

TOP *of* MIND

THE POST-PANDEMIC FUTURE OF WORK



As workers have started to return to the office, the extent to which pandemic-related shifts in work will persist—and the implications for workers, companies, cities and beyond—is Top of Mind. We speak with Stanford’s Erik Brynjolfsson and Nicholas Bloom, McKinsey’s Sven Smit, and UC Berkeley’s Enrico Moretti. They generally agree that a “hybrid” in-person/remote work model will become the new normal for about half of the US workforce—with important implications for companies—but differ on what this and other pandemic-related shifts in work will mean for productivity: Bloom expects hybrid to be a large productivity driver, Smit argues this is only likely if tech hurdles are overcome, and Brynjolfsson believes that we’re just

at the start of a productivity boom as the pandemic only hastened the organizational transformation required for existing technologies to reach their full potential. GS economists also see lasting productivity gains. And, as for cities, most think these shifts won’t spell the end of them, and may result in modestly less expensive and congested ones.



Unleashing the full power of new technologies like artificial intelligence... requires that companies reinvent their businesses, co-invent new goods and services, and invest in human capital. That process can take over a decade... the pandemic compressed that time frame.”

- Erik Brynjolfsson

Over the long run, productivity could actually slow if we continued to work fully remote forever. In contrast, I see hybrid work... as a big driver of productivity, because it combines the best of both models. Workers spend part of the week at home being more productive at individual tasks, and part of it in the office, collaborating and innovating.

- Nicholas Bloom

Hybrid work isn't really working at this point... And what might really break the back of the hybrid model are tech hurdles.

- Sven Smit



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...AND MORE

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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

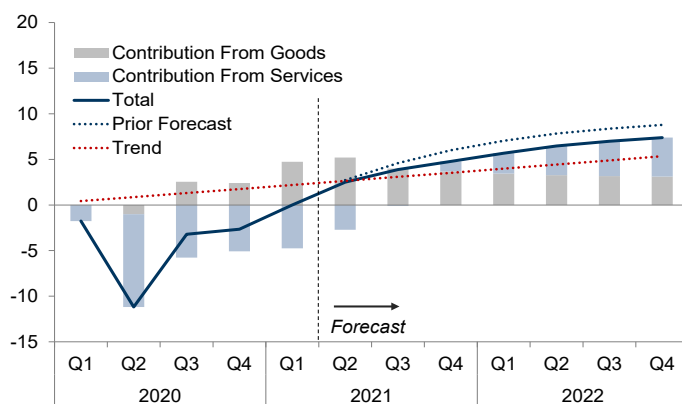
- We lowered our 3Q/4Q21 growth forecasts by 1pp based on our expectation for a less seamless goods-to-services consumption rotation amid the Delta driven virus resurgence.
- We now expect core PCE inflation to end the year at 3.3%, but continue to view overheating risks as limited.

Datapoints/trends we're focused on

- Growth deceleration; we expect trend-like growth of 1.5-2% by 2H22, implying a sharper slowdown than consensus.
- Labor mkt; we see av. payrolls ~1mn over next 3-4 months.
- A gradual return to office, which will delay the recovery in services spending.

A slower rebound in services

GS real PCE forecast, % change vs. 4Q19



Source: Department of Commerce, Goldman Sachs GIR.

Japan

Latest GS proprietary datapoints/major changes in views

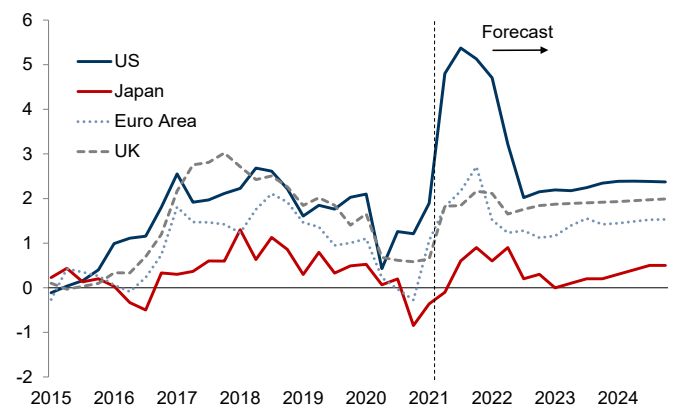
- We lowered our 3Q21 growth forecast after the declaration of the fourth state of emergency, but expect a strong 4Q21 rebound and above-consensus growth of 2.6% in CY21.

Datapoints/trends we're focused on

- Vaccination progress, which PM Suga hopes will provide a political boost ahead of elections later this year.
- Inflation isolation; Japan's inflation has become increasingly desynchronized with the global cycle, suggesting continued sluggishness in the years ahead.
- BoJ Green Financing program, which will provide funds to financial institutions for climate-related investments and loans.

Inflation isolation

CPI inflation (all items) in Japan and other major DMs, % yoy



Source: Ministry of Internal Affairs and Communications, Goldman Sachs GIR.

Europe

Latest GS proprietary datapoints/major changes in views

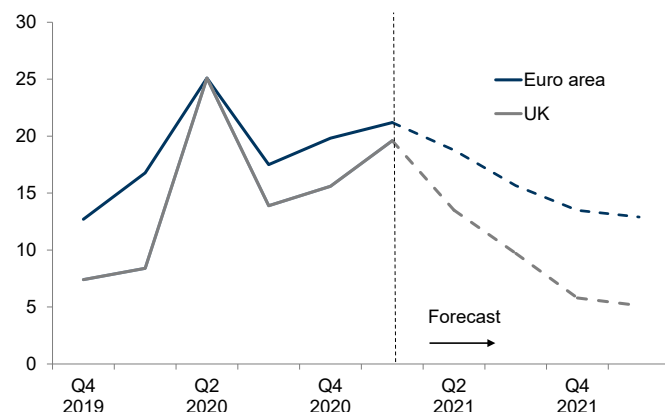
- We now expect Euro area core inflation to rise to 2% yoy in November before falling to 0.9% yoy in January 2022.

Datapoints/trends we're focused on

- Delta variant, which could lead to more persistent travel restrictions and cautious consumer behavior, though we see the economic and medical risks as mostly manageable.
- Sizable pent-up savings, which should support strong consumer spending and growth momentum in 2H21.
- ECB QE; we expect the Governing Council to agree to a small reduction in the Q4 PEPP purchase pace in September.

The savings unwind

Household saving rate, % of gross disposable income



Source: Haver Analytics, Goldman Sachs GIR.

Emerging Markets (EM)

Latest GS proprietary datapoints/major changes in views

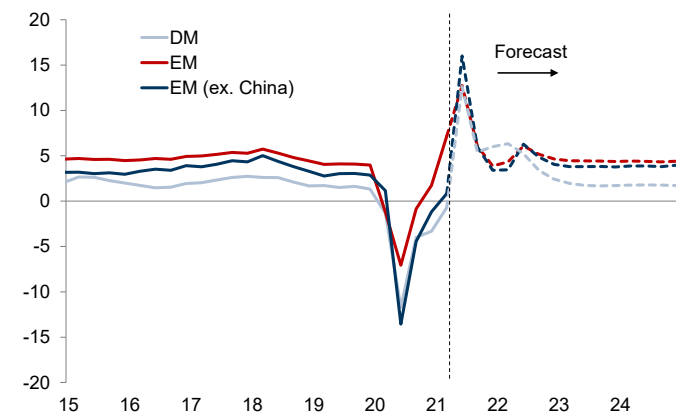
- We expect 8.6% real GDP growth in China for 2021, but with a slower pace of 5-6% and a modestly more favorable macro policy backdrop in 2H.
- We've lowered our 2H21 growth forecasts by 180bp on average across ASEAN in light of a renewed virus wave.

Datapoints/trends we're focused on

- Delta risks, which will delay but not derail the EM recovery, especially given faster vaccine rollouts in many large EMs.
- EM-DM growth gap; while we see a smaller gap ahead, we expect productivity will sustain EM growth outperformance.

An eventual return to EM outperformance

GDP growth, % yoy



Source: Goldman Sachs GIR.

The post-pandemic future of work

As workers across the US and other economies have started to return to the office—albeit in fits and starts as the Delta and other COVID-19 variants loom large—to what extent pandemic-related shifts in work will prove lasting—and the implications for workers, companies, cities and beyond—is Top of Mind.

We first get perspectives from four people who have studied trends in work and their broader implications long before the pandemic hit: Erik Brynjolfsson, Professor at the Stanford Institute for Human-Centered AI, Nicholas Bloom, Professor at the Stanford Graduate School of Business, Enrico Moretti, Professor at UC Berkeley and Sven Smit, Co-chairman of the McKinsey Global Institute. They zero in on two major aspects of work that the pandemic has shifted: how much work is done remotely, and the prevalence of automation, artificial intelligence (AI), and other technologies in the workplace.

In terms of the former, Bloom and Smit first clarify that remote work in the major economies is only possible for roughly 50% of workers—primarily office workers. So, at the height of lockdowns, about half of the workforce was still heading into work—and bearing more pandemic-related risk (thank you essential workers!). But for the other half of the working population—most of whom are still working remotely at least some of the time—the key question is whether a “hybrid” work model that entails both in-person and remote work becomes the new normal.

Our interviewees generally find that survey-based and other data suggests this is likely to be the case, certainly in the near term and most likely over the longer term, with companies on average allowing workers to work from home roughly two days per week. According to Smit, this owes in part to worker preferences—in a recent McKinsey survey of US employees that worked in the office full time pre-pandemic, roughly 50% indicated that they are likely to switch jobs if required to return to in-person work full time. Surveys conducted by Bloom showed similar findings, with the number of days that workers desire to work from home currently averaging about 2.6, having risen moderately over the course of the pandemic. But other factors have also played a role, says Bloom, such as substantial sunk costs in work from home technologies and infrastructure by both individuals and firms, as well as productivity gains in some areas. In short, Brynjolfsson concludes: after some investment, both workers and companies discovered better ways of doing some things at home, and those things are likely to stick.

But our interviewees are also quick to point out that the averages mask important underlying differences between workers and industries, with significant implications for companies. For example, Bloom’s surveys find that the largest shares of workers actually either want to return to working in the office full time, or not at all. So pleasing everyone could prove challenging, potentially generating employee churn. He also highlights the inequality inherent in hybrid models, in which executives get to work from home some of the time while manufacturing and service workers—that are disproportionately represented by women and minorities—don’t. Companies will eventually have to address this, he says, potentially by paying full-time in-person workers more (or, as Moretti suggests, paying full-time remote workers less, depending on their location.)

A central question underlying this discussion is whether those who can work from home are more productive when doing so. At first glance, the surge in reported US productivity during the pandemic would suggest the answer is yes. Indeed, Spencer Hill, GS US Senior Economist, argues that most of this surge owes to a pickup in underlying trends tied to pandemic-related shifts in work patterns. And he sees many of them as sustainable, boosting the level of productivity in the US nonfarm business sector by around 4% by 2022 relative to the baseline.

But Bloom contends that the rise in productivity has owed to some degree to the sharp loss in low-productivity jobs at the same time that GDP has rebounded back to pre-pandemic levels—with the more puzzling part of that the above-trend GDP levels, which he doesn’t expect to last. And while his surveys and other analysis suggest that workers are able to work longer and more efficiently from home, he believes that fully remote work would probably be negative for productivity in the long run, because it impedes creativity and innovation.

Moretti agrees that full-time remote work will eventually be bad for productivity, explaining that “agglomeration economies”—the tendency of companies and workers to cluster geographically in a handful of locations—have measureable, economically sizable productivity advantages for the same reason. This seems to suggest, as Bloom argues, that hybrid work would capture the best of both worlds in terms of productivity—enabling people to efficiently work on individual projects at home and then collaborate creatively with others at the office. But Smit sees a potential fly in the ointment, namely, that hybrid models so far aren’t working well, primarily due to technological gaps; for example, even though individuals and firms have upgraded their Wi-Fi, many hotels haven’t, which makes joining Zooms from the road on business travel problematic. So technologies need to catch up, or firms will give up on the hybrid model, in his view.

All that said, Brynjolfsson argues that what the pandemic really did was bring forward productivity gains by forcing companies to reorganize and rethink how to leverage existing technologies to make remote work possible, accelerating the trends towards increased adoption of automation, AI, and machine learning that were already well underway. This, he says, “compressed about 20 years of change into 20 weeks.” And he thinks that we’re just at the start of a productivity boom that will see organizational transformation realize the full potential of these technologies.

We then discuss the broader implications of potentially lasting shifts in work for cities and related markets. Marty Young, GS Senior Housing and Mortgage Analyst, details the pandemic hit to office real estate versus the boom to single-family homes in the US and beyond—trends he expects to continue. And our interviewees generally agree that these shifts won’t spell the end of cities, and could even result in modestly less expensive and congested ones. Finally, our equity analysts provide a snapshot of what all of this means for their sectors.

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Interview with Erik Brynjolfsson

[Erik Brynjolfsson](#) is Jerry Yang and Akiko Yamazaki Professor and Senior Fellow at the Stanford Institute for Human-Centered AI and Director of the Stanford Digital Economy Lab. He has co-authored several books, including *The Second Machine Age* and *Machine, Platform, Crowd*. Below, he discusses how current trends in digitization and automation will likely affect the way we work in the future, and the potential economic implications of these shifts.

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



Allison Nathan: At the early stages of the COVID-19 pandemic, you argued that the crisis would have a lasting impact on the way we work. As people have started to return to the office, do you still believe that will be the case?

Erik Brynjolfsson: Definitely. Let me first dispense with two strawmen:

clearly, everyone won't continue working from home forever, and everything also won't go back to exactly the way it was pre-pandemic. But the pandemic has led to investments and changed behavior in important ways that will likely prove permanent. Take my own personal experience. I bought a special microphone and a new camera that allow me to effectively teach classes from home. All of Stanford's seminars in the fall will be hybrid; some students will attend in person, but others will be able to attend remotely from around the world. And many schools and businesses are doing similar things, because they've discovered capabilities that make it possible to work from home efficiently and to reach a broader audience.

It reminds me a bit of what happened during the [London Underground strike](#) in 2014. The strike prevented commuters from using certain routes to work, forcing them to take new ones. But when the strike ended just a few days later, a significant number of commuters continued to use those new routes because they discovered that they were faster than their old ones. The pandemic was similar in that it was a giant jolt to the system that forced us to think outside the box, and we discovered that some of the new ways of working were actually better than the old ways. Those new, better ways will likely stick.

Allison Nathan: How should we think about the difference between digitization and automation, and to what extent was each accelerated by the pandemic?

Erik Brynjolfsson: Many areas of our lives are becoming digital, which means that goods and services are moving from being atoms to being bits. Anything digital has three properties: it's free, instant, and perfect, which are adjectives that don't apply to physical goods and services like apples and oranges, cars or haircuts. It's free because it has almost zero marginal cost. It's instant because it can be moved from one location to another with the snap of a finger. And it's perfect because each copy is identical to the original.

