist

Email: *joseph.briggs@gs.com* *Goldman Sachs & Co. LLC*
Tel: *212-902-2163*

[1] This problem was formalized in a 1967 paper by Yale economist William Brainard and a 1970 paper by former St. Louis Fed President William Poole, which intuitively conclude that policy should respond more cautiously to shocks than would be the case if uncertainty did not exist.

[2] To assess how an actual or perceived increase in economic data uncertainty could affect policymaking going forward, we use a model based on a 2001 research paper by former ECB Governing Council member Athanasios Orphanides (written while working as staff economist at the Federal Reserve) in which policy is determined after the policymaker solves a "filtering problem" where policymakers account for the noise content of real-time information when assessing the underlying state of the economy. We calibrate the model to historical US data (where the "noise" processes are estimated by comparing the Federal Reserve staff's real-time estimates of the output gap and inflation level to their current estimates of historical data).

Dealing with dodgy data

Andrew Tilton discusses ways to overcome economic data reliability issues, using China as an example

Unreliable data make it difficult to gauge current economic conditions accurately, let alone forecast the economy's direction of travel. And the noisier the data, the harder it is to see the true picture—especially when data collection and processing lack transparency or, in the worst case, are subject to intentional manipulation. China's macro data are often the subject of client questions about data quality, so we use them here to illustrate several techniques for identifying and overcoming data reliability issues, although we emphasize that these challenges are by no means unique to China.

Warning signs

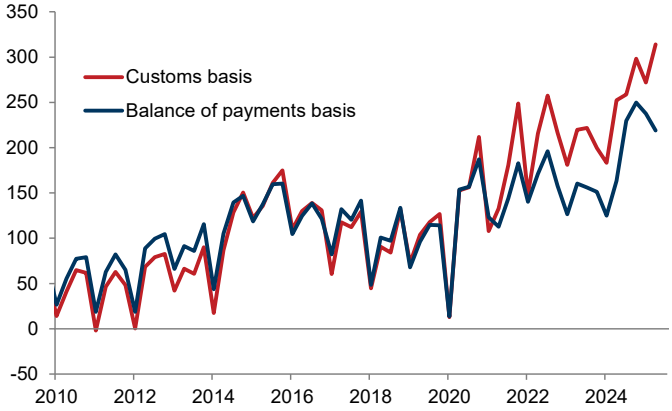
At the macro level, almost all data is derived from a sample rather than a full count of the population, which inevitably creates some "noise" along with the signal. For example, biased survey samples, incomplete responses, misunderstanding of questions, and many other factors can distort the picture from a given set of data. And, in more serious cases, parties involved in the data gathering process—including survey respondents, statistical agencies, or policymakers—may be incentivized to actively distort the numbers. For instance, companies may want to reclassify certain transactions to avoid taxes or take advantage of subsidies, while statistical agencies may be under pressure to report favorable news or help policymakers meet official targets. As such, any given data series must be taken with a few grains of salt. Macro data users must have an appreciation for the potential flaws in the data and the degree of uncertainty involved. Armed with such an understanding, users may be able to take action to reduce potential distortions.

Warning signs of data quality issues that should raise the antennae of market-watchers include:

1. **A lack of component-level or methodological detail.** Without such detail, external analysts struggle to deconstruct major indicators and understand the main factors driving changes. For instance, China's GDP figures lack the granular, quarterly real expenditure-side level data commonly provided in other large economies, and their seasonal adjustment methods are difficult to replicate.
2. **Large discrepancies in data meant to measure similar concepts.** A recent example is the large gap between China's trade surplus as measured by China Customs and as measured in the Balance of Payments (BOP) statistics. While, in theory, different definitions could explain this gap—Customs records trade when goods cross the border whereas BOP is based on change of ownership—the latter set of data has become increasingly difficult to reconcile with the evident strength of Chinese exports around the world (we rely more heavily on the China Customs data, which are more consistent with other countries' reports on trade with China). Another example is the gap between national GDP and the sum of provincial-level GDP.
3. **Significant changes in data volatility—particularly overly smooth data.** Between 2013 and 2019, China's year-over-year real GDP growth figures did not fluctuate by more than 0.4pp from one quarter to the next, typically shifting by just 0.2pp or less. This exceptionally low level of volatility stands out not only compared to China's historical trends but also relative to other countries. (Indonesia is another example of an economy with stunningly stable real GDP growth, excluding the pandemic years.)

The gap between China's trade surplus as measured by China Customs versus BOP statistics has widened in recent years

China goods trade surplus, $bn



Source: Haver Analytics, CEIC, Goldman Sachs GIR.

4. **Large discrepancies between the data and policymaker behavior.** Investors should remain alert to situations where the official data looks fine, yet policymakers act as though the economy is in bad shape. A notable illustration is China's mid-2010s experience: while GDP growth was consistently in line with official government targets, policymakers engaged in a massive stimulus effort in 2015. This served as confirmation that the real economy was performing more poorly than the high-profile official statistics suggested.

Despite steady reported GDP growth in the mid-2010s, policymakers engaged in major stimulus efforts

China domestic macro policy proxy (lhs, z-score) vs. real GDP growth (rhs, % change, yoy)

Source: Haver Analytics, Goldman Sachs GIR.

5. **High-profile data that form the basis for publicly stated policy targets, or otherwise are key to policymaker legitimacy.** Each year at the National People's Congress meeting in March, China's premier publicly announces a series of macro policy targets, including GDP growth ("around 5%" for 2025) and CPI inflation (around 2% for

2025). While these targets serve the important purpose of helping to commit and coordinate policymakers around common goals, they may also create pressure to 'make the numbers' in difficult years, potentially incentivizing policymakers to distort macro data.[1] Economists often refer to this bias as Goodhart's Law: "When a measure becomes a target, it ceases to be a good measure".

