Goldman Sachs | Global Macro Research

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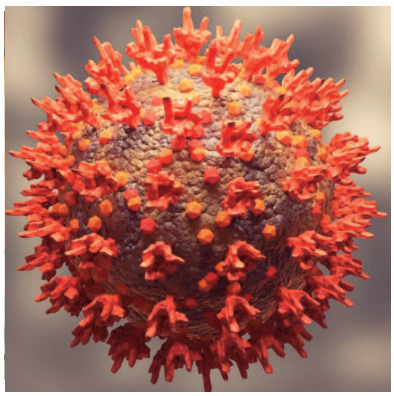
TOP of MIND

2022: THE ENDEMIC YEAR?



While the lightning spread of the Omicron virus variant has led to a record surge in cases globally, its more transmissible but milder nature has also raised the question of whether it's ushering in a more manageable, endemic phase of the virus in 2022. But is that actually the case? And what could be the macro and market impacts if it is, and isn't? For answers, we turn to Scripps' Dr. Eric Topol and Columbia's Jeffrey Shaman, who warn that Omicron's milder nature shouldn't be seen as a harbinger of things to come, and it's too soon to say that we're moving into a durable endemic phase. But they see new oral antiviral drugs—expected to be more widely available later this year—as a possible game-changer. In the meantime, our economists conclude that another virus curveball would likely have more implications for inflation than growth, potentially further fueling market worries about the Fed's tightening cycle, and that the consequences of China's zero-Covid policy could be a major theme in 2022. Finally, our strategists consider what "moving on" from the virus would mean for markets.

"While it's hard to imagine a more transmissible variant than Omicron emerging, if we keep going without the global vaccine equity needed to achieve containment and without people receiving boosters, we could see another variant that exhibits true immune escape… effectively blowing through our immunity wall."

- Dr. Eric Topol

"I don't see any mechanism for the virus to evolve to be milder. This argument is based on evolutionary theory that says that as a pathogen persists in a host, it evolves to become more transmissible and less virulent… The problem is that this selective pressure towards reduced virulence isn't anywhere close to applicable for SARS-CoV-2."

- Jeffrey Shaman

WHAT'S INSIDE

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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 2022 GDP forecast to 2.4% Q4/Q4 heading into 2022, as we no longer expect the BBB bill will pass.
- We pulled forward our Fed balance sheet runoff forecast to July following the release of the December FOMC minutes, and now expect four rate hikes this year, although we see the risks around these forecasts as tilted toward somewhat faster tightening.

Datapoints/trends we're focused on

- Financial conditions, which have recently begun to tighten, although tightening so far has remained fairly limited.

Japan

Latest GS proprietary datapoints/major changes in views

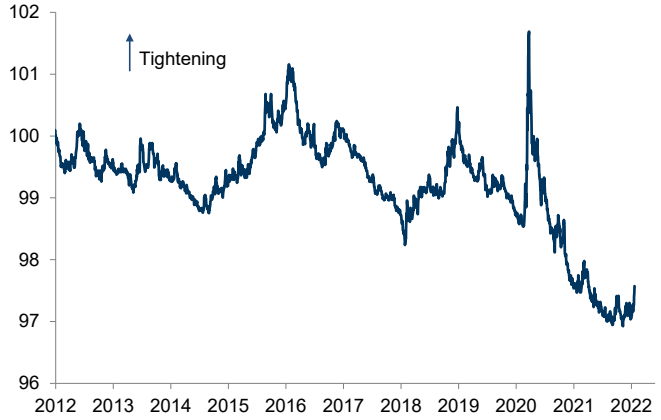
- We recently raised our 2022 avg core CPI forecast to 1.3%, and our new core CPI forecast to 0.3%, due to higher commodity prices, yen depreciation, and changes in special factors.

Datapoints/trends we're focused on

- Virus cases, which have risen sharply since the start of the year and could trigger a new state of emergency, although this is not in our base case.
- Monetary policy; we expect the BOJ to maintain current yield curve control throughout 2022, while continuing to effectively taper JGB and ETF purchases.

Fairly limited tightening in financial conditions so far

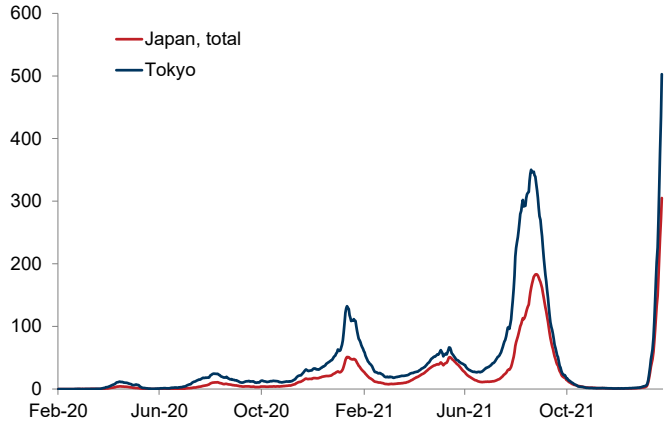
GS US Financial Conditions Index



Source: Goldman Sachs GIR.