Automation, on the other hand, involves using technology to replace or, more importantly, augment human work with machines. Managers and technologists tend to think about automation too narrowly only as technology that replaces human work. That's certainly part of it, and automation can increase

productivity by replacing certain types of work. But, throughout history, most of the value of technology has actually come from augmentation or complementary uses of it that enable people to do new things. The Wright Brothers' invention of the airplane created demand for pilots, and the development of the jet engine only increased that demand rather than replacing work.

The move towards a more digital and automated economy was already well underway before the pandemic, with the automation of the economy essentially ongoing for centuries, and its digitization for several decades. But the pandemic clearly accelerated these shifts. One of the reasons we were able to successfully shift from having one in six Americans working from home pre-pandemic to one in two [during the pandemic](#) was because so much of the digital infrastructure had already been put in place—the core technologies existed, we just weren't using them much. I'm fairly confident that more and more people would have discovered these capabilities even without a pandemic, but the pandemic compressed about 20 years of change into 20 weeks, marking the biggest shift in the way people work since WWII.

“The pandemic compressed about 20 years of change into 20 weeks, marking the biggest shift in the way people work since WWII.”

Allison Nathan: Considering these trends, what do you expect work will look like in the future, and how will that affect different types of companies?

Erik Brynjolfsson: Many CEOs tell me they are implementing a hybrid workplace in which people come in for part of the week to engage in group activities and collaboration, and work from home the other days on solo projects while continuing to interact virtually. This suggests that the best way to think about the future of work is in terms of tasks rather than occupations, and preliminary estimates based on the O*Net database that categorizes 19,000 tasks in our economy suggest that up to 40% of tasks can be done remotely. That varies significantly between occupations and wage levels, with a bigger share of higher-income, knowledge work and a smaller share of lower-income jobs able to be performed remotely, as the latter tend to require more face-to-face or equipment interaction.

The companies that will thrive in this new environment are those that have a robust digital infrastructure. We've [found](#) that firms with higher digital capabilities before the pandemic had significantly higher sales, net incomes, and stock returns during the pandemic than firms that didn't have those capabilities. And,

interestingly, those firms that were further behind are making much bigger investments in IT and digital infrastructure right now, because they've received a very strong signal from the market that they need to invest more in those areas.

Allison Nathan: There was a big jump in productivity over the course of the pandemic. Do you see this persisting as the pandemic subsidies and workers return to the office?

Erik Brynjolfsson: Yes. I'm anticipating a [productivity boom](#) over the coming years, and actually made a bet to that effect with my colleague Bob Gordon, who has been a longtime productivity skeptic and has been mostly right for the last decade. The pandemic was not the driver of the recent surge in productivity—rather, it brought forward where we were on what I call the [Productivity J-curve](#), which explains why productivity slowdowns often accompany the creation of general purpose technologies such as the steam engine or electricity. Unleashing the full power of new technologies like artificial intelligence (AI) and machine learning requires more than simply buying some hardware and software. It requires that companies reinvent their businesses, co-invent new goods and services, and invest in human capital. That process can take over a decade. In the case of electricity, it took 30 years before the technology led to big productivity gains. The pandemic compressed that time frame by forcing executives, managers, and workers to think harder about how they could use these technologies, providing support for the old adage, 'necessity is the mother of invention'. Without a pandemic, we would have still eventually experienced productivity gains, but they would have been spread out over a number of years.

And we're not even close to seeing peak productivity. AI and machine learning in particular are such fundamental drivers of new ways of doing work across skills and occupations that we'll likely spend the next couple of decades sorting through all of the opportunities they offer. This is just the first or second inning of a game of organizational transformation to realize the full productivity potential of these technologies.

“ We're not even close to seeing peak productivity.”

Allison Nathan: Could this organizational transformation have other—potentially less positive—economic implications?

Erik Brynjolfsson: Yes. At least so far, it's led to growing inequality on multiple dimensions. At the firm level, most of the investments in organizational and human capital that are necessary to extract value from the latest wave of technological advancements are [concentrated](#) among a relatively small subset

of firms. The top 10% of firms by market value account for over 60% of this intangible digital investment, which we call digital capital. And they're pulling further away from firms at the median and bottom, so that inequality is growing over time. That's leading to a winner-take-most outcome in which superstar firms are harvesting most of the gains from new technologies rather than those insights diffusing evenly throughout the economy. And that's also happening at the level of individuals and workers—the labor share of income has fallen in recent decades, and the top 1% is getting ever wealthier as they capture a growing share of total income.

Allison Nathan: Will this trend of technology exacerbating inequality inevitably continue?

Erik Brynjolfsson: Not necessarily. The technologies we have today are the most powerful tools we've ever had. So we have more power than ever to shape the world in one direction or the other. Over the past few decades, technological innovation has been predominantly used to concentrate wealth and power, and increase economic inequality. Although people have generally worked more over this period, wages have stagnated or even fallen in certain segments of the workforce. People with only a high school education earn less today in real terms than they did 20, 30, or 40 years ago, because technology has enabled machines to do many of the jobs they've typically occupied. In contrast, college-educated workers have seen their wages rise. So while the overall economic pie has grown, the benefits have been unevenly distributed, and many people have unfortunately been left behind by technological advances.

But the future is not predetermined; it's the outcome of choices, and we don't have to continue making such choices.

Technologists, managers, entrepreneurs and policymakers could think less about how to replace workers with machines and more about how to augment workers with machines in ways that increase innovation, productivity, wages and ensure that prosperity is more widely shared. We could invest more in education and training to give more people a chance to participate in the knowledge economy. We could restructure the tax system to benefit lower-wage workers and treat labor on par with or even more favorably than capital. And we could choose to boost entrepreneurship. I'm encouraged by the recent move to eliminate many occupational licensing rules, [which inhibit entrepreneurship and make the economy less dynamic](#).

So I'm optimistic that technologies like machine learning and AI could increase productivity growth, and allow us to devote more resources to health and welfare, education, and the environment. And some recent policies suggest we could be moving in that direction. But whether or not we as a society keep making those choices is perhaps one of the most pressing and consequential questions of our time.

Interview with Nicholas Bloom

Nicholas Bloom is William Eberle Professor of Economics at Stanford University, Senior Fellow at the Stanford Institute for Economic Policy Research, and Co-Director of the Productivity, Innovation and Entrepreneurship program at the National Bureau of Economic Research. Below, he discusses why work from home will likely persist post-pandemic, and the opportunities—and challenges—this presents for workers, companies, cities and beyond.

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



Allison Nathan: As workers across the US have started to return to offices, how prevalent is remote work today compared to during the height of and before the pandemic?

Nicholas Bloom: According to estimates from my work with Jose Barrero and Steven Davis, remote work was fairly rare before COVID-19. Only 5% of paid, full working days in the US were spent working from home pre-pandemic. 2% of that came from people who worked from home full time, and the other 3% came from the roughly 15% of people who worked from home part of the time. It rose sharply during the pandemic, with 50% of working days, on average, spent working from home. That came from 50% of people working remotely full time, and the other 50% either physically coming to work or not working at all. The type of worker going fully remote was highly correlated with education and income, because college graduates and high earners tend to do managerial and professional jobs in fields like tech and finance that can be performed remotely, and non-college educated workers tend to work in face-to-face service or manufacturing jobs that can't. One amazing fact is that, in terms of labor income, nearly two-thirds of GDP was generated by remote workers during the peak of the initial lockdown—the US was primarily a working-from-home economy. Even now, about half of labor income is still coming from remote workers.

Allison Nathan: What evidence are you looking at to assess how persistent these shifts might be? What does it suggest?

Nicholas Bloom: We have data on that from two different angles. One is from employees themselves; our monthly [Survey of Workplace Arrangements and Attitudes](#) surveys 5,000 people aged 20-64 that made \$10K or more pre-pandemic, so that we are capturing full-time members of the US workforce. And the second is from employers; we survey around 1,000 US firms. And we conduct parallel individual and firm surveys in the UK. Within these surveys, we ask people, 'What has your employer told you?' and we ask firms, 'What have you told your employees?' And looking at both sides tells us basically the same thing—that roughly 20% of paid working days will be spent working from home post-pandemic. The breakdown for this is that the half of the US labor pool that can work from home are going to continue to do so for two days a week on average in the future. And the other half of the labor force that never worked from home throughout the pandemic never will.

So a hybrid work model will be the new normal for half of the workforce. And the experience of a handful of firms demonstrates the extent to which the business mentality around this has already shifted. In May 2020, Mark Zuckerberg's

announcement that Facebook would be going hybrid was all anyone could talk about. But hybrid is no longer news because everyone's doing it—over 80% of US firms have announced some kind of hybrid plan. Instead, firms like Goldman Sachs and JPMorgan are now in the news because they're calling for all employees to return to the office full time.

Allison Nathan: But why has a hybrid model become the new normal even as virus concerns have abated somewhat?

Nicholas Bloom: [Several reasons](#) explain this shift. One, a lot of time and money has been invested to facilitate working from home. Americans spent an estimated 1-2% of GDP to set up remote work, and companies have made huge investments in the technology underlying work from home. Investment in IT and software rose by over 10% as a share of GDP as soon as the pandemic hit. All of that is irreversible. Two, technology, such as Zoom and Microsoft Teams, has improved. In work with Steven Davis and Yulia Zhestkova, we show that the number of [new patents](#) issued by the US Patent and Trademark Office that mention working from home has exploded, doubling between January and September 2020. And as the profitability of work from home technologies has surged, there's bound to be more innovation. Three, the stigma around work from home has evaporated. I've been studying working from home for almost 20 years, and pre-pandemic, it was often referred to as 'shirking from home', but that is no longer the case. Four, the productivity experience has been incredibly positive. In our survey data, people on average reported being 2-3% more productive at home. And five, people have become much more aware of infection risk. A large number of people we surveyed remain extremely nervous, even post-vaccination, about being in crowded situations, especially given the Delta and other virus variants. For these reasons, some degree of working from home will clearly stick, and I believe it will actually grow.

Allison Nathan: Do employees actually want to keep working from home?

Nicholas Bloom: In surveying 50K full-time US and 15K UK workers, we've actually found that 20% of people don't want to work from home at all post-pandemic. Those tend to be either young singles living in small apartments in city centers, or older empty-nesters. Another 30% want to work from home five days a week and are happy to never return to the office again; they tend to be married with young kids and live further away from work. The remaining 50% of workers are fairly evenly spread between wanting to work one to four days a week at home. So it's notable that the biggest groups want either zero or five days in the office. The average turns out to be about 2.6 days working from home, an increase from roughly two days a week at the start of the pandemic. This suggests that the initial narrative that people would get fed up with working from home has proven

incorrect as remote work has become more popular. But even with the announced shifts to a hybrid model by most firms, on average, employees that can work from home want to do so slightly more than companies will likely allow them to. And the half of the population that can't work from home on average desires to do so to some extent despite the fact that the nature of their jobs doesn't make that possible.

Allison Nathan: What are the implications of this for firms?

Nicholas Bloom: At one extreme, firms that require their employees to return to the office full time could experience massive turnover, especially in today's tight labor market. A possible solution to that would be to raise employee salaries to compensate them for more time spent in the office; our surveys suggest that people are willing to give up about 8% in salary on average in order to be able to work from home part of the time, so employers could pay roughly that much more to compel people to come in full time.

At the other extreme, a company that goes fully remote would probably also experience significant employee churn, because most people don't want that either. That said, because of the barbell nature of employee preferences, it doesn't make sense for all firms in the same industry to do the same thing. And there's always a spread between price and quality within industries. So the companies with fully in-person models may end up paying more to their employees to work in person and receiving more money from clients for arguably better in-person interactions, depending on clients' price sensitivity, and other firms may have lower employee costs but also receive lower fees. The truth is, we don't know yet how this will all shake out. And I wouldn't be surprised if work models changed radically one or two more times in the next five years.

There is also an issue of inequality over who does and does not get to work from home, which creates enormous political and managerial issues for companies. One pharmaceutical executive recently told me that his employees that bore the brunt of having to work in person during the pandemic were upset that they would not get working-from-home perks post-pandemic, while the executives who did not work on site during the pandemic would. There are also diversity aspects to this inequality because women and minorities are significantly more likely to be employed in jobs that need to be done on business premises, so are less likely to receive work from home perks. Again, this might be solved in the short run by paying these workers more, but, over the longer term, this issue will need to be better addressed as the way we work evolves.

Allison Nathan: Despite the recent surge in reported productivity, there seems to be a fair amount of debate around the productivity implications of working from home. What are you looking at to assess this?

Nicholas Bloom: In 2010-2011, I [ran](#) a large randomized control trial on the productivity effects of remote work using Chinese call-center workers, which found that employees working from home were 13% more productive compared to those who continued working in the office, for two reasons. One is that their work environment at home was quieter and less distracting, leading workers to increase the number of calls they took per

minute, which accounted for 4pp of the 13% rise in productivity. The remaining 9pp of boost came from employees working longer during each shift due to a reduction in the number and length of breaks, and people also tended to take fewer sick days, etc. That 9% increase in working time would be even larger for professionals who can also work for a portion of what would have been their commute. Indeed, we've [found](#) that workers on average spent about an hour per day commuting pre-pandemic, and roughly half of the time saved by not commuting was used to work during the pandemic.

That said, the reported increase in US macro productivity was most likely due, at least in part, to composition effects rather than work from home. GDP is close to pre-pandemic levels, but the economy has lost seven million jobs, many of them in low-productivity sectors. So the fact that productivity rose isn't puzzling. The GDP strength is much more surprising because the economy has shed jobs and capital isn't being used as efficiently due to social distancing. I struggle to explain that, but I don't think this above-trend level of GDP will be permanent.

Allison Nathan: What does all of this suggest for productivity going forward?

Nicholas Bloom: While the evidence on the productivity of working from home has been surprisingly positive, full-time remote work would probably be negative for productivity in the long run. Working fully remote impedes creativity and innovation—a lot of new ideas come from in-person meetings and brainstorming. So over the long run, productivity could actually slow if we continued to work fully remote forever. In contrast, I see hybrid work, in which people work one to three days a week from home, as a big driver of productivity, because it combines the best of both models. Workers spend part of the week at home being more productive at individual tasks, and part of it in the office, collaborating and innovating.

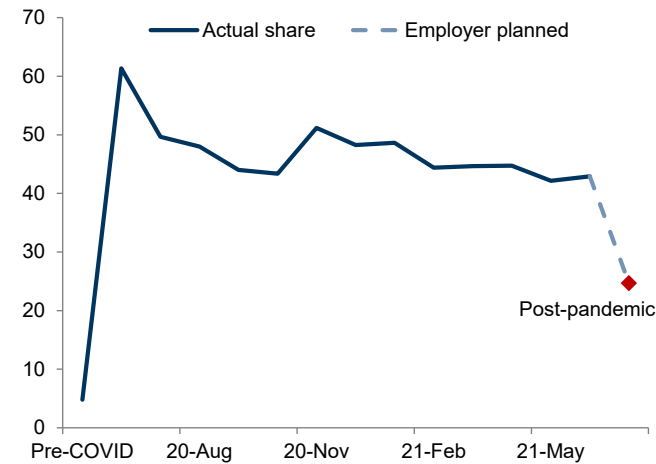
Allison Nathan: How has the increasing trend towards hybrid work impacted cities, and how do you expect that to evolve from here?