6. **Sudden re-definition of data (without overlapping periods to compare the changes in definition).** Examples from China include the redefinition of the youth unemployment rate in 2024 to exclude students as well as the experience with fixed asset investment in the late 2010s after some local officials admitted to falsifying data. (Specifically, in 2018, Inner Mongolia cut its estimate of 2016 industrial output by 40% and Tianjin's Binhai New Area cut its 2016 GDP figure by a third.)

Clearing the fog

To overcome issues with unreliable data, we follow three basic steps in analyzing economic data.

First, we clean the data series we have. In particular, we adjust for seasonality as well as for breaks in the series (e.g. major changes in methodology or sample). We may also 'deflate' the data by converting nominal values to real quantity/volume indexes. At times, we may also back-cast or interpolate data series to fill gaps using relationships from 'cleaner' periods, although we generally do this sparingly (i.e., only when we need a longer series for analytical purposes or inclusion in a proprietary indicator).[2] When series are especially difficult to 'clean' or may have been intentionally distorted, we try to limit their use or avoid them altogether.

Second, we look for alternative data. When the quality of government data is in question, we rely more heavily on private-sector data (though private data providers may also face pressure at times[3]). Widely used private sector macro data include surveys such as the S&P PMIs, while micro data include corporate financial reports. Where possible, we may also use data from other jurisdictions entirely (like 'mirror data' to cross-check trade statistics, or Taiwanese IP data to gauge Mainland China's industrial activity). Another example of alternative data is the consumption of key commodities, which can provide a proxy for economic activity.

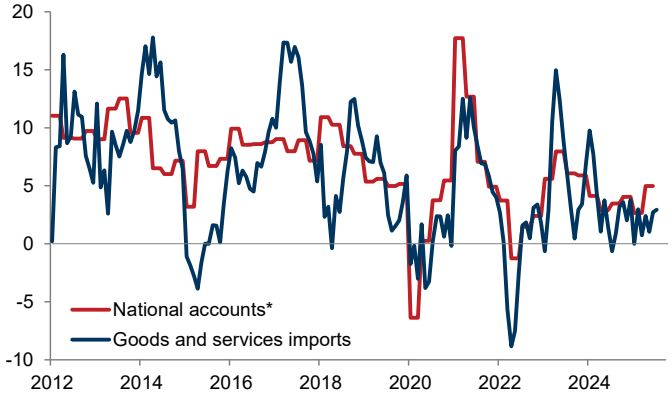
Other micro data such as revenues of listed corporates, which need to meet some minimum requirements, may also provide value. Micro data has the benefit of 'flying below the radar' in the sense that they are less likely to invite government focus or manipulation (at least until/unless they gain more prominence). In past research, we have explored a range of micro and macro indicators to shed light on China's economy.

Third, we build a mosaic of the data we find most reliable. Sometimes this takes the form of an informed comparison of stronger versus weaker figures and an interpretation of what this means for the economy. For example, our China Matters publication typically features a 'heatmap' of high-frequency data from different sectors of the economy (e.g., July activity data painted a consistent picture of strong manufacturing/exports and very weak property sector activity). On other occasions we use statistical techniques to summarize data, including for our GS Current Activity Indicators, which summarize a set of high-frequency activity indicators in a single figure meant to represent the current pace of economic growth.

For China specifically, we have developed a trade-based domestic demand proxy that leverages import data (which can be easily cross-checked against foreign data) to infer growth in consumption and investment in China. Similarly, our US economics team regularly analyzes the details of both the payroll and household surveys for the monthly employment report, and also updates a quantitative indicator of the pace of employment growth that leverages data from both.

Our trade-based domestic demand proxy leverages import data to infer China consumption and investment growth

Real domestic demand implied by national accounts vs. implied by goods and services imports, % change, year ago, 3mma



*GDP - (exports - imports), deflated by a 60:40 mix of CPI and PPI in USD terms.
Source: Haver Analytics, Goldman Sachs GIR.

Dodgy data: not the end all be all

High-quality, unbiased data helps both private sector and official sector actors make better decisions. Underinvestment in data quality—or worse, deliberate data manipulation—can distort decision-making in unpredictable ways and erode trust in the data, even for genuinely good news. In China's case, for example, skepticism among foreign investors over certain macro figures has at times contributed to overly negative views about all aspects of the economy, even those—like manufacturing exports—that are performing well. When data quality is in question, a combination of data cleaning, alternative data sources, and comparative analysis can help users gain a more reliable understanding of underlying economic conditions.

Andrew Tilton, Chief Asia Pacific Economist

Email: andrew.tilton@gs.com *Goldman Sachs (Asia) LLC*
Tel: 852-2978-1802

[1] As a general demonstration of the potential for governments to distort macro data, Martinez (2018) uses data on night-time lighting intensity as a proxy for economic activity to suggest that more authoritarian regimes are more likely to inflate GDP statistics.
[2] For more on typical data issues and techniques, see our various "Understanding" books on macro data for key economies (e.g. Understanding China's Economic Statistics, "Basics of Interpreting the Numbers" section).
[3] For example, property research firm Beike apologized for a report showing high vacancy rates in urban China, and later discontinued a series on secondary home prices which showed larger declines than other providers.

Data reliability concerns, in their words

"In my opinion, today's Jobs Numbers were RIGGED in order to make the Republicans, and ME, look bad... We need accurate Jobs Numbers. I have directed my Team to fire this Biden Political Appointee, IMMEDIATELY. She will be replaced with someone much more competent and qualified. Important numbers like this must be fair and accurate."

"Last weeks Job's Report was RIGGED, just like the numbers prior to the Presidential Election were Rigged. That's why, in both cases, there was massive, record setting revisions, in favor of the Radical Left Democrats. Those big adjustments were made to cover up, and level out, the FAKE political numbers that were CONCOCTED in order to make a great Republican Success look less stellar!!! I will pick an exceptional replacement."

- President Trump, August 2025

"How on earth are businesses supposed to plan—or how is the Fed supposed to conduct monetary policy—when they don't know how many jobs are being added or lost in our economy? It's a serious problem that needs to be fixed immediately... Until it is corrected, the BLS should suspend issuing the monthly job reports. "

""The problems in the BLS data have been evident for three years now, and they still haven't been fixed... The fact that you consistently have large downward revisions means that there are other things wrong with your models and methodologies. Statistical assumptions that may have worked fine before COVID no longer work in today's economy and therefore need to be revised."

- E.J. Antoni, Trump nominee for BLS Commissioner, August 2025

"BLS has tackled the problem of declining response rates from many angles... All data collection activities incorporate quality assurance assessments, including reinterviews with data providers, reviews by senior staff, computer-based data checks, and more. "

- BLS statement, March 2023

"I wouldn't say that I'm concerned about the data today, although there has been a very mild degradation of the scope of the surveys. But I would say the direction of travel is something I'm concerned about. It's really important not just for the Fed, but for Congress and for businesses, frankly, to know what really is going on in the economy. I don't like to see the kind of stories I'm reading and the idea being that the data is going to become more volatile and less reliable. That'll make it more difficult for the private sector and for you and for us."

- Jerome Powell, Fed Chair, July 2025

"There's a heck of a lot of noisiness in the labor market data right now, which is bad for markets, it's bad for transparency and it's something that I think a fresh set of eyes should really look at and try to fix because the jobs numbers... need to be independently produced but they need to be reliable and not subject to massive revisions."

"If the data aren't that good, then it's a real problem for the US. And right now the data... have become very unreliable with these massive revisions over the last few years."

- Kevin Hassett, Director of the National Economic Council, August 2025

"Post-pandemic shifts mean our statistical systems are still catching up. Surveys can lag reality, and we have to adjust our readings accordingly."

- Austan Goolsbee, Chicago Fed President, April 2025

"I think the most important thing here is that we get back to the integrity of the numbers, because it just became OK, just like so many things in our government, for it to get sloppy... what we want is good data, because you can't make good decisions without good data... It's very likely that the Fed would have been doing something else in June, in July, if they had had this data."

- Scott Bessent, Treasury Secretary, August 2025

"We've been surprised a few times this year by big revisions. That's just a reminder that the first number you see is not the final story."

- Raphael Bostic, Atlanta Fed President, August 2025

Source: BLS, Fox News, CBS News, Truth Social, various news sources, compiled by Goldman Sachs GIR.

Data reliability: one more worry for USD

Michael Cahill argues that increased concerns about US data reliability provide another reason to be bearish the US Dollar

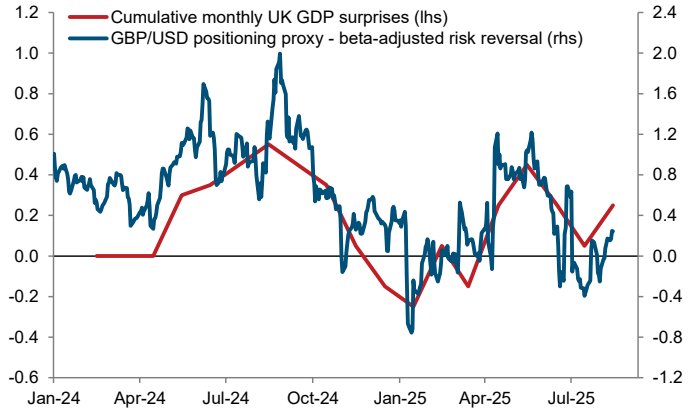
Questions about the reliability of economic data can negatively impact a country's currency by dampening investors' appetite as they become less confident about current economic conditions and return prospects, and more worried that unreliable data will lead to riskier policy decisions (intentionally or not) and worse economic outcomes. While we expect the Dollar to fall further mainly owing to less exceptional US economic performance, growing concerns about the reliability of US data reinforces this bearish view, providing an additional reason for global investors to at least seek some diversification.

Slow down: reduced visibility ahead

Most directly, less reliable data can make international investors less confident about underlying economic trends and so less willing to deploy fresh capital. We have found that correcting for subsequent data revisions helps resolve some of the apparent disconnect between economic fundamentals and FX returns, as investors respond to data as it is reported and not necessarily the "true" economic picture. For example, our estimate of FX positioning in the British Pound has followed data surprises closely. But concerns about data reliability could lead investors to deploy less capital as they wait for a clearer signal. This is especially important for the US, which relies on foreign capital to fund its persistent budget deficits and enjoys an asset premium owing to foreign creditors' portfolio preferences. Under these circumstances, foreign investors would require a lower price—in the form of a weaker currency and higher yields—to compensate for the higher risks.

Investors tend to respond to data as it is reported

% (lhs), index (rhs)



Source: Bloomberg, Goldman Sachs GIR.

Wrong way: make a U-turn

Reduced data reliability can also increase the risk of a policy error and lead to worse economic outcomes over the medium term as policymakers—just like investors—contend with more uncertainty. This would provide another channel for Dollar weakness, as it becomes more likely that monetary and fiscal policy decisions will be misdirected. Policy errors are currency-negative because, on the one hand, too loose monetary policy may fuel inflation, thereby weighing on a currency's purchasing power, while too tight policy may weaken economic fundamentals, leading to less investment demand. Even if policymakers manage to keep things on track despite the challenges, elevated monetary policy uncertainty leads to higher implied FX volatility and a weaker exchange rate.

Caution: rough road

More indirectly but perhaps most importantly, the *reason* for reduced data reliability can be especially important for FX. If data is perceived to be produced in a way meant to obscure true underlying conditions, this would amplify the direct effects discussed above. FX investors are particularly attuned to this risk because they have seen the impact of such doubts on foreign investor demand and, in turn, the value of currencies, before. Episodes of less reliable economic data in Turkiye and Argentina made it more difficult to assess underlying economic conditions, and the motivation behind the changes was clear: to stimulate domestic demand despite high domestic inflation. In the current US context, this could lead both private investors and official sector reserve managers to take precautionary steps to diversify their holdings and reduce the Dollar's dominance in their portfolios.