Nicholas Bloom: Change-of-address data from the US Postal Service as well as Zillow property price data show a clear pattern of migration called the "[donut effect](#)". About 15% of businesses and individuals left the center of cities during the pandemic and moved primarily to the suburbs within the same city or smaller secondary cities. The increasing trend towards hybrid work explains that—individuals expect to spend some part of the week in the office, so they can't move away entirely, but can move to the suburbs because they don't have to commute as frequently. So the price of real estate in city centers relative to suburbs has fallen by around 10-15%. It's less obvious how commercial real estate costs have been affected by the business moves, due to a lack of transactions, but leases have shortened significantly. That said, while the move away from city centers may continue, hybrid work isn't the end of cities by any means. Relative prices may just fall back to where they were maybe 10 years ago. But given that city centers have been on an upswing for the past four decades, that means they will still remain very expensive places to work and live, just not quite as expensive as they were pre-pandemic.

WFH: crunching the numbers

Remote work looks set to be more common post-pandemic

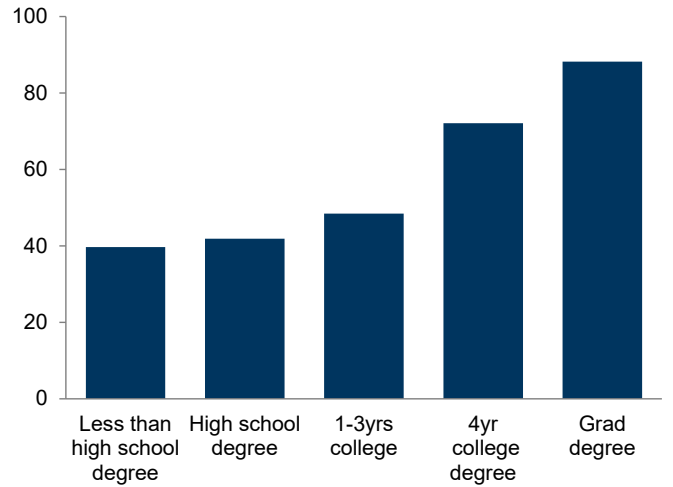
Share of US paid full days worked from home, %



Note: Pre-COVID estimate from 2017-18 American Time Use Survey; post-COVID estimate based on employees' expectations in latest survey wave. Source: *Survey of Working Arrangements and Attitudes*, BLS, Goldman Sachs GIR.

Remote work was more common among the highly educated

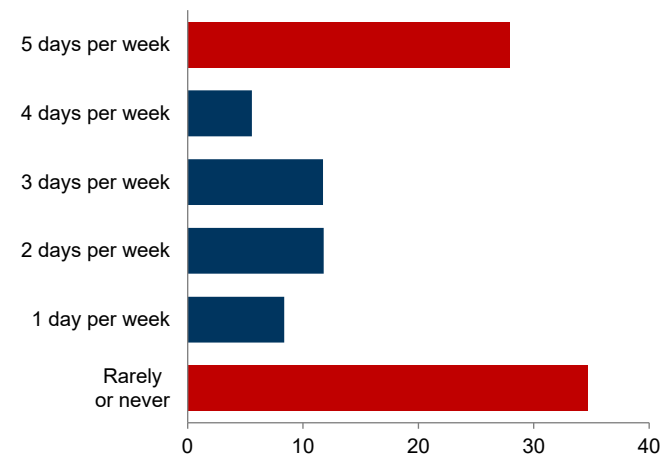
Share of workers who worked remotely at all during pandemic, %



Note: Based on all survey waves since May 2020. Source: *Survey of Working Arrangements and Attitudes*, Goldman Sachs GIR.

Most workers prefer fully remote or fully in-office work

Preferred employee WFH days after COVID (2022+), %



Note: Based on all survey waves since May 2020; reflects all respondents. Source: *Survey of Working Arrangements and Attitudes*, Goldman Sachs GIR.

While employers favor a return to office

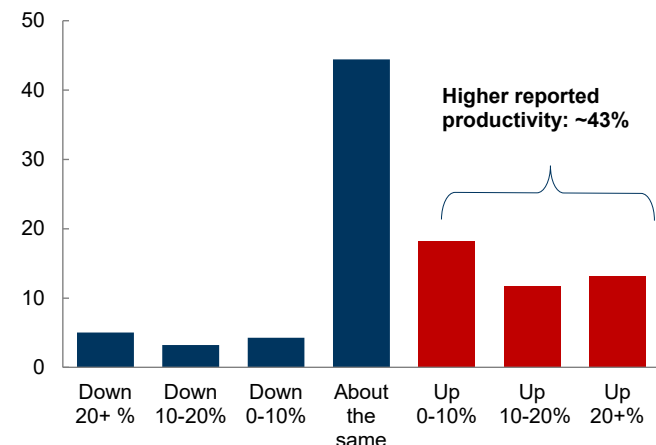
Preferred employer WFH days after COVID (2022+), %



Note: Based on all survey waves since May 2020. Source: *Survey of Working Arrangements and Attitudes*, Goldman Sachs GIR.

Workers report being more productive from home

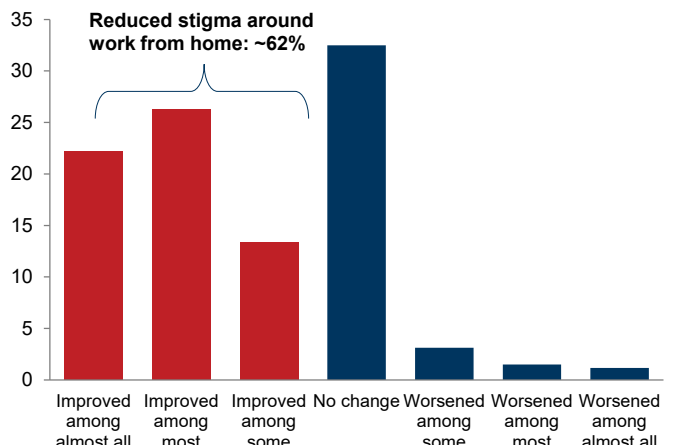
Workers' self-stated productivity during WFH vs in office, %



Note: Based on all survey waves since July 2020. Source: *Survey of Working Arrangements and Attitudes*, Goldman Sachs GIR.

And the perceived stigma around WFH has improved

Change in perception of WFH among people you know, %

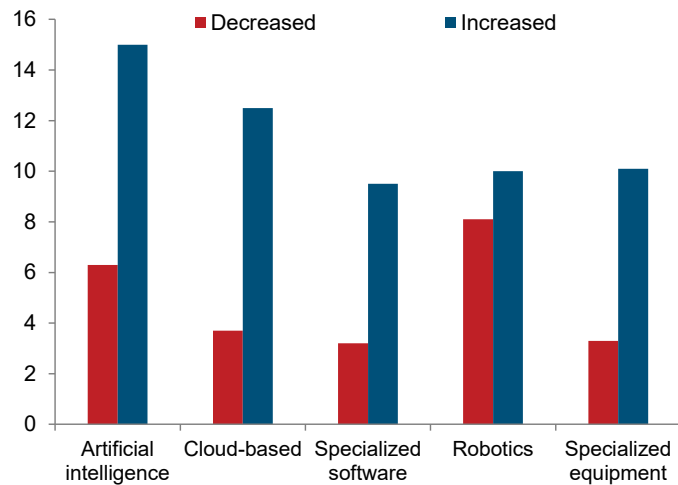


Note: Based on all survey waves since July 2020. Source: *Survey of Working Arrangements and Attitudes*, Goldman Sachs GIR.

Long trends in automation/digitization

Some technologies have benefitted employment...

% of surveyed firms that said each technology increased/decreased the number of workers they employ

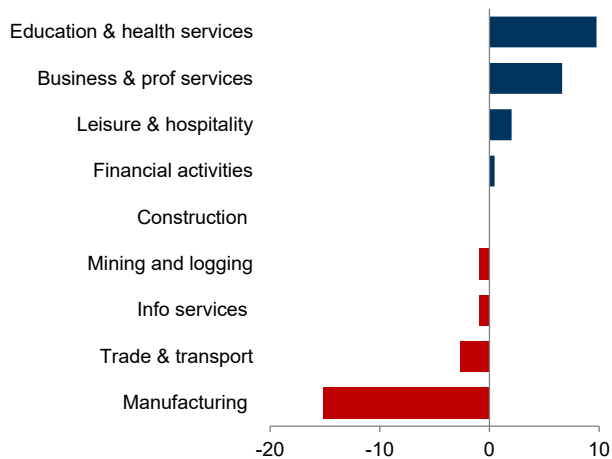


Note: 2018 data (latest data available).

Source: US Census Bureau Annual Business Survey, Goldman Sachs GIR.

Jobs have reorganized across industries...

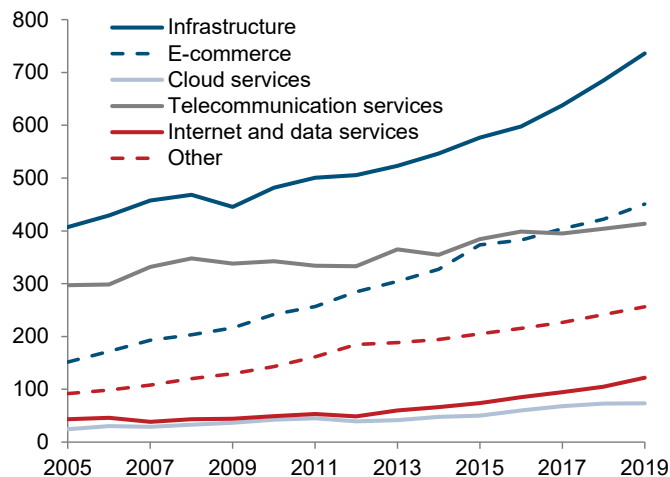
Change in employment by sector, 1980-2020, %



Source: US Bureau of Labor Statistics, Goldman Sachs GIR.

The digital economy has grown significantly...

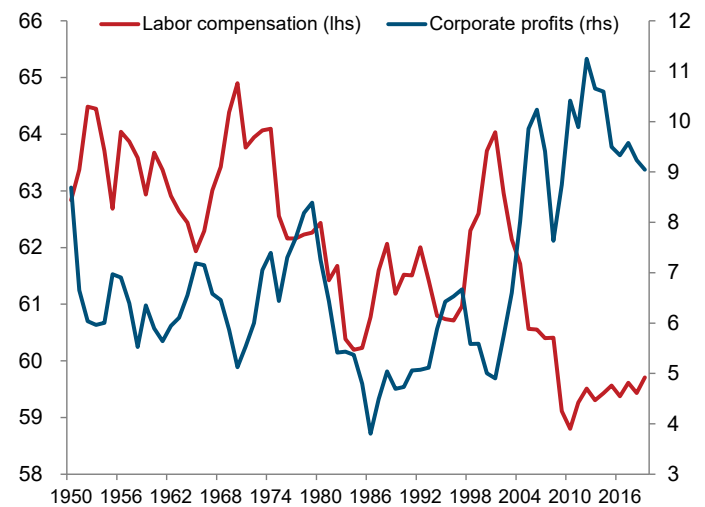
Size of various components of digital economy, \$bn



Source: US Bureau of Economic Analysis, Goldman Sachs GIR.

...although workers' prospects have deteriorated

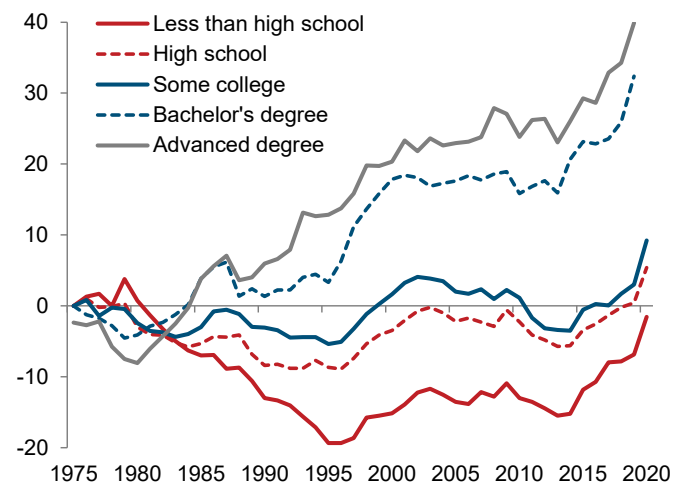
% of GDP



Source: Federal Reserve Bank of St. Louis, Goldman Sachs GIR.

...and wages have fallen sharply for lower-educated workers

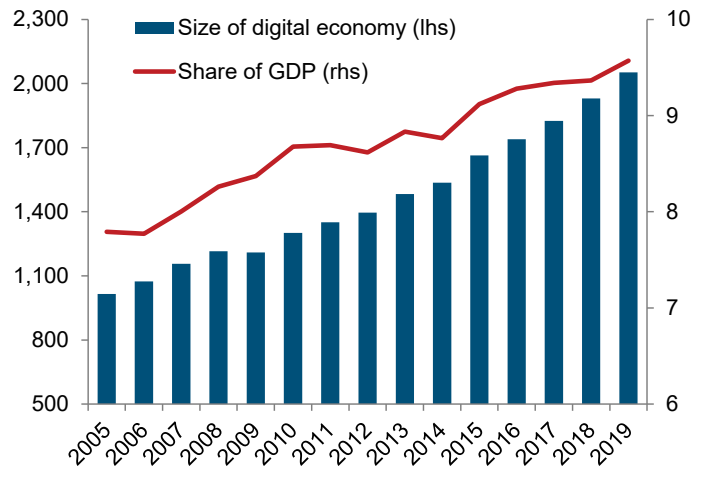
Change in wages by education level since 1975, %



Source: Economic Policy Institute, US Census Bureau CPS, Goldman Sachs GIR.

...accounting for nearly 10% of US GDP by latest estimates

\$bn (lhs), % (rhs)



Source: US Bureau of Economic Analysis, Goldman Sachs GIR.

Interview with Sven Smit

Sven Smit is Co-chairman of the McKinsey Global Institute (MGI), McKinsey's business and economics research arm. He leads research and co-authors MGI reports on topics including productivity and growth, urbanization, labor markets and the future of work. Below, he argues that while hybrid work will likely be more common post-pandemic, problems with the hybrid model will need to be resolved for it to remain the new normal longer term.