The Dollar could decline further if global portfolio flows become more balanced as foreign investors pull back

Valuation-adjusted portfolio flows, 12ma, $bn

Source: Federal Reserve Board, Goldman Sachs GIR.

Detour: this way

A decline in the reliability of official economic data provides yet another reason to be bearish the Dollar. But such a decline could also have some long-term upsides. Necessity is the mother of invention, and FX investors will be quick to point out that prior episodes of difficult data collection have also led to key innovations in the search for information. It is no coincidence that after years of contending with inflation concerns Brazil now reports a variety of inflation data every week—with consensus expectations reported out to two decimal points!—that are the direct result of investors seeking new and better information. And after the Covid data scramble, many investors now incorporate alternative data like office badge swipes and restaurant reservations into their assessments of economic activity. While private sector surveys and "big data" come with their own challenges, several cross-checks on government data already exist in the US, which should only expand under increased scrutiny.

Michael Cahill, Head of G10 FX Strategy

Email: michael.e.cahill@gs.com *Goldman Sachs International*
Tel: 44-20-7552-8314

A potential (data) tax on TIPS

William Marshall argues that less reliable inflation data could affect the TIPS market

Diminished confidence in official economic data would have ramifications across markets, but few corners would feel the effects as directly as Treasury Inflation Protected Securities (TIPS). TIPS are US government bonds designed to protect investors from inflation. Unlike nominal bonds, TIPS' principal and interest adjust based on changes in the Consumer Price Index (CPI), specifically the non-seasonally adjusted (NSA) CPI for All Urban Consumers (CPI-U). The principal value adjusts over the bond's life, rising in times of inflation and falling in deflationary periods, which affects the interest payments investors receive given that the coupon rate on the security is applied to the inflation-adjusted principal (though TIPS have a deflation floor that guarantees investors at least the original principal at maturity). The demand for TIPS has grown since the pandemic, largely owing to inflation concerns. But reduced confidence that inflation data will reliably reflect true price pressures could erode these bonds' perceived usefulness.

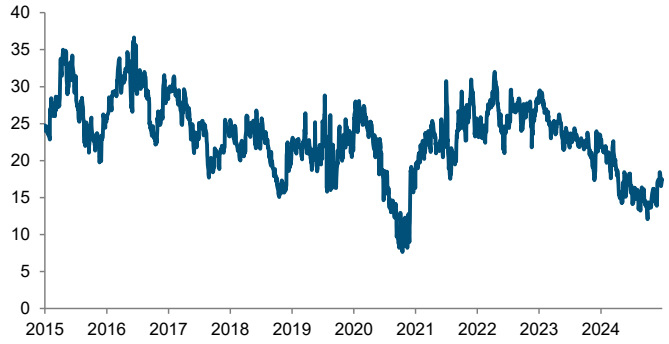
A more "useful" market...

One of the defining characteristics of TIPS is that they have historically been less liquid than their nominal counterparts. At slightly north of $2tn in total outstanding value, the TIPS market makes up around 7% of the overall Treasury market (and nearly half of the global inflation-linked aggregate bond index), but has accounted for only around 2.5% of overall Treasury trading volume in the last year. Investors tend to be compensated for this illiquidity, with TIPS offering 10-20bp of additional yield vs. a synthetic real rate position created via nominal bonds and inflation swaps.

Still, TIPS market turnover (measured as volume normalized by market size) has risen relative to nominals and the additional premium has compressed vs. pre-pandemic norms, suggesting favorable liquidity trends for the market following a period of higher inflation.

TIPS' additional premium has compressed in recent years

10y TIPS basis (TIPS yield vs. nominal yield deflated by inflation swap)

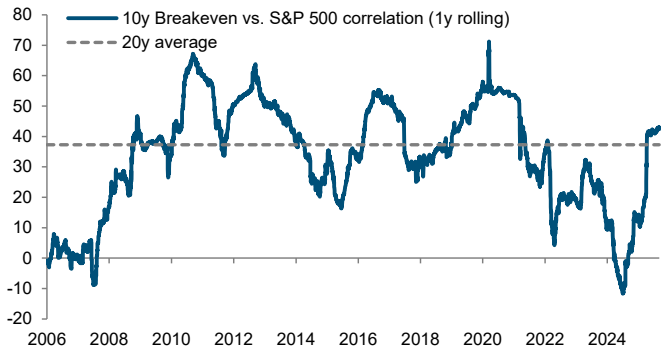


Source: Goldman Sachs FICC and Equities, Goldman Sachs GIR.

Historically, TIPS scored somewhat poorly as a portfolio diversifier compared to nominal bonds. Whether comparing asset correlations or examining the risk-adjusted returns of a 60/40 portfolio, the long-term picture suggests that TIPS have acted as a less useful hedge to risk assets than nominal bonds, with inflation breakevens on average positively correlated with equities (meaning that TIPS tend to outperform nominal yields when risk assets rise and underperform when risk assets fall). But TIPS tend to provide more value in a portfolio context when the market becomes more concerned about near-term inflation upside—the "useful" state of the world for these securities is one in which investors believe near-term inflation will be higher relative to what's anticipated over the longer run.

Breakevens tend to be positively correlated with risk assets

%



Source: Bloomberg, Goldman Sachs GIR.

...but beware unreliable data

But the gains the TIPS market has made since the pandemic can be dented by a loss of confidence in the official inflation data. Two types of potential data concerns could impact TIPS and inflation pricing. The first is noise in the data collection process, wherein reduced response rates, for example, increase standard errors (see pgs. 12-13). In theory, such noise could lead investors to demand additional compensation for holding inflation longs given the increased uncertainty around realized inflation outcomes. In reality, however, we suspect the impact would be somewhat modest as any noise would likely affect the month-to-month data more significantly than the longer-term inflation trend.

The second, and more pernicious, concern is methodological changes that are perceived as introducing downward bias into the inflation data and reducing confidence that the data fully reflects true price pressures. Beyond the mechanical headwind from a lower inflation trajectory, TIPS' value in such a scenario would be eroded by the perception that curtailed upside inflation risk would significantly limit the cases where TIPS are more useful than nominal bonds as a hedge to risk assets.

Such data issues would erode the perceived usefulness of an asset that already faces an important challenge—namely, a relative lack of structural need for US institutions to hedge inflation-linked liabilities. For example, while some domestic pensions provide cost-of-living adjustments, they are not required to do so. But TIPS offer global investors that have a structural need to hedge inflation risks a relatively liquid way to do so at a time when some sovereign issuers have scaled back or eliminated their inflation-linked programs. Perhaps reflecting this, foreign private investors accounted for around 17% of TIPS ownership at end-2024, a record high. A scenario in which investors lose confidence in the official inflation data could sap global sponsorship for the asset class.

William Marshall, Head of US Rates Strategy

Email: *william.c.marshall@gs.com* *Goldman Sachs & Co. LLC*
Tel: *212-357-0413*

Summary of our key forecasts

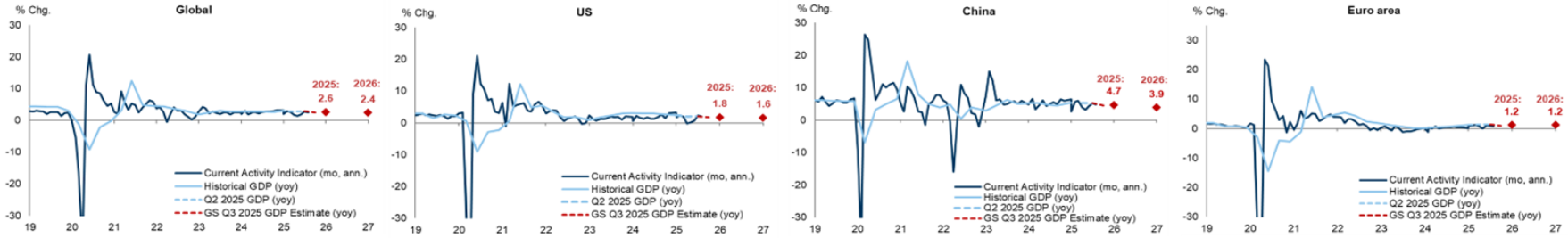
GS GIR: Macro at a glance

Watching

- **Globally,** we expect real GDP growth to slow to 2.6% yoy in 2025, reflecting headwinds from higher US tariffs. We expect global core inflation to remain relatively steady this year and end the year at around 2.8% as the tariff-driven boost to inflation in the US is largely offset by disinflationary impulses from declines in shelter inflation and wage inflation.
- **In the US,** we expect real GDP growth to slow to 1.3% in 2025 on a Q4/Q4 basis as higher tariffs weigh on disposable income, consumer spending, and business investment, although we expect the economy to gradually reaccelerate toward potential next year as the tariff drag fades, fiscal policy turns more expansionary, and the Fed eases. We expect core PCE inflation to rise to 3.2% yoy by end-2025, reflecting a boost from higher tariffs. We expect the unemployment rate to rise to 4.4% by end-2025.
- **We expect the Fed** to deliver three 25bp rate cuts this year in September, October, and December followed by two more 25bp cuts in 2026 for a terminal rate range of 3-3.25%.
- **In the Euro area,** we expect real GDP growth of 1.2% yoy in 2025 amid higher US tariffs, although the trade-related growth headwind should recede next year. We expect core inflation to fall to 2.0% by end-2025, reflecting a further cooling in services inflation, lower demand, as well as a modest disinflationary impulse from excess supply amid higher US tariffs.
- **We believe the ECB's** cutting cycle is now finished, although ongoing trade tensions continue to skew the risks around our baseline to the downside.
- **In China,** we expect real GDP growth of 4.7% yoy in 2025, roughly in line with the government's "around 5%" target, amid higher US tariffs, although the risks remain to the upside amid relatively resilient Chinese exports so far. On the inflation front, we believe China's overcapacity problem will take time and effort to solve and expect CPI/PPI inflation of 0%/-2.8% this year.
- **WATCH US POLICY, GLOBAL FISCAL DYNAMICS, AND GEOPOLITICAL DEVELOPMENTS.** Uncertainty about US policy, including tariff policy, remains elevated, presenting risk to the US and global economies. Fiscal pressures—including in the US, UK, France, and Japan—could have important macro and market implications. Geopolitical developments also remain important to watch as conflict in the Middle East continues, US-China relations remain fraught, and a potential resolution to the Russia-Ukraine war remains highly uncertain.

Goldman Sachs Global Investment Research.

Growth



Source: Haver Analytics, Goldman Sachs Global Investment Research.
Note: GS CAI is a measure of current growth. For more information on the methodology of the CAI please see "Technical Updates to Our Global CAIs," Global Economics Comment, Sep. 01, 2025.

Forecasts

Economics

GDP growth (%)	2025				2026	
	GS (Q4/Q4)	Cons. (Q4/Q4)	GS (CY)	Cons. (CY)	GS (CY)	Cons. (CY)
Global	2.1	--	2.6	2.5	2.4	2.4
US	1.3	1.1	1.8	1.7	1.6	1.7
China	4.0	4.0	4.7	4.8	3.9	4.2
Euro area	0.9	0.9	1.2	1.1	1.2	1.1

Policy rates (%)	2025		2026	
	GS	Mkt.	GS	Mkt.
US	3.63	3.66	3.13	2.86
Euro area	2.00	1.85	2.00	1.79
China	1.30	1.50	1.10	--
Japan	0.50	0.94	1.00	1.08

Markets

Interest rates 10Yr (%)	Last	E2025	E2026
US	4.04	4.20	4.20
Germany	2.61	3.00	3.25
Japan	1.57	1.70	1.90
UK	4.57	4.25	4.25