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



Allison Nathan: To what extent did the pandemic just accelerate existing trends in the way we work versus create new ones?

Sven Smit: COVID-19 added a distinct new element to the conversation around the future of work: physical proximity. Prior to the pandemic, discussions about the changing nature

of work focused on the idea that 50% of tasks could be automated with available technology within the next couple of decades, and all of the knock-on effects that creates for businesses, workers and society. But the unique nature of the COVID-19 crisis elevated the importance of the physical aspects of work across different occupations, and forced companies and workers to adapt to new ways of working that maintained distance.

It's important to point out from the start that remote work is only possible for about 50% of the US workforce that primarily includes office workers, and the other 50% of workers bore the most risk from the pandemic by continuing to show up to work. That said, we learned from this experience that far more work can be done remotely than previously thought. We [estimate](#) that around 20-25% of the workforce in advanced economies could work remotely for the majority of the week without losing effectiveness. Even very difficult service jobs such as fixing complex equipment could be performed remotely as technicians used video conferencing to guide someone on the ground.

But while this focus on the physical aspects of work is somewhat new, most of the changes we're seeing in the nature of work are an acceleration of trends that existed prior to the pandemic. For example, despite the recent increase in attention on hybrid work models, working from home had already become more common on the margin prior to the pandemic. And we expect that trend to continue post-pandemic, likely amounting to an additional day of working from home on average in the future. There's also likely going to be an acceleration of the longer-term trends toward automation, digitization and the adoption of artificial intelligence (AI).

Allison Nathan: What are you hearing from companies that leads you to expect some pandemic shifts will stick after the health crisis has been resolved?

Sven Smit: In contrast to the experience in China, where deep but ultimately short-lived pandemic-related disruptions to work allowed for a relatively swift return to the old way of doing things, the longer period of remote work in the US and Europe amounted to a more profound experience for workers. People became accustomed to the flexibility offered by remote work.

And, with the return to office and in-person meetings, they've realized that productivity was actually higher during the pandemic for certain activities. This was especially the case for repetitive tasks, like giving the same presentation to different clients. For example, while during the pandemic people might have been able to knock out 10 video conferences in a day with time to spare to go to the gym, if they are now expected to travel to some meetings, they may only be able to do a handful. So one thing I'm hearing about from several companies is a trend towards more intentional travel—business trips will be more infrequent but longer to accommodate more meetings per trip, and trips for one-hour meetings will be out the window.

But for other activities, like relationship building, training, negotiations, and co-creating, working from home was less productive. A lot is lost when people aren't interacting face-to-face. Just take, for example, what happens during the bookends of in-office meetings. Important interaction goes on in the first and last five minutes of meetings as they are being set up or winding down. There's the tap on the shoulder from a manager to signal a job well done, someone asking to connect later, or eye contact indicating how well a meeting went. Some of that can probably still happen via email or video conferencing, but it's different. And [analyses](#) of the networks within companies also show that a significant portion of them are built through unstructured meetings or casual interactions around the water cooler or in the cafeteria, etc. So we are in a period of experimentation, but companies seem intent on figuring out what aspects of the pandemic experience are worth keeping, and there's little doubt that at least some of them will permanently stick for many companies.

Allison Nathan: Have companies' plans shifted throughout the pandemic?

Sven Smit: Yes, plans have been quite volatile as the pandemic has ebbed and flowed. After the first virus wave last summer, companies were generally optimistic that work could soon return to normal. The onset of second and third waves, though, created a new reality as people became more accustomed to working from home over time. And although we've seen some companies returning or planning to soon return people to offices, there seems to be more nuance at this point, with some version of hybrid work involving three or so days in the office as generally the most common expectation.

These evolving plans owe not only to the virus and vaccine trajectory but also to employees' preferences. Although executives tend to view in-person work positively because it fosters apprenticeship, culture formation, relationships, and networking within the company, in our [survey](#) of US employees that worked in the office full time pre-pandemic, roughly 50% say they are "likely" or "very likely" to switch jobs if they require

returning to in-person work full time. So, a substantial shift has occurred in employee expectations shaped by the work from home experience that goes beyond virus concerns. Indeed, as one airline CEO pointed out to me, this shift has little to do with the virus—people are increasingly willing to fly on cramped planes for vacation travel, so it's unlikely that reluctance to return to the office owes to virus worries. Those employee preferences will undoubtedly impact how work evolves from here.

Allison Nathan: Even if the new normal is leaning towards an increase in more remote work on average, how widely does this vary, and are there differences by industry?

Sven Smit: The spectrum is wide both between and within industries. Some companies, particularly in tech, have looked at the productivity of their workforce during the pandemic and the high cost of office rent and have started to question whether they even need an office anymore. Another set of companies argues that the types of in-office activities will simply evolve, and are therefore focused on reshaping the office environment to, for example, facilitate bigger and more creative meetings. And yet another group of firms is pushing for a return to the old ways of working, but with only four days of in-person work instead of five. But very few companies are actually talking about a return to five days a week of in-person work, which is one reason why we see a tendency toward a three-day model in aggregate.

And we do see big differences between industries, with finance seeming most intent on returning to pre-pandemic work models. This is interesting because we've found that finance, along with tech, has the highest potential for remote work, whereas sectors like construction, accommodation and food services, and agriculture have the lowest. [We estimate](#) that around 75% of work hours in financial services could be done remotely with no productivity losses, compared to an average of 29% across all US industries. The lively debate in the financial sector right now around return to office plans is precisely because the possibility for remote work is so high.

Allison Nathan: As workers have begun to return to the office in the US and in Europe, how would you rate the hybrid model so far? Is it working?

Sven Smit: No, hybrid work isn't really working at this point. Many of the CEOs and clients I speak with say it's been challenging to hold meetings with some people in the office and others still working remotely. Most people are inevitably on their screens and the benefits of in-person interaction are largely lost. And what might really break the back of the hybrid model are tech hurdles. Although many workers and employers have upgraded their home and office network capabilities to accommodate video conferencing, many other places, like hotels, haven't. So as business travel has risen within the hybrid model, problems of dropped calls, latency, frozen videos, etc. that can be awkward and frustrating have proliferated. Of course, the tech world is doing everything possible to address these issues, but until and unless these types of problems are resolved, I'm doubtful that a true hybrid model can really work, which may ultimately force companies to choose between a more fully in-person or remote model.

Allison Nathan: If the hybrid work model ultimately proves successful, what might be the implications for cities?

Sven Smit: The beauty of cities and urban life is variety. A greater concentration of people allows for a much wider variety of offerings in terms of restaurants and entertainment, as well as tastes, background and culture. And the long-term trend has been toward greater concentration and growth in cities relative to rural areas. The pandemic-driven acceleration of e-commerce and home delivery has chipped away at this advantage by increasing the variety available in suburban and rural areas. But it's still nowhere near what you can get in cities, and doesn't provide a comparable experience to urban life. So as long as cities continue to offer variety and opportunity, they'll likely remain the preferred place to live, especially for young people.

Allison Nathan: Beyond the shift to hybrid work, in what other ways has the pandemic impacted the future of work?

Sven Smit: As I mentioned, the pandemic also accelerated ongoing trends toward automation, digitization and AI. This acceleration will likely have more lasting implications on the number and types of jobs in the future than how hybrid work shakes out. In a [survey](#) we conducted in June 2020, two-thirds of senior executives reported stepping up investments in automation and AI either somewhat or significantly, with the highest concentration in areas like warehousing and self-checkout that were needed to cope with pandemic-related demand surges. We estimate that this investment will likely pull forward the process of automating 50% of current tasks with existing technology by five years, which will substantially increase the need for occupation transitioning and re-skilling.

Allison Nathan: What are the labor implications of this more rapid adoption of automation and digital technology for companies and policymakers?

Sven Smit: Companies will not only need financial plans, but also robust workforce transition plans to keep up with the rapid pace of transformation. And they will need to play a bigger role in re-skilling and re-training workers, both out of a sense of social responsibility and self-interest given current talent shortages. That will also offer them a strategic opportunity to reassess the workforce they want longer term. Around 10% of firms spanning most sectors are already doing this down to each individual job. For example, I've worked with a company of 50K employees that has planned out exactly what every employee will be doing in five years' time. This sort of forward-looking planning yields a competitive advantage by enabling companies to access talent earlier and build up necessary future expertise faster. Given the speed of these trends, my guess is in three years' time all companies will be engaging in these types of strategic workplace plans.

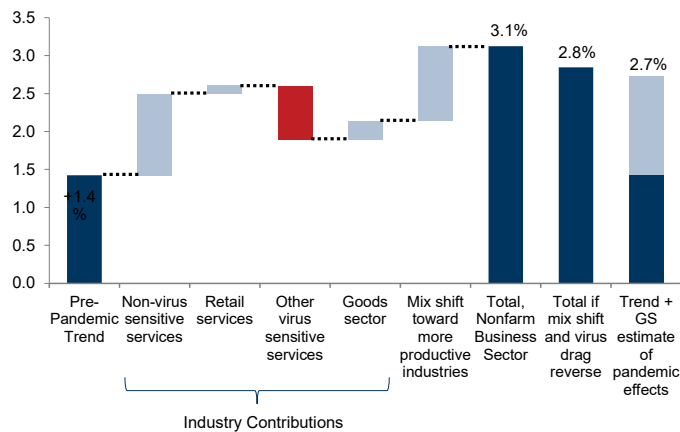
And, on the policy side, governments will also need to be more active on worker re-training because it will no longer be the case that the market will find new jobs for people whose occupations become obsolete. Since it's 50% of tasks—rather than jobs—that will be automated, the focus should be on retraining workers in tasks. New labor laws that allow people to switch jobs by requalifying for a few tasks rather than an entirely new job are a positive step in this direction. That's reducing re-skilling times from a few years to half a year, which is quite dramatic and makes a substantial difference in terms of the flexibility of the labor market. More changes like that will help ensure that the workforce is well-matched to the jobs of the future.

A persistent productivity pickup

Spencer Hill argues that most of the pandemic surge in productivity owes to a pickup in trends largely related to a shift in work patterns, many of which will likely persist

Stronger productivity growth has been one of the few silver linings of the COVID-19 pandemic. US output per hour in the nonfarm business sector has grown by 3.1% on an annualized basis since the start of the pandemic versus 1.4% in the previous business cycle, and surged 4.1% year-on-year in the first quarter, nearly triple its pre-pandemic trend. We estimate that less than 1pp of the cumulative productivity gains as of June can be accounted for by the shift away from lower-productivity workers and industries.

Only a small share of the productivity gains attributable to composition shift towards more productive industries
Decomposition of productivity growth, 1Q21 vs. 4Q19, annual rate



Source: Department of Commerce, Department of Labor, Haver Analytics, GS GIR. This implies that most of the productivity gains instead came from a pickup in underlying trends, which were largely related to a shift in work patterns—many of which we think will prove sustainable. We therefore expect higher productivity growth to persist over the next few years even as the economy continues to normalize.

What drove the rise in productivity?

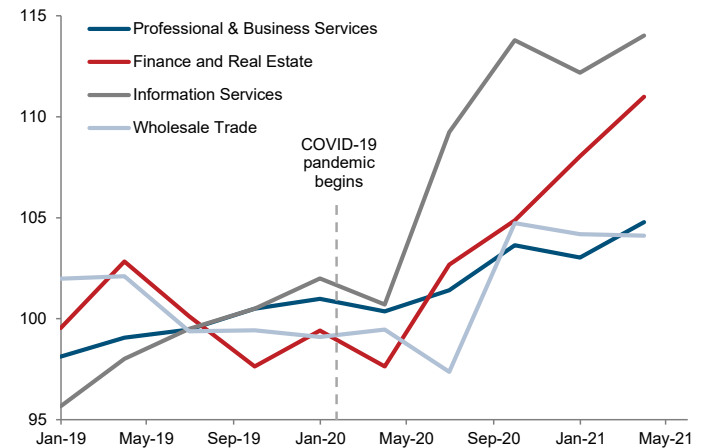
The digitization of the workplace during the pandemic boosted efficiency in industries where virtual meetings were feasible and in-person expenses like travel and entertainment had scope to decline. We find that the productivity gains since 4Q19 are most pronounced in such industries, including information technology services, professional services, and product development/wholesale trade.¹

A second channel boosting productivity during the pandemic was the accelerated shift to e-commerce that accompanied the shift to remote work—and people staying at home more generally amid lockdowns—as e-commerce typically requires less labor and real estate than brick-and-mortar retail. Traditional retailers also evolved their business models, expanding curbside pickup, “Buy Online, Pickup in Store”, and fulfillment of online orders directly from stores as opposed to

distribution centers. The combination of these two tailwinds likely explains why the retail sector ranked highly in productivity growth despite depressed levels of mall traffic.

Productivity surge in non-virus-sensitive services continued during 1Q21

Productivity: real GDP per worker hour, index, 2019 = 100



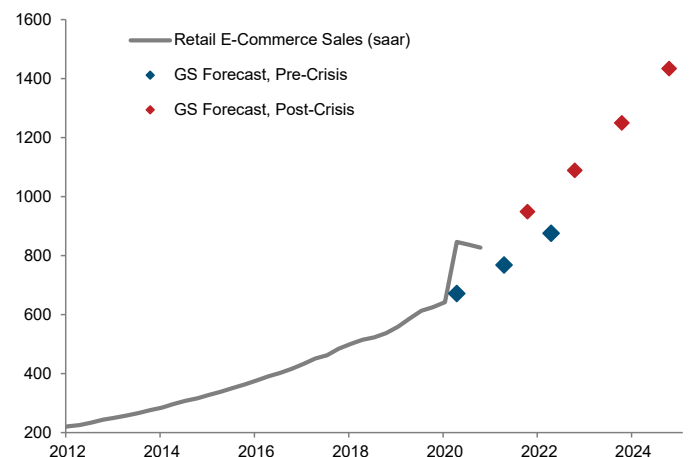
Source: Department of Commerce, Department of Labor, Haver Analytics, GS GIR.

These trends are sustainable

While the reopening of the economy has revived many worksites and foot traffic at malls and restaurants, we believe the pandemic-driven shifts in work and consumption patterns, as well as time usage, are unlikely to substantially reverse—particularly those related to the digitization of economic and social activity. Two salient examples illustrate this point: the surge in online spending and the rise of video conferencing.

Higher e-commerce penetration is here to stay

\$bn



Source: Goldman Sachs GIR.

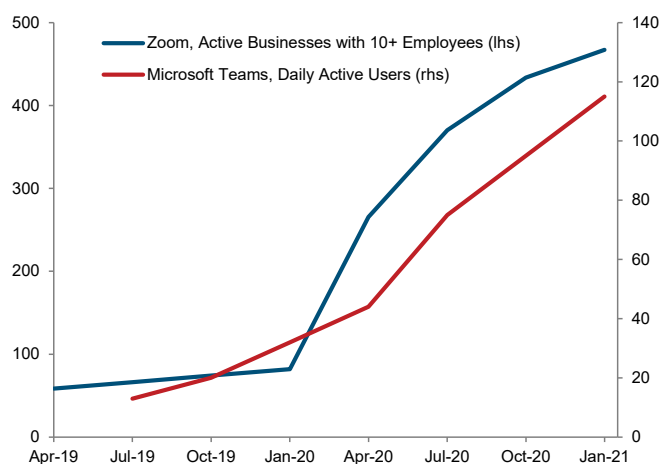
The equivalent of three years of e-commerce market-share gains took place in 2020, and neither the 2021 reopening experience nor our sector analyst forecasts imply a significant reversal of this step-up. The surge in virtual meetings also shows no sign of reversing, with the [pace of growth](#) for Zoom and Microsoft Teams slowing but remaining positive during the first few quarters of the economic reopening. [Business surveys](#) from the Atlanta Fed are also consistent with a persistent shift,

¹ Company data mirror the productivity growth rebound in the GDP statistics and suggest that it continued into 2Q21.

with firms expecting three times as many external meetings, on average, to be conducted virtually post-pandemic.

Virtual meetings still expanding despite shift back to offices

Thousands (lhs), millions (rhs)



Source: Zoom 10-Q, Tom Talks, Goldman Sachs GIR.

Work from home in the post-pandemic economy

Business models and cost structures are also evolving in ways that could affect medium-term productivity. If changes in the workplace reduce business-sector consumption of intermediate inputs like office space, building maintenance, and travel and entertainment, this would in turn boost GDP and productivity as these resources are repurposed—for example, as condominiums, concierge services, and consumer recreation. The ultimate size of these cost savings in part hinges on the viability and industry breadth of flexible work arrangements themselves.

While the physical presence of labor is essential in much of the goods sector and some consumer-facing services like leisure and hospitality and personal care, the pandemic revealed that remote computing was a viable alternative in many other parts of the economy. [Data](#) from the US Bureau of Labor Statistics shows that 46% of industries (employment-weighted) implemented work from home during the spring lockdowns last year. Similarly, University of Chicago economists Jonathan Dingle and Brent Neiman [estimate](#) that 37% of jobs can be done entirely at home—representing 46% of wages. These surprisingly large figures suggest scope for a nearly seven-fold increase in flexible workforce arrangements relative to the 7% pre-crisis level—provided of course that workers and employers are both willing to implement them. Averaging across surveys, we find that roughly a third of the workforce would be willing and able to work from home at least some of the time. A smaller, but still significant, share of workers expect such policies to actually be implemented (27%), nearly matching the share (25%) of employers that plan to implement them.

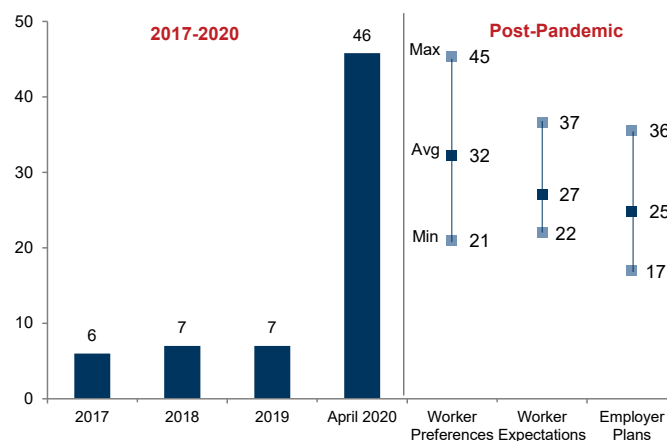
Implications for productivity

We believe remote computing will reduce the demand for some business-sector inputs in coming years, because work from home has mobilized part of the household capital stock, like home offices and computers, for business purposes, much like what Uber did for cars and Airbnb did for second homes. We estimate that \$2.6tn of upstream business inputs could

decline in importance in the post-pandemic economy. A 15% reduction in travel and entertainment costs alone would free up \$70bn of resources and could boost economy-wide productivity by 0.3% over the medium term.

Around a quarter of the workforce is likely to adopt flexible workplace arrangements

Share of employees working remotely (full- or part-time), %



Note/Source: Averages reflect surveys by Stanford/UChicago, PWC, GetAbstract, ResumeLab, Grossman Group, Morning Consult, McKinsey, Gallup, Garner, Citrix Systems, Atlanta Fed, Scandinavia 2017 actuals; data adjusted to be comparable to 2017-20 actuals from the America Time Use Survey/BLS; Goldman Sachs GIR.

What about the productivity implications for workers themselves? The most straightforward time savings from work from home is the reduction in commuting. Before the crisis, the average worker spent 28 minutes commuting one way, representing nearly five hours of transit time per week, plus the stress and monetary costs that came with that. If employee and employer expectations about flexible workplace arrangements prove correct—and a quarter of workers working from home two days per week on average going forward—the time savings would total 5.3% of the average workweek for this group and 1.1% of total business-sector hours worked. In the long-run, the benefits of a shorter commute are likely to be split in some fashion between workers and employers. If half of these time savings are spent working—or otherwise boosting worker efficiency—the effective labor input provided by these workers would rise by 2.7%, boosting sector-wide productivity by 0.5%. Randomized trials and natural experiments have generally found positive results from remote computing as well, with worker-level productivity gains of 4%, 8%, and 13% across three respective studies.

We continue to expect the evolution of business models and gains in worker efficiency to boost the level of productivity in the nonfarm business sector by around 4% by 2022, representing a 1.3pp boost to annual productivity growth over three years. The productivity acceleration to date and our estimates imply an output gap of 4-4.5% in Q2—roughly twice as large as the pre-pandemic productivity trend would imply. This would lengthen the runway for expansion as the business cycle matures.

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Goldman Sachs and Co. LLC

Interview with Enrico Moretti

Enrico Moretti is Michael Peevey and Donald Vial Professor of Economics at the University of California, Berkeley. His research focuses on labor, urban, and regional economics. Below, he argues that pandemic-related shifts in work are unlikely to cause a permanent shift in the economic geography of the US.

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



Allison Nathan: You recently argued that the economic geography of the US won't look much different in the long run than it did before the COVID-19 pandemic. Why don't you believe the crisis will mark a permanent shift in where we live and work?

Enrico Moretti: There's a lot of hype in the media about how COVID-19 has changed various aspects of our lives for good. But I believe that's mostly overblown because it fails to distinguish between the direct effects of the pandemic in the short run and the long-run effects after the health crisis has been resolved. There's no question that the economic geography of the US has looked quite different during the pandemic. Superstar cities like New York and San Francisco lost a number of residents as downtowns and offices were shut. Even today, the majority of office workers in those cities are still working remotely. But assuming that vaccines remain effective against new virus strains, and we continue to feel safe around each other, the economic geography of the US in 2022 won't look all that different from how it looked pre-pandemic, because the fundamental economic factors that made superstar cities economically successful, thriving, and prosperous are still going to be there after the health crisis has passed.

Allison Nathan: In terms of work, what are those fundamental factors that favor cities?

Enrico Moretti: Agglomeration economies—the tendency of companies and workers to cluster geographically in a handful of locations—have measurable, economically sizable productivity advantages. This is particularly true in the most advanced and innovative sectors of the economy. I've [found](#) that the productivity of scientists, engineers, and innovators is higher the more other scientists, engineers, and innovators are physically around them. A scientist or engineer moving from a small cluster of peers to a large cluster like Silicon Valley almost suddenly becomes more productive, creative, and innovative. This is consistent with a large and growing number of [studies](#) that suggest substantial productivity gains from physically working in a cluster of people, especially for the most creative workers. And the evidence suggests that the productivity benefits of agglomeration don't translate to remote work.

Allison Nathan: If workers are more productive when they gather in person, what do you make of the sharp rise in reported productivity during the pandemic, and what does that suggest for productivity going forward?

Enrico Moretti: It's true that the productivity numbers early in the pandemic suggested that people remained at least as productive—if not more so—when working from home. But that represented a short-run effect for a given set of coworkers,

projects, and clients—people were largely completing at home what they had started in the office. I'm skeptical that workers can remain as productive over the long run without seeing their colleagues, clients, vendors, etc. Think about onboarding new recruits from scratch; their experience would be quite different if they operated 100% remotely versus having a chance to mingle with co-workers. And even for people who aren't new, connectivity with colleagues and clients would inevitably fade over time without in-person interaction, leading to measurable productivity losses over the long run. Indeed, there are already signs that the strong productivity that we saw at the start of the pandemic has begun to weaken.

Of course, clustering geographically also has some negative effects, including high living and congestion costs and more time spent commuting. The average office worker [reportedly](#) worked 40 minutes longer per day during the lockdown, likely due in part to time saved from not commuting. There's no question that the lack of a commute is a clear and important advantage of working from home. But up to now the productivity and creativity advantages of concentration have dominated those negative effects. That's why superstar cities were doing so well prior to the pandemic, and why I believe we'll continue to cluster in them over the longer term.

Allison Nathan: Productivity considerations aside, if workers show a strong preference for greater flexibility, won't that limit firms' ability to bring them back to the office?

Enrico Moretti: The notion that we can all work remotely from the Alps, Hawaii, or Tibet is not realistic. An analysis of the most recent data indicates that jobs that are entirely remote remain the exception. Specifically, I've been looking at a dataset that includes all of the new job openings across the US and have found that even though job openings for entirely remote jobs have increased dramatically since the pandemic started—tripling in the typical US city—they remain a small fraction of overall job openings. Before the pandemic, about 2% of all job openings were entirely remote. The current share is 6-7%, and that rise was mostly concentrated around the time the pandemic began. So the media stories that describe the future of superstar cities based on a world where everybody can decide whether they can work 100% remotely are clearly inconsistent with the data.

The more plausible scenario is that many workers will be allowed to work remotely one or two days a week going forward. That still represents an important change for people who were working full time in the office before the pandemic and will create sustained demand for the technologies and applications that make that possible. But it also means that the link between place of work and place of residence will largely remain intact, because workers will still need to live in the metro area where their office is located. Ultimately, this implies that the demand for living in superstar cities will remain largely intact.

Allison Nathan: But even if workers aren't moving to some far-flung location, couldn't they move further out of cities than before, as commuting times are reduced?

Enrico Moretti: It's possible, but it's also possible that these shifts will benefit residency in urban cores. Less time commuting makes it easier for people to live further away. On the other hand, if everyone works from home one to two days a week, that means 20-40% fewer workers on the subways and freeways and less congestion in the central business districts, which increases the attractiveness of living in urban centers. Both forces are likely going to be at play, and it's too early to say which one will ultimately prevail.

Allison Nathan: What did we actually see over the course of the pandemic in this regard? How significant was the exodus from cities into the suburbs, and how many of those people do you expect will ultimately return?

Enrico Moretti: People tend to move less during recessions in general, which is what we saw during the pandemic. That said, we did see some population losses in the most expensive cities. San Francisco, for example, lost 20,000 residents. But most of the decline in San Francisco and New York came from a lack of people moving in, rather than residents moving out. That's not surprising; without the need to live in these relatively expensive cities to access jobs or educational institutions, people stayed put. And among the people who did leave the urban core, most of them relocated to the suburbs within the same metro area.

If anything, what I found surprising is the number of people who remained in the cities despite the fact that physical offices and urban amenities like restaurants, bars, and entertainment venues that make cities such attractive places to live were closed. Overall, US cities proved to be remarkably resilient to a shock of unprecedented magnitude.

As offices and urban amenities reopen, people who didn't move to those cities because of the pandemic will likely end up moving in. The people who moved to the suburbs from the urban core within the same metro area probably won't come back anytime soon, but a new cohort of workers and residents will likely move in to take their place. Ultimately, as offices and urban amenities continue to reopen, I expect cities to completely regain the number of residents they lost.

Allison Nathan: What are the implications of these types of shifts for the local economies and job markets of cities?

Enrico Moretti: Much has been made of the death of downtowns and the idea of remote work killing local businesses in them. I believe that's a misplaced perception for the simple reason that downtown office buildings are not going anywhere. The supply of office space is fixed, and, at some point, it will be filled. The only question is at what price. The rent that companies pay may differ depending on how much of a reduction in office footprint companies can achieve by allowing employees to work one or two days remotely. When I ask commercial real estate professionals how much they think companies can shrink their footprint for each day of remote work granted to their employees, the answer is between 0% and 20%. It will probably not be 20%, because it can't shrink one-to-one with the reduction in worker presence, but it's almost certainly not zero, either. Overall, the office footprint may shrink and commercial

real estate costs may decline somewhat alongside that decline in demand, but I don't expect the number of workers in central business districts to be all that different in the long run. And lower real estate costs may even benefit companies located in superstar cities. Local businesses in downtowns will ultimately recover, and business presence in suburban neighborhoods may also increase to be closer to people working from home.

Allison Nathan: Given all that, how do you expect work and the country's economic geography to evolve from here?

Enrico Moretti: The way we work will likely become more flexible, although by differing degrees depending on the industry. Financial firms seem much more eager for their employees to return to the office, while tech firms seem to be fine with remote work. There will be significant differences even within industries, across occupation and tasks. But across the overall US labor force, it's highly unlikely that the majority of office workers—or even a significant number—will be 100% remote once the pandemic finally ends.

Moreover, those that are fully remote may be asked to pass on some of those cost savings back to their employers, which may reduce the attractiveness of remote work. Facebook, for example, has already said it will adjust the salaries of remote workers somewhat to the cost of living in their locations. So by and large, I don't expect workers and companies to be in significantly different locations than where they were pre-pandemic. Workers will need to continue living within the same metro areas they work. Even though some subtler geographical shifts may occur, company headquarters and satellite offices will largely remain where they are. Overall, I believe the future of superstar cities looks bright, and may even improve due to lower congestion and office costs.

Allison Nathan: So you don't believe the pandemic will significantly change the long-term economic geography of the US. But what about the longer-term trend towards cost savings as many companies open offices in less expensive locations that seemed to gain traction during the pandemic? Will that lead to important shifts in economic geography?

Enrico Moretti: That trend was already well underway before the pandemic began and will likely continue. New York's financial sector began moving people out of Manhattan to less expensive locations 60 years ago, and the Bay Area's tech sector has also been doing so over the past couple of decades. But again, this hasn't and likely won't lead to the death of superstar cities. Financial jobs will largely remain in Manhattan and tech jobs in San Francisco. If anything, I see this as good news for companies headquartered in expensive cities. Workers in satellite offices often complement rather than substitute for workers in headquarters, and tend to strengthen companies rather than weaken them. They allow companies to grow and become more efficient. In some recent research, I've found that, at least for the tech sector, the best jobs are not located in cheap locations. Google, for example, locates its R&D and management jobs in expensive cities—places like San Francisco, Mountain View, Zurich, Austin, Seattle, and New York—that already have many of those types of jobs. While the cost reduction trend will likely continue, I don't see it negatively affecting superstar cities. They will likely thrive as the best jobs ultimately continue to cluster there.