Commodities	Last	3m	12m
Crude Oil, Brent ($/bbl)	67	63	53
Nat Gas, NYMEX ($/mmBtu)	3.03	4.00	4.50
Nat Gas, TTF (EUR/MWh)	33.28	39	29
Copper ($/mt)	9,956	9,650	10,025
Gold ($/troy oz)	3,651	3,610	4,120

FX	Last	3m	12m
EUR/$	1.17	1.17	1.25
GBP/$	1.35	1.35	1.39
$/JPY	147	142	135
$/CNY	7.10	7.10	6.90

Credit (bp)		Last	2Q25	4Q25
USD	IG	77	88	85
	HY	274	303	300
EUR	IG	93	102	100
	HY	289	310	307

Equities

S&P 500	E2025		E2026	
	GS	Cons.	GS	Cons.
Price	6,600			
EPS	$262	$268	$280	$305
Growth	7%	9%	7%	14%

Consumer	2025		2026	
	CPI (%, yoy)	Unemp. Rate	CPI (%, yoy)	Unemp. Rate
US	2.7	4.4	2.8	4.2
Euro area	2.1	6.4	1.8	6.5
China	0.0	--	1.0	--

Returns (%)	12m	YTD	E2025 P/E
S&P 500	5.9	11.1	24.8x
MXAPJ	4.4	20.7	16.9x
Topix	1.9	12.8	16.7x
STOXX 600	5.0	8.8	15.6x

Wage Tracker 2025 (%)			
Q1	Q2	Q3	Q4
3.9	3.9	4.0	--
--	--	--	--
--	--	--	--

Source: Bloomberg, Goldman Sachs Global Investment Research. For important disclosures, see the Disclosure Appendix or go to www.gs.com/research/hedge.html.

Market pricing as of September 10, 2025

Glossary of GS proprietary indices

Current Activity Indicator (CAI)

GS CAIs measure the growth signal in a broad range of weekly and monthly indicators, offering an alternative to Gross Domestic Product (GDP). GDP is an imperfect guide to current activity: In most countries, it is only available quarterly and is released with a substantial delay, and its initial estimates are often heavily revised. GDP also ignores important measures of real activity, such as employment and the purchasing managers' indexes (PMIs). All of these problems reduce the effectiveness of GDP for investment and policy decisions. Our CAIs aim to address GDP's shortcomings and provide a timelier read on the pace of growth.

For more, see our CAI page and Global Economics Comment: Technical Updates to Our Global CAIs.

Dynamic Equilibrium Exchange Rates (DEER)

The GSDEER framework establishes an equilibrium (or "fair") value of the real exchange rate based on relative productivity and terms-of-trade differentials.

For more, see our GSDEER page, Global Economics Paper No. 227: Finding Fair Value in EM FX, 26 January 2016, and Global Markets Analyst: A Look at Valuation Across G10 FX, 29 June 2017.

Financial Conditions Index (FCI)

GS FCIs gauge the "looseness" or "tightness" of financial conditions across the world's major economies, incorporating variables that directly affect spending on domestically produced goods and services. FCIs can provide valuable information about the economic growth outlook and the direct and indirect effects of monetary policy on real economic activity.

FCIs for the G10 economies are calculated as a weighted average of a policy rate, a long-term risk-free bond yield, a corporate credit spread, an equity price variable, and a trade-weighted exchange rate; the Euro area FCI also includes a sovereign credit spread. The weights mirror the effects of the financial variables on real GDP growth in our models over a one-year horizon. FCIs for emerging markets are calculated as a weighted average of a short-term interest rate, a long-term swap rate, a CDS spread, an equity price variable, a trade-weighted exchange rate, and—in economies with large foreign-currency-denominated debt stocks—a debt-weighted exchange rate index.

For more, see our FCI page, Global Economics Analyst: Our New G10 Financial Conditions Indices, 20 April 2017, and Global Economics Analyst: Tracking EM Financial Conditions – Our New FCIs, 6 October 2017.

Goldman Sachs Analyst Index (GSAI)

The US GSAI is based on a monthly survey of GS equity analysts to obtain their assessments of business conditions in the industries they follow. The results provide timely "bottom-up" information about US economic activity to supplement and cross-check our analysis of "top-down" data. Based on analysts' responses, we create a diffusion index for economic activity comparable to the ISM's indexes for activity in the manufacturing and nonmanufacturing sectors.

Macro-Data Assessment Platform (MAP)

GS MAP scores facilitate rapid interpretation of new data releases for economic indicators worldwide. MAP summarizes the importance of a specific data release (i.e., its historical correlation with GDP) and the degree of surprise relative to the consensus forecast. The sign on the degree of surprise characterizes underperformance with a negative number and outperformance with a positive number. Each of these two components is ranked on a scale from 0 to 5, with the MAP score being the product of the two, i.e., from -25 to +25. For example, a MAP score of +20 (5;+4) would indicate that the data has a very high correlation to GDP (5) and that it came out well above consensus expectations (+4), for a total MAP value of +20.