Shifts in work shifting real estate

Marty Young discusses the impacts of pandemic-related shifts in work on global real estate markets, many of which he expects to persist even as workers return to offices

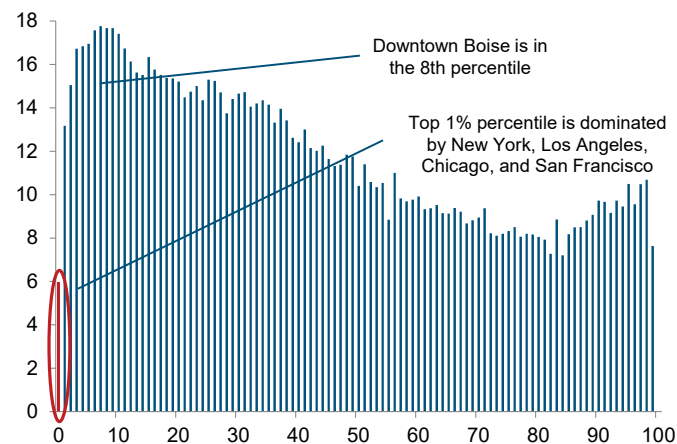
Pandemic-related shifts in work have significantly impacted global real estate markets, both residential and commercial. Across the US and other developed economies, demand for owner-occupied housing increased sharply, driving double-digit home price gains, and office prices in central business districts declined as people shifted towards working from home. Although workers have started to return to offices as virus concerns have somewhat abated, evidence suggests that work from home will remain an important component of post-COVID work life, suggesting that at least some of the shifts in residential and commercial property markets will likely persist.

Rising residential real estate

Residential home prices have increased 16% year-over-year in the US, with even larger increases of over 25% in historically more affordable and less dense cities like Austin, Boise and Phoenix. The housing bull market has not been restricted to the US. New Zealand, Canada, Sweden, Canada and the Netherlands have all also seen double-digit home price gains over the past year, fueled by low interest rates and the sharp increase in demand for owner-occupied housing as people shifted toward working from home. In contrast, the densest 1% of ZIP codes in the US, which include parts of New York City, Chicago, Los Angeles and San Francisco, have experienced average year-over-year price gains of just 5%, pointing to a shift in housing demand away from cities and toward the suburbs. The overall trend of housing demand exceeding supply appears likely to extend—we look for house price growth to remain strong into 2022.

Housing markets in the 1% most densely populated ZIP codes have underperformed

Population density percentile (most to least dense, x-axis) vs. average year-over-year house price appreciation (y-axis)



Source: US Census Bureau, Zillow, Goldman Sachs GIR.

Declining commercial real estate

Commercial real estate has not fared nearly as well as single-family housing. Office prices in central business districts in the US have declined 9% over the past year, as vacancy rates have

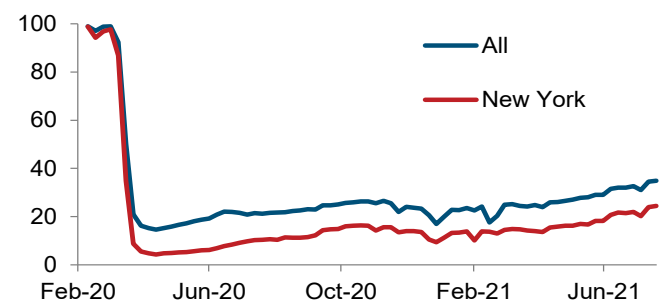
increased and rental rates have compressed. Office properties in New York and San Francisco have been hit particularly hard, with office utilization in these cities still less than 25% of pre-COVID levels. While office utilization is likely to increase in the coming months as workers continue to return to offices, evidence suggests that lower office occupancy rates may persist. A January 2021 survey from the Federal Reserve Bank of Atlanta, for example, indicates that employers expect 18% of office workers to spend at least two days a week working from home after the pandemic, up from 6% in 2019.

Trading implications

The market pricing of pandemic-related shifts in work patterns has varied across asset classes. US office REITs, for example, have underperformed the broader US equity market by over 35% since the onset of the pandemic, suggesting that REIT investors are pricing in a slow and incomplete return to office work. Pricing of commercial mortgage-backed securities (CMBS), however, shows less evidence of pessimism around the office sector—our analysis of CMBS bonds suggests that investors are not demanding wider spreads for bonds backed by pools with higher concentrations of office collateral. Given these potentially differentiated views of commercial real estate risks across equities versus debt markets, investors with a bullish outlook on the office sector may prefer to express that view via public REITs, while those with a more bearish view may choose to hedge office risks via the CMBX credit default swap indices, which reference CMBS bond tranches.

Office utilization remains well below pre-COVID levels

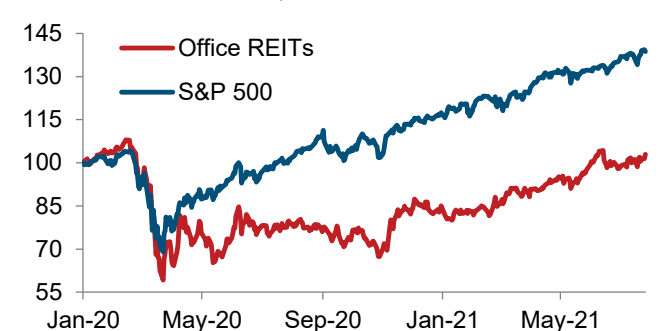
Kastle workplace occupancy barometer



Source: Kastle, Goldman Sachs GIR.

Office REITs have underperformed broader equity market

Total return indices, January 2020 = 100



Source: S&P, Goldman Sachs GIR.

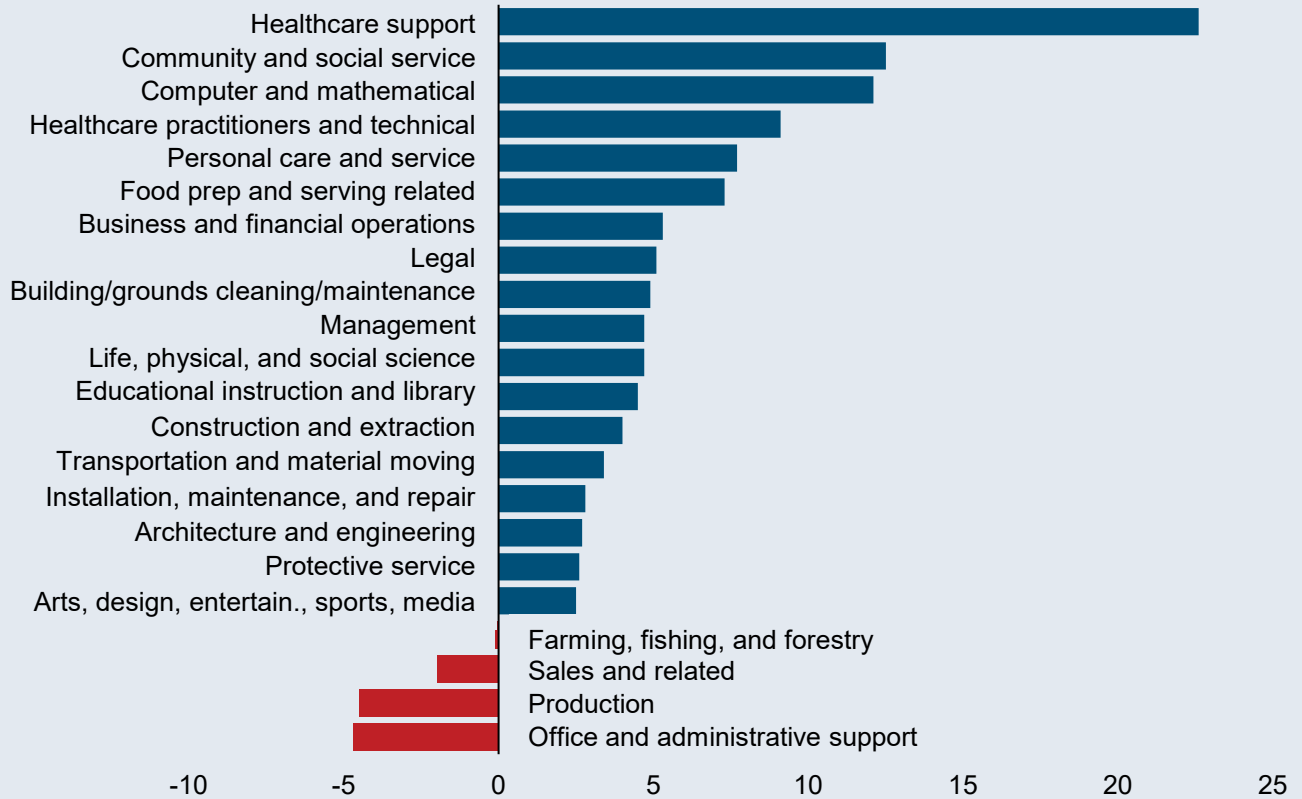
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Goldman Sachs and Co. LLC

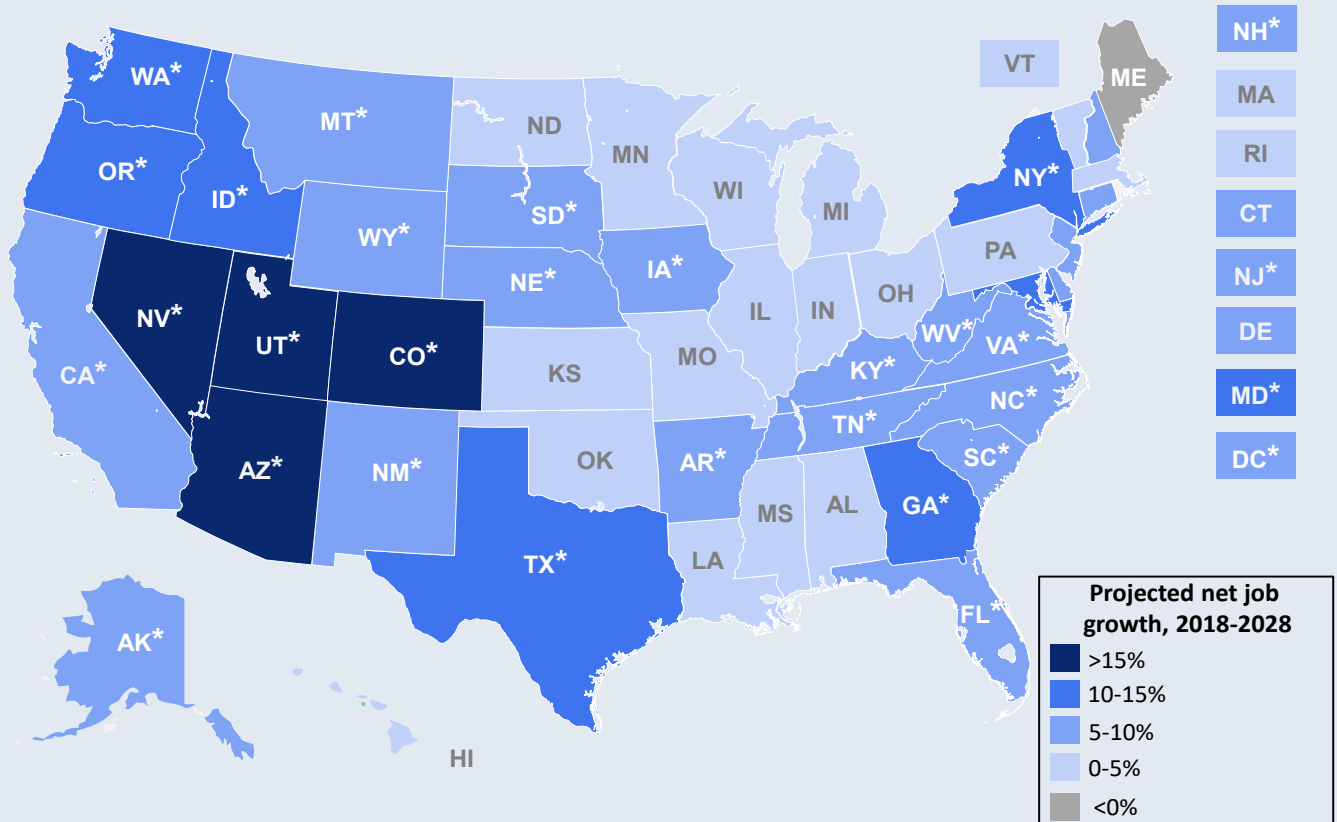
Where will work be in the future?

Healthcare and STEM workers are expected to be in high demand over the next several years...



Note: Bars reflect projected employment growth (%) in each industry over the 2019-2029 decade; 2019 figures reflect latest available employment data from the BLS. Source: US Bureau of Labor Statistics, Goldman Sachs GIR.

...as job growth is forecasted to be highest in the Mountain States



Note: Map reflects average growth of all occupations in a state; starred areas represent states that are forecasted to have higher net job growth than the US as a whole. Source: Projections Central (aggregates employment projections developed by each state), Goldman Sachs GIR.

The future of work: sector views

We speak with GS equity analysts about the implications of pandemic-related shifts in work on their sectors



Software — Kash Rangan

Digital acceleration here to stay

How have pandemic-related shifts in the way we work impacted the software sector?

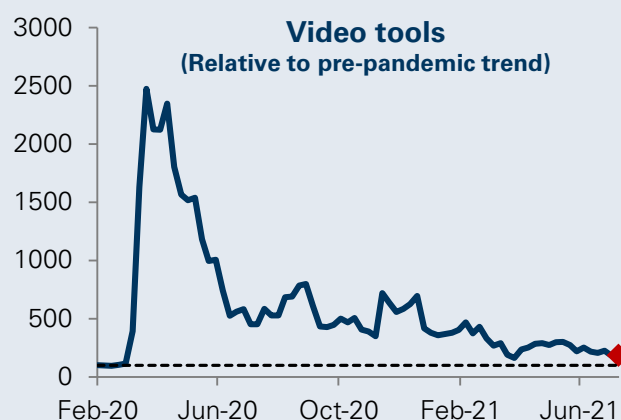
The pandemic accelerated many trends in digital transformation that were already underway as companies made new investments to streamline operations, stay connected to customers and employees, and monitor products and inventories in an environment of remote work. Specifically, two trends stand out. First, digital transactions and app usage rose sharply because everyone was suddenly conducting all of their activity—whether it was shopping, ordering from restaurants, streaming entertainment, etc.—online from home. The online share of US retail sales increased by 3pp from 11% in 2019 to 14% in 2020 versus a 1pp increase from 2018 to 2019. Second, companies invested heavily in new technologies to facilitate remote work, such as using sensors connected to apps to monitor inventories and remote communication that saw a surge in the use of Zoom, Google Meet and a number of teleconferencing and other applications.

Do you expect these changes will persist post-pandemic?

Although the pendulum is swinging back to in-person work, we expect digital infrastructure will prove sticky because hybrid work will likely be more common in coming years and companies will want to remain resilient against future risks. The COVID-19 crisis revealed far more efficient ways to transact, operate, and communicate that won't just disappear. So, we expect sustained higher demand for Customer Relationship Management, Digital Marketing, uCaaS, ERP and Business Intelligence. As workers return to the office and resume in-person activities, a dip is possible in some of the major digital categories—like e-commerce, video conferencing, and food delivery—that boomed during the pandemic. But while some skeptics may argue that the notion of a digital revolution has been inflated, our CIO surveys suggest that we're likely to see normalization back to higher levels once the reopening buzz starts to fade and businesses realize the power of digital transformation.

Looking further out, the risk is that the pandemic pulled forward a multi-year IT investment cycle, so that a positive 6-7-year cycle might be condensed to 2-3 years. But just sizing the market for the major software technologies suggests longer-term upside. Cloud computing, for example, is only around 35bp of global GDP today, compared to 175bp for enterprise tech. That suggests the potential for 5x growth in cloud computing if it simply replaces legacy technology, which is a conservative estimate.

Chart source: Sensor Tower, Goldman Sachs GIR.



Hardware and Communications Technology — Rod Hall

Higher networking demand to stick post-pandemic

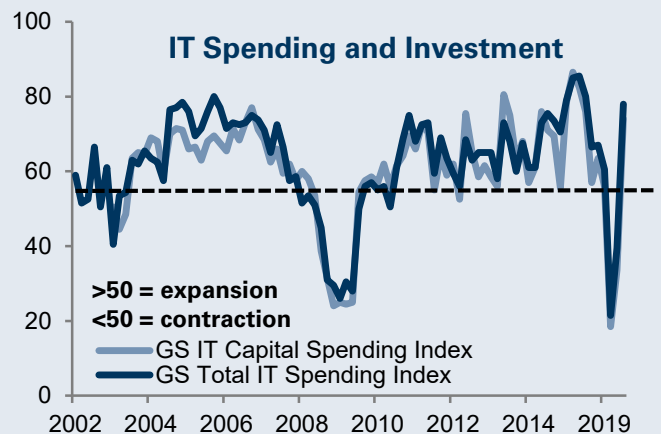
How have pandemic-related shifts in the way we work impacted your sector?

There were two big implications for the hardware sector. First, many firms increased and upgraded their PC fleets to equip employees working from home. For example, call center workers suddenly required PCs to do their job remotely. The total number of PCs sold last year grew by 13.4% to around 296mn, compared to an annual run rate of 255m-265m in the five years prior, and we're forecasting a sharp increase to 318mn this year. Second, the rise of Zoom and other new communications technologies has substantially increased demand for office networking equipment, which was insufficient to support the network requirements of video conferencing that requires >15 times more bandwidth than audio, on average. As a result, spending on campus networking is expected to rise by 4.3% to \$15.6bn in 2021 as employees return to offices. But one thing that didn't change was overall data center workloads, because workers generally use the same amount of data whether they're working from the office or from home.

Do you expect these trends to persist?

CIOs' spending intentions suggest the combination of a stronger macro backdrop and an acceleration of the trends toward digitization and hybrid work should contribute to a period of strong IT investment over the next year, including above-trend spending on networking equipment. Virtual reality technology, which essentially sold out when the pandemic hit due to high demand from Silicon Valley engineers, may also see slightly faster adoption post pandemic though the eventual addressable market still seems small. True AR technologies likely have a larger total addressable market (TAM), but are not expected to be available for 4-5 years. For PCs, while we expect some strength to persist next year and forecast sales of 285mm in 2022, we think this mostly reflects a pull-forward in replacement demand rather than a new normal for the segment, which saw essentially flat demand growth for the three years prior to the pandemic.

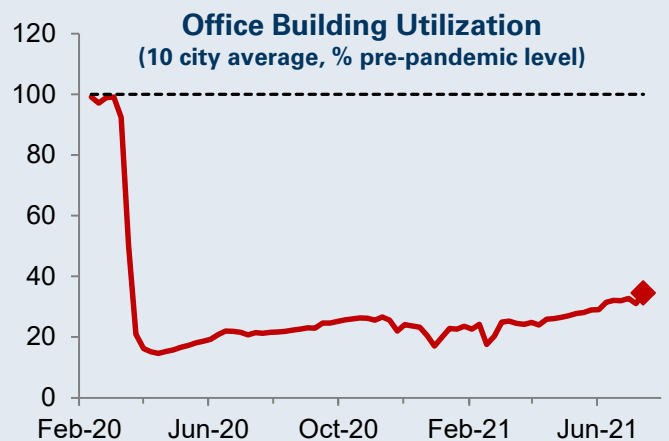
Chart source: Goldman Sachs GIR.



Real Estate/REITs — Caitlin Burrows
Too much discount for office REITs

How have pandemic-related shifts in the way we work impacted your sector?

In terms of office REITs, it's first important to note that the amount of square footage per person in offices had already been trending lower pre-pandemic based on the changing structure of modern work spaces. During the pandemic, in-office work troughed in April 2020 at up to 90% below the pre-pandemic level (depending on the location) and the average office utilization rate across the top 10 US metros has rebounded to only 34% as of July 2021. But despite this decline in office utilization, the drop in office occupancy, or the amount of space actually leased, has been less than 500bps because most office leases are multi-year contracts. Office REIT rent collections in 2Q20 averaged 96.2%, suggesting that tenants largely continued to pay their rents. At the same time, industrial REITs saw a substantial boost from the surge in demand for warehouse space as the pandemic accelerated shifts towards e-commerce. In 2H20, industrial leasing activity increased 17% versus 2019 levels, and this strong double-digit growth has continued in 2021: 2Q21 leasing activity increased 21% versus 2Q19.



Do you expect these changes will persist as the economy reopens?

We're fairly optimistic on the likely return of in-person office work, and expect the demand for office space won't fall significantly even if hybrid work is here to stay. A recent survey we conducted showed that 75% of office workers expect to be back full time by mid-2022. And, in NY, office workers expect to work from the office on average 4.1 days per week by mid-2022, compared to 4.3 prior to the pandemic, suggesting only a small shift from the pre-pandemic environment. In a world of hybrid work, where employees are coming in 3 or more days a week, calculations for how much space firms need just won't change much relative to pre-pandemic levels. On the industrial side, the boom in e-commerce growth could decline from the peak, but we believe demand for industrial space will continue to be elevated as tenants focus on supply chain security by increasing safety stock and focusing on warehouse locations near dense urban areas to support faster delivery times.

Chart source: Kastle Systems, Goldman Sachs GIR.



Travel & Leisure — Stephen Grambling

Business travel recovery has room to run

How have pandemic-related shifts in the way we work impacted your sector?

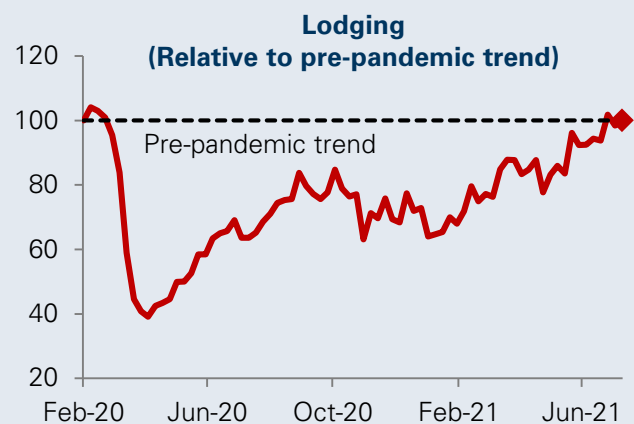
The shift toward remote work and the associated sharp decline in business travel was a massive shock to the hotel and leisure industry given that business travel accounts for about 55% of US hotel revenues, and is therefore highly correlated with macro indicators such as Industrial Production (IP) and non-farm payrolls especially. At the height of the pandemic in the US during 2Q20, revenue per available room night (RevPAR)—the industry's standard performance metric that takes into account both occupancy and room rates—fell over 80%. But a strong rebound in leisure travel this summer has pushed RevPAR back to pre-pandemic levels in recent weeks. That said, business travel remains more than 30% below pre-pandemic levels, and cities with high exposure to business travel remain more depressed, with RevPAR in San Francisco, Boston, Washington and New York all more than 60% below 2019 levels.

Do you expect these changes will persist?

We expect business travel to recover faster than people think, but also anticipate longer-lasting changes in the way that people travel that will permanently impact the sector. At our Travel & Leisure conference in early June, not a single investor we polled thought business travel would exceed 2019 activity levels this year and ~20% believed it would never recover. This corresponded with our own investor conversations and management teams only looking for a full recovery in hotel RevPAR by 2023. Despite these fears, US RevPAR hit 2019 levels in early July, though business travel remains depressed. So, we think people are a bit too pessimistic on the prospects for Travel and Leisure in general, and on the outlook for business travel in particular.

And remote work is not necessarily a net negative if people now need to travel occasionally to check in at headquarters/attend meetings in person or companies plan offsites/conventions to gather their people periodically. We're also seeing a blurring of the line between business and leisure travel, or "Bleisure" travel, in which people take longer-duration trips that combine elements of both. The percentage of business trips with a leisure component grew from ~43% in 2016 to 60% in 2018, according to Expedia, and we expect the pandemic to accelerate this trend, which should be a tailwind for the travel recovery. On net, we expect business travel to continue to recover to ~15% below 2019 levels in 2022 and RevPAR to do be only down ~10% vs. 2019, ahead of consensus looking for down ~20%.

Chart source: Google, STR, ShopperTrak RCT Corporation, Booking.com, OpenTable, Goldman Sachs GIR.





Airlines – Catherine O'Brien

Leisure gains help offset business losses

How have pandemic-related shifts in the way we work impacted your sector?

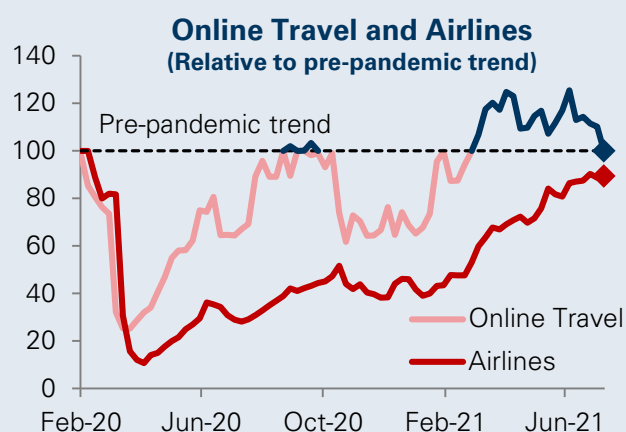
Business travel fell by roughly 95% during the height of the pandemic as face-to-face meetings came to an abrupt standstill, and remains down roughly 60% relative to 2019 levels. This slow recovery is significant because business travel represents about a third of all US airline traffic, and we estimate ~50% of revenue for each of the "Big 3" US carriers (American, Delta, and United). But the shift to remote work was not all bad news for airlines;

volumes increased on typically slower travel days like Wednesdays as "work from anywhere" allowed customers to more easily travel midweek. Airlines were also able to respond to the changing dynamics by reallocating a sizable portion of their flights to leisure destinations (Delta allocated roughly a third of its domestic fourth quarter 2020 capacity to leisure routes). And overall travel volumes continue to recover towards pre-pandemic levels in recent weeks as domestic leisure demand has picked up.

Do you expect these changes to persist?

We expect a step-up in business travel demand in the fall as offices reopen and more people head back to work, but think the recovery to pre-pandemic levels will take several years, and 10-15% of corporate demand could permanently be lost. A recent Delta survey of their large corporate accounts found that 36% expected a return to pre-pandemic business travel no later than 2022 and 21% no later than 2023 (vs. 38% unsure and 5% never). Even if some workers don't return to the office, a continuation of "work from anywhere" off-peak travel and the potential for people to need to travel occasionally for in-office meetings and/or to gather with colleagues could support travel volumes.

Chart source: TSA, Facteus, STR, Kayak, Goldman Sachs GIR.



Retail/Broadlines & Hardlines – Kate McShane

Leaps for e-commerce, fulfillment and automation

How have pandemic-related shifts in the way we work impacted your sector?

The pandemic has rapidly accelerated the shift toward e-commerce and triggered a new digital age for the retail industry as most people moved to work and shop remotely. Just to size the surge, most of the companies we cover have earned four years of revenue in just the last two, as the wallet share from restaurants and leisure shifted to retail. E-commerce sales accounted for a large portion of the increase; US e-commerce sales rose by over 40% yoy in 2Q20, and have roughly remained at the same dollar levels ever since. And among the companies we cover, we estimate digital sales on average made up ~19% of total 2020 sales, up from ~12% in 2019. More broadly, the pandemic meaningfully increased in-store fulfillment, sped up the ongoing race among retailers for same day delivery and shifted the demand for workers across the industry, with, for example, the demand for pickers versus salespeople growing. The ongoing trend towards automation has also been in play, with for example, robotic arms increasingly picking the most popular items for order fulfillment.

Do you expect these changes will persist?

We expect retail spending will tick down this year as some consumers return to the office and the economy normalizes because people will arguably have less idle time to shop online and will have more options to spend their money on restaurants, entertainment, etc. But we still expect total retail spending levels to be elevated vs. 2019 given continued levels of excess savings, improving employment trends and ongoing child tax credits. And when it comes to industry headcount, although automation trends will persist, we expect employment to remain relatively flat over the next few years as many workers transition to new jobs. For example, Target Inc. (TGT) and Walmart Inc. (WMT) are increasingly focused on positioning employees as "experts" in certain areas as more routine tasks become automated. And wages are rising as more states adopt a higher minimum wage, reinforcing the trend towards rising wages.

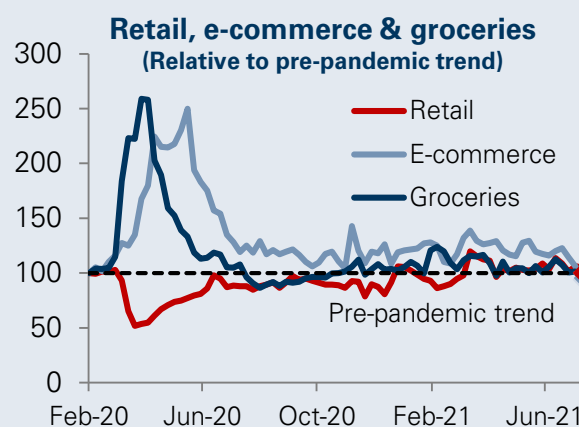


Chart source: IRI Worldwide, Sensor Tower, Goldman Sachs GIR.



Banks & Advisors – Richard Ramsden

More digitization means more investment

How have pandemic-related shifts in the way we work impacted your sector, and how are these impacts likely to evolve?