Top of Mind archive: click to access

Issue 141
Stablecoin summer
August 19, 2025

Issue 140
US fiscal worries: Is this time different?
June 12, 2025

Issue 139
Fed independence: how concerning?
May 15, 2025

Issue 138
Tariff-induced recession risk
April 17, 2025

Issue 137
Europe's shifting security landscape
March 13, 2025

Issue 136
Trump tariffs: mostly talk, or big action?
February 26, 2025

Issue 135
High bond yields: here to stay?
February 5, 2025

Special Issue
2024: 4 themes in charts
December 18, 2024

Issue 134
Will China's policy stimulus be enough?
December 11, 2024

Issue 133
Market concentration: how big a worry?
November 25, 2024

Issue 132
Post-election economic policies
October 21, 2024

Issue 131
Is the Fed behind the curve?
September 3, 2024

Issue 130
How investable is Europe?
August 1, 2024

Issue 129
Gen AI: too much spend, too little benefit?
June 25, 2024

Issue 128
Central bank divergence room to run?
May 21, 2024

Issue 127
Weighing the GLP-1 market
April 12, 2024

Issue 126
Global transit & trade: in rough waters
March 12, 2024

Issue 125
2024: The year of elections
February 1, 2024

Issue 124
Middle East risks
December 5, 2023

Issue 123
US outperformance: at a turning point?
October 30, 2023

Issue 122
Commercial real estate risks
October 9, 2023

Issue 121
Corporate credit concerns
August 10, 2023

Issue 120
Generative AI: hype, or truly transformative?
July 5, 2023

Issue 119
Daunting debt limit dynamics
May 22, 2023

Issue 118
US-China: more decoupling ahead?
May 1, 2023

Issue 117
All about bank(panic)s
April 3, 2023

Issue 116
(Japanese) Bonds, Bonds, Bonds
February 23, 2023

Issue 115
The Bigger Worry: Growth or Inflation?
January 27, 2023

Special Issue
2022: 3 themes in charts
December 15, 2022

Issue 114
The Winter of Crypto's Discontents
December 9, 2022

Issue 113
Central Bank Tightening: what could break?
November 11, 2022

Issue 112
China's Congress: an inflection point?
October 11, 2022

Issue 111
Will slaying inflation require recession?
September 13, 2022

Issue 110
Food, Fuel, and the Cost-of-Living Crisis
July 28, 2022

Source of photos: www.gettyimages.com, www.istockphoto.com, www.shutterstock.com, US Department of State/Wikimedia Commons/Public Domain.

Disclosure Appendix

Reg AC

We, Allison Nathan, Jenny Grimberg, Ashley Rhodes, Andrew Tilton, Joseph Briggs, Michael Cahill, William Marshall, and Ronnie Walker, hereby certify that all of the views expressed in this report accurately reflect our personal views, which have not been influenced by considerations of the firm's business or client relationships.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

Disclosures

Regulatory disclosures

Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; for equity securities, market making and/or specialist role. Goldman Sachs trades or may trade as a principal in debt securities (or in related derivatives) of issuers discussed in this report.

The following are additional required disclosures: **Ownership and material conflicts of interest:** Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst's area of coverage. **Analyst compensation:** Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. **Analyst as officer or director:** Goldman Sachs policy generally prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director or advisor of any company in the analyst's area of coverage. **Non-U.S. Analysts:** Non-U.S. analysts may not be associated persons of Goldman Sachs & Co. LLC and therefore may not be subject to FINRA Rule 2241 or FINRA Rule 2242 restrictions on communications with a subject company, public appearances and trading in securities covered by the analysts.

Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. **Australia:** Goldman Sachs Australia Pty Ltd and its affiliates are not authorised deposit-taking institutions (as that term is defined in the Banking Act 1959 (Cth)) in Australia and do not provide banking services, nor carry on a banking business, in Australia. This research, and any access to it, is intended only for "wholesale clients" within the meaning of the Australian Corporations Act, unless otherwise agreed by Goldman Sachs. In producing research reports, members of Global Investment Research of Goldman Sachs Australia may attend site visits and other meetings hosted by the companies and other entities which are the subject of its research reports. In some instances the costs of such site visits or meetings may be met in part or in whole by the issuers concerned if Goldman Sachs Australia considers it is appropriate and reasonable in the specific circumstances relating to the site visit or meeting. To the extent that the contents of this document contains any financial product advice, it is general advice only and has been prepared by Goldman Sachs without taking into account a client's objectives, financial situation or needs. A client should, before acting on any such advice, consider the appropriateness of the advice having regard to the client's own objectives, financial situation and needs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests and a copy of Goldman Sachs' Australian Sell-Side Research Independence Policy Statement are available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Brazil:** Disclosure information in relation to CVM Resolution n. 20 is available at https://www.gs.com/worldwide/brazil/area/gir/index.html. Where applicable, the Brazil-registered analyst primarily responsible for the content of this research report, as defined in Article 20 of CVM Resolution n. 20, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. **Canada:** This information is being provided to you for information purposes only and is not, and under no circumstances should be construed as, an advertisement, offering or solicitation by Goldman Sachs & Co. LLC for purchasers of securities in Canada to trade in any Canadian security. Goldman Sachs & Co. LLC is not registered as a dealer in any jurisdiction in Canada under applicable Canadian securities laws and generally is not permitted to trade in Canadian securities and may be prohibited from selling certain securities and products in certain jurisdictions in Canada. If you wish to trade in any Canadian securities or other products in Canada please contact Goldman Sachs Canada Inc., an affiliate of The Goldman Sachs Group Inc., or another registered Canadian dealer. **Hong Kong:** Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C. **India:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (India) Securities Private Limited, Research Analyst - SEBI Registration Number INH000001493, 951-A, Rational House, Appasaheb Marathe Marg, Prabhadevi, Mumbai 400 025, India, Corporate Identity Number U74140MH2006FTC160634, Phone +91 22 6616 9000, Fax +91 22 6616 9001. Goldman Sachs may beneficially own 1% or more of the securities (as such term is defined in clause 2 (h) the Indian Securities Contracts (Regulation) Act, 1956) of the subject company or companies referred to in this research report. Investment in securities market are subject to market risks. Read all the related documents carefully before investing. Registration granted by SEBI and certification from NISM in no way guarantee performance of the intermediary or

provide any assurance of returns to investors. Goldman Sachs (India) Securities Private Limited compliance officer and investor grievance contact details can be found at this link: https://publishing.gs.com/disclosures/hedge.html - /general/equity. **Japan:** See below. **Korea:** This research, and any access to it, is intended only for "professional investors" within the meaning of the Financial Services and Capital Markets Act, unless otherwise agreed by Goldman Sachs. Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. **New Zealand:** Goldman Sachs New Zealand Limited and its affiliates are neither "registered banks" nor "deposit takers" (as defined in the Reserve Bank of New Zealand Act 1989) in New Zealand. This research, and any access to it, is intended for "wholesale clients" (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests is available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Russia:** Research reports distributed in the Russian Federation are not advertising as defined in the Russian legislation, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian legislation on appraisal activity. Research reports do not constitute a personalized investment recommendation as defined in Russian laws and regulations, are not addressed to a specific client, and are prepared without analyzing the financial circumstances, investment profiles or risk profiles of clients. Goldman Sachs assumes no responsibility for any investment decisions that may be taken by a client or any other person based on this research report. **Singapore:** Goldman Sachs (Singapore) Pte. (Company Number: 198602165W), which is regulated by the Monetary Authority of Singapore, accepts legal responsibility for this research, and should be contacted with respect to any matters arising from, or in connection with, this research. **Taiwan:** This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk. Investment results are the responsibility of the individual investor. **United Kingdom:** Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Conduct Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.