The financial sector has been digitizing for years, which has typically meant fewer cash and check transactions. The pandemic accelerated this shift, forcing the holdouts to fully embrace digitization. We've seen the use of cash and checks decline by around 20%, and one of our banks flagged that digital transactions increased by 13pp from 67% to 80% of their total transactions from early 2019 to early 2020. These shifts are likely to persist as once retail customers switch to transacting digitally, they rarely step foot in a branch again, except when they require advice on major financial decisions around mortgages, estate planning, etc. That means that the type of people working in bank branches will need to evolve, and that bank spending on IT and digital infrastructure will remain elevated. About 10% of the revenue of the banks we cover is already spent on technology, but with customers now benchmarking their banks' digital experience against the likes of Amazon and Google as opposed to against competitor banks, future investment will need to be substantial. The acceleration—and widespread acceptance—of these shifts is set to compress a 5-year investment cycle into 2-3 years.

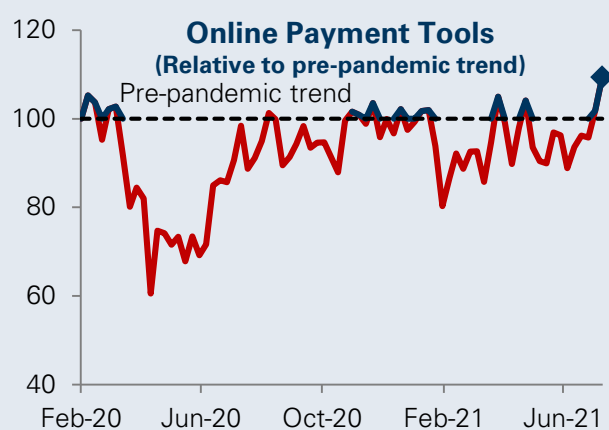
What are the implications of this for bank profitability?

Most of the benefits of these investments will accrue to customers rather than shareholders, as has been the trend historically, in the form of lower transaction costs and an improved user experience. But this is more about staying competitive as opposed to boosting profitability. Banks must keep up with the technological innovation occurring in other parts of the financial sector to keep customers.

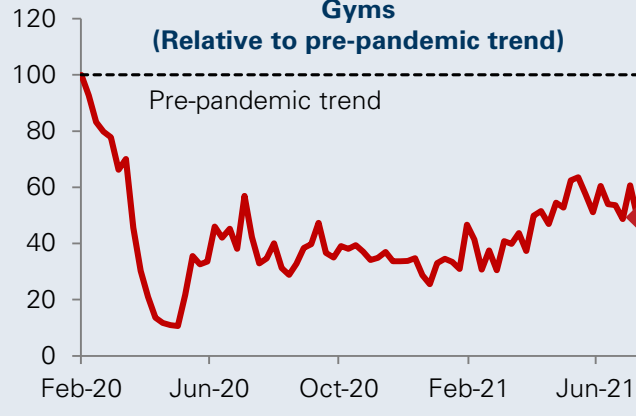
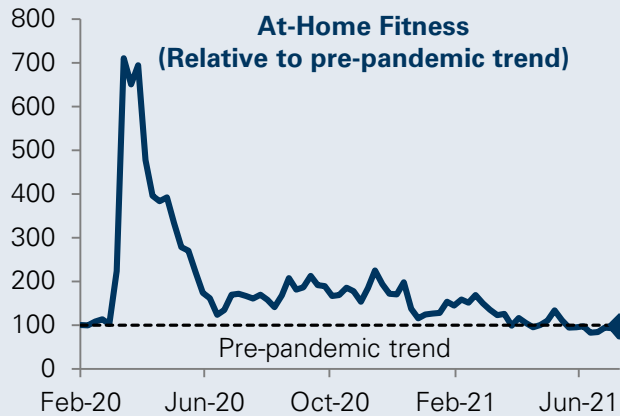
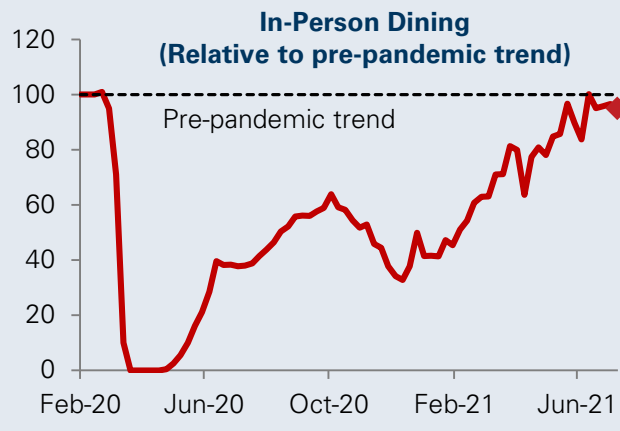
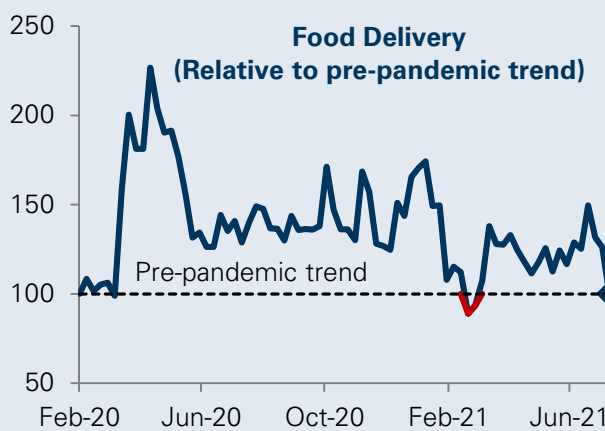
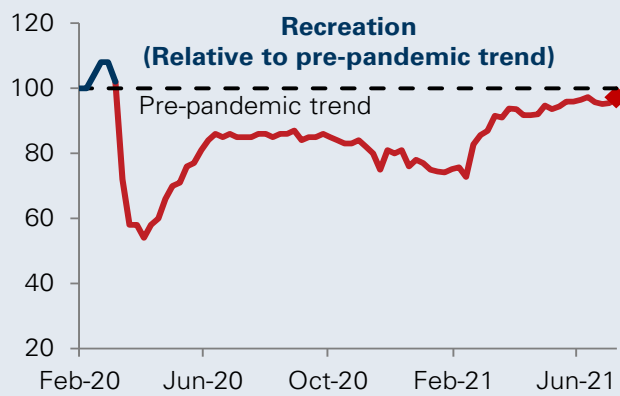
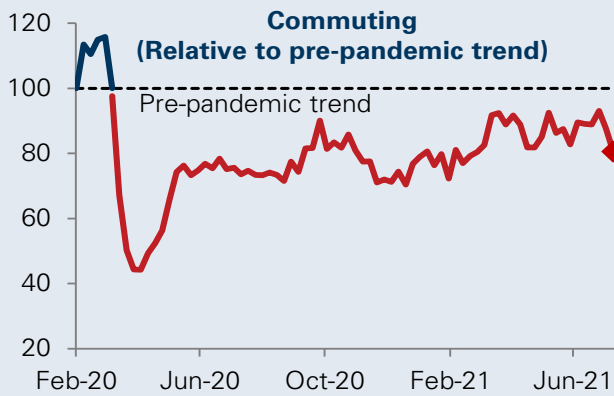
Where does the sector stand on the issue of Return to Work (RTW)?

Banks have diverged substantially on plans to bring workers back to the office. Some banks argue that remote work was successful during the pandemic precisely because employees had built up a store of goodwill, collaboration, and cohesion from having worked together in person. The pandemic forced them to draw down some of this reserve, and the only way to build it back up is by returning to the office. Other banks see the ability to offer workers more flexibility as a potential competitive advantage in attracting and retaining talent. But different pandemic-related shifts have arguably had just as material implications for workers in the sector; for example, the fact that investment bankers could make many more pitches per day over Zoom versus having to travel created substantially more work for junior bankers no matter where they were working, which is likely unsustainable given the current levels of burnout. And all of this has been occurring against the trend of financial institutions reducing headcount in large cities to reduce costs and leverage local talent that was well underway before the pandemic. Where the talent stays/goes in the context of all of these evolving dynamics will be a telling indicator of the sector's future of work.

Chart source: Sensor Tower, Goldman Sachs GIR.



A look at where other sectors stand:



Note: Index uses yoy % change through January 2021 and 2-yr stacked metrics Feb 1st, 2021 onwards as we begin to lap the COVID-19 impact from 2020.
 Source: Google LLC "Google COVID-19 Community Mobility Reports"; <https://www.google.com/covid19/mobility/>. Accessed: 7/27/21; Sensor Tower, Goldman Sachs GIR.

Summary of our key forecasts

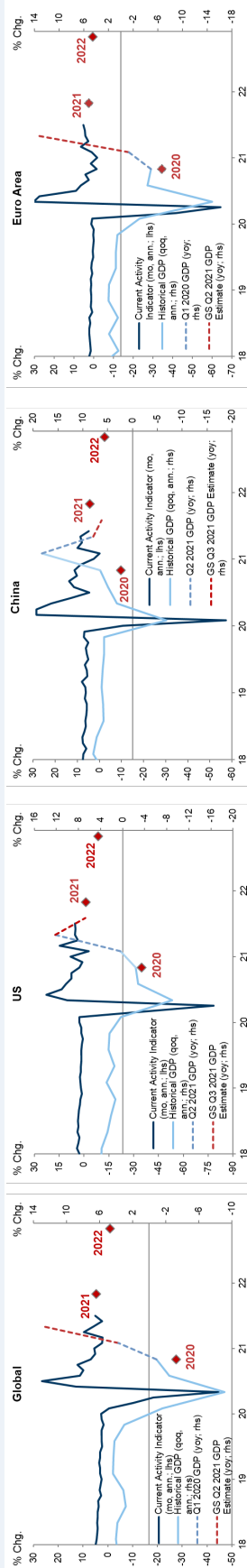
GS GIR: Macro at a glance

Watching

- **Globally**, we expect moderately above-consensus growth of 6.4% in 2021. Our optimism reflects the view that post-vaccination reopening, accommodative monetary and fiscal policy, pent-up savings, and limited scarring effects will support a continued recovery in economic activity, though post-pandemic shortages are weighing on output and the spread of the Delta variant is somewhat offsetting progress from rising vaccinations.
- **In the US**, we expect full-year growth of 6.6% in 2021 on the back of significant fiscal stimulus and widespread immunization. We expect the unemployment rate to fall to 4.4% by year-end, and we believe that core PCE inflation has likely already peaked or will peak in coming months, and will end the year at 3.3%.
- **The Fed** has adopted outcome-based forward guidance for asset purchases, and we expect tapering will be announced in December and begin in 1Q22. With the Fed now appearing to set a lower inflation bar for liftoff, we forecast that the Fed will begin to hike rates in 3Q23, although we believe the odds of a hike by the end of 2023 are only modestly above 50%. On the fiscal policy front, we expect the passage of additional spending in mid/late Q3 or Q4 focused on infrastructure, social benefits, and long-term investment totaling around \$3tn and tax hikes of around \$1.5tn over 10 years, though risks tilt in the direction of a smaller package.
- **In the Euro area**, we expect above-consensus full-year growth of 5.2% in 2021 on the back of widespread immunization. While the Delta variant poses a risk to the 2H growth outlook, we think momentum will remain firm given evidence of continued vaccine efficacy and our expectation for a drawdown in sizable pent-up savings. We expect core inflation to peak at 2% yoy in November, before falling back sharply to 0.9% yoy in January 2022.
- **The ECB** recently strengthened their forward guidance on interest rates to align with their new strategy, which we view as consistent with the first rate hike in 2025. We expect the ECB will announce a reduction of the PEPP purchase pace at the September meeting, partly due to the strong growth outlook, and see PEPP running until June 2022 and the APP continuing at EUR 20bn until mid-2023.
- **In China**, we expect 2021 real GDP growth of 8.6% and believe government-led investment will step up in 2H21 to ensure stable growth amid a peak in exports and still recovering consumption.
- **WATCH CORONAVIRUS**. While the Delta variant implies a slightly slower global reopening, our base case assumes that rising immunity owing to a combination of vaccination and prior infection will drive a continued recovery in global economic activity this year. We expect 50% of the global population to be vaccinated with a first dose in November and that 60-90% of people in all of the major economies will have some degree of immunity to COVID-19 by end-2021.

Goldman Sachs GIR.

Growth



Source: Haver Analytics and Goldman Sachs Global Investment Research.
 Note: GS CAI is a measure of current growth. We have recently revised our methodology for calculating this measure. For more information on the methodology of the CAI please see "Lessons Learned: Re-engineering Our CAIs in Light of the Pandemic Recession," Global Economics Analyst, Sep. 29, 2020.

Forecasts

Economics	Interest rates 10Yr (%)				Markets				Equities												
	2021	2022		Last	E2021	E2022	FX	Last	3m	12m	S&P 500	E2021	E2022	GS	Cons.	Returns (%)	12m	YTD	E2021	PIE	
GDP growth (%)		GS	Cons.																		
Global	6.4	6.0	4.7	4.5	1.26	1.90	2.10	EUR/\$	1.18	1.20	1.25	Price	4,300	--	4,600	--	S&P500	1.0	17.0	23.0x	
US	6.6	6.6	4.4	4.1	-0.45	0.00	0.05	GBP/\$	1.39	1.36	1.42	EPS	\$193	\$196	\$202	\$214	MXAPJ	19.0	-2.0	15.5x	
China	8.6	8.5	5.6	5.6	0.01	0.30	0.30	\$/JPY	110	110	106	Growth	35%	39%	5%	8%	Topix	13.0	6.0	20.1x	
Euro area	5.2	4.6	4.5	4.3	0.57	1.10	1.25	\$/CNY	6.5	6.4	6.15	Credit					STOXX 600	4.0	16.0	17.7x	
Policy rates (%)		GS	Mkt.	GS	Mkt.																
US	0.13	0.15	0.13	0.32	75	75	75	USD	IG	85	91	97	US	5.1	4.4	2.2	3.6	4.4	2.1	--	Q4
Euro area	-0.50	-0.52	-0.50	-0.51	4.04	3.25	2.90	Nat Gas (\$/mmBtu)	HY	294	281	296	Euro area	2.0	8.4	1.4	7.9	--	--	--	--
China	2.30	2.09	2.30	2.22	9,664	10,500	11,500	EUR	IG	97	92	90	China	0.9	--	1.2	--	12.1	--	--	--
Japan	-0.10	-0.06	-0.10	-0.08	1,797	2,000	2,000	Gold (\$/troy oz)	HY	310	285	275	Wage Tracker 2021 (%)								

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 July 28, 2021.

Glossary of GS proprietary indices

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For more, see our [CAI page](#) and [Global Economics Analyst: Trackin' All Over the World – Our New Global CAI, 25 February 2017](#).

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.

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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](#).

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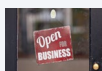
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