European Union and United Kingdom: Disclosure information in relation to Article 6 (2) of the European Commission Delegated Regulation (EU) (2016/958) supplementing Regulation (EU) No 596/2014 of the European Parliament and of the Council (including as that Delegated Regulation is implemented into United Kingdom domestic law and regulation following the United Kingdom's departure from the European Union and the European Economic Area) with regard to regulatory technical standards for the technical arrangements for objective presentation of investment recommendations or other information recommending or suggesting an investment strategy and for disclosure of particular interests or indications of conflicts of interest is available at https://www.gs.com/disclosures/europeanpolicy.html which states the European Policy for Managing Conflicts of Interest in Connection with Investment Research.

Japan: Goldman Sachs Japan Co., Ltd. is a Financial Instrument Dealer registered with the Kanto Financial Bureau under registration number Kinsho 69, and a member of Japan Securities Dealers Association, Financial Futures Association of Japan Type II Financial Instruments Firms Association, The Investment Trusts Association, Japan, and Japan Investment Advisers Association. Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

Global product; distributing entities

Goldman Sachs Global Investment Research produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; Public Communication Channel Goldman Sachs Brazil: 0800 727 5764 and / or contatogoldmanbrasil@gs.com. Available Weekdays (except holidays), from 9am to 6pm. Canal de Comunicação com o Público Goldman Sachs Brasil: 0800 727 5764 e/ou contatogoldmanbrasil@gs.com. Horário de funcionamento: segunda-feira à sexta-feira (exceto feriados), das 9h às 18h; in Canada by Goldman Sachs & Co. LLC; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman Sachs & Co. LLC. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom.

Goldman Sachs International ("GSI"), authorised by the Prudential Regulation Authority ("PRA") and regulated by the Financial Conduct Authority ("FCA") and the PRA, has approved this research in connection with its distribution in the United Kingdom.

European Economic Area: Goldman Sachs Bank Europe SE ("GSBE") is a credit institution incorporated in Germany and, within the Single Supervisory Mechanism, subject to direct prudential supervision by the European Central Bank and in other respects supervised by German Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin) and Deutsche Bundesbank and disseminates research within the European Economic Area.

General disclosures

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. The information, opinions, estimates and forecasts contained herein are as of the date hereof and are subject to change without prior notification. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst's judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by Global Investment Research. Goldman Sachs & Co. LLC, the United States broker dealer, is a member of SIPC (https://www.sipc.org).

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and principal trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, principal trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.

We and our affiliates, officers, directors, and employees will from time to time have long or short positions in, act as principal in, and buy or sell, the securities or derivatives, if any, referred to in this research, unless otherwise prohibited by regulation or Goldman Sachs policy.

The views attributed to third party presenters at Goldman Sachs arranged conferences, including individuals from other parts of Goldman Sachs, do not necessarily reflect those of Global Investment Research and are not an official view of Goldman Sachs.

Any third party referenced herein, including any salespeople, traders and other professionals or members of their household, may have positions in the products mentioned that are inconsistent with the views expressed by analysts named in this report.

This research is focused on investment themes across markets, industries and sectors. It does not attempt to distinguish between the prospects or performance of, or provide analysis of, individual companies within any industry or sector we describe.

Any trading recommendation in this research relating to an equity or credit security or securities within an industry or sector is reflective of the investment theme being discussed and is not a recommendation of any such security in isolation.

This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of investments referred to in this research and the income from them may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors. Investors should review current options and futures disclosure documents which are available from Goldman Sachs sales representatives or at https://www.theocc.com/about/publications/character-risks.jsp and https://www.goldmansachs.com/disclosures/cftc_fcm_disclosures. Transaction costs may be significant in option strategies calling for multiple purchase and sales of options such as spreads. Supporting documentation will be supplied upon request.

Differing Levels of Service provided by Global Investment Research: The level and types of services provided to you by Goldman Sachs Global Investment Research may vary as compared to that provided to internal and other external clients of GS, depending on various factors including your individual preferences as to the frequency and manner of receiving communication, your risk profile and investment focus and perspective (e.g., marketwide, sector specific, long term, short term), the size and scope of your overall client relationship with GS, and legal and regulatory constraints. As an example, certain clients may request to receive notifications when research on specific securities is published, and certain clients may request that specific data underlying analysts' fundamental analysis available on our internal client websites be delivered to them electronically through data feeds or otherwise. No change to an analyst's fundamental research views (e.g., ratings, price targets, or material changes to earnings estimates for equity securities), will be communicated to any client prior to inclusion of such information in a research report broadly disseminated through electronic publication to our internal client websites or through other means, as necessary, to all clients who are entitled to receive such reports.

All research reports are disseminated and available to all clients simultaneously through electronic publication to our internal client websites. Not all research content is redistributed to our clients or available to third-party aggregators, nor is Goldman Sachs responsible for the redistribution of our research by third party aggregators. For research, models or other data related to one or more securities, markets or asset classes (including related services) that may be available to you, please contact your GS representative or go to https://research.gs.com.

Disclosure information is also available at https://www.gs.com/research/hedge.html or from Research Compliance, 200 West Street, New York, NY 10282.