Virus cases have recently risen sharply

New cases per million, 7 day average



Source: Ministry of Health, Labor, and Welfare, JHU, Goldman Sachs GIR.

Europe

Latest GS proprietary datapoints/major changes in views

- Following the BoE's unexpected rate hike in Dec, we view the incoming data over the last few weeks as supporting our expectation of 25bps Bank Rate hikes in both Feb and May.

Datapoints/trends we're focused on

- Omicron hit to activity; we expect it to be short-lived, and expect EA growth to outpace US growth in 2022.
- EA core inflation, which we forecast will fall sharply to 1.7% in January as base effects wash out and end 2022 at 1.3%.
- EA fiscal policy, which we expect to remain expansionary in 2022 due to the Recovery Fund and new German govt.

Emerging Markets (EM)

Latest GS proprietary datapoints/major changes in views

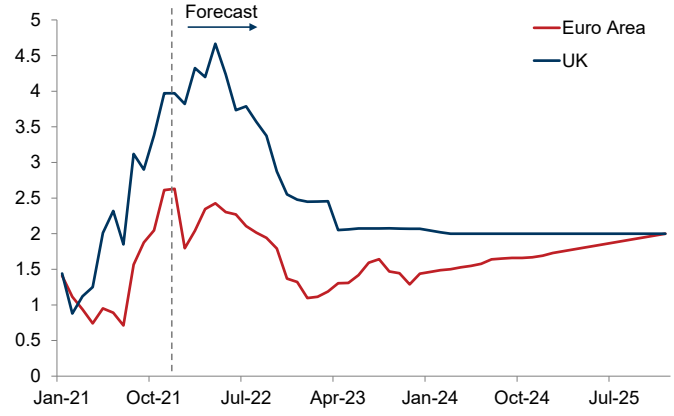
- With 4Q21 GDP in hand, we forecast below-consensus 2022 China GDP growth of 4.5% due to virus-related disruptions and the housing market slowdown.
- We have recently lowered our 1Q22 GDP forecasts across most EMs in Asia-Pacific due to continued Omicron spread.

Datapoints/trends we're focused on

- China policy, which we expect to further ease this year in response to growth headwinds from Covid and housing.
- EM hiking cycle, which we expect to broaden in EM Asia this year and continue in most of LatAm and CEEMEA.

Inflation to fall sharply in the EA and UK this year

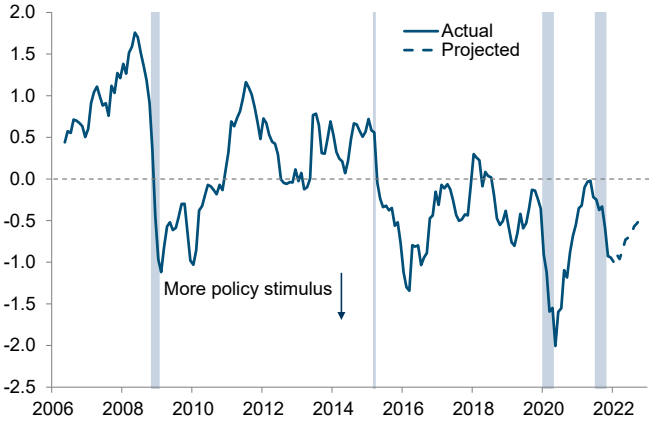
Core inflation, % yoy



Source: Haver Analytics, Goldman Sachs GIR.

China macro policy likely to remain relatively easy

China domestic macro policy proxy, z-score



Source: Haver Analytics, Wind, CEIC, Goldman Sachs GIR.

2022: The endemic year?

While the lightning spread of the Omicron variant of SARS-CoV-2 has led to a record surge in cases globally, its more transmissible but intrinsically milder nature has also raised the question of whether it's ushering in a more manageable, endemic phase of the virus in 2022 that would allow us to return to our normal daily lives without pause. Indeed, the market has seemingly already begun to move on from worrying about the virus to worrying that it's now time to pay the piper for the massive pandemic-era monetary and fiscal stimulus—and the inflation surge it has induced. But is an endemic phase of the virus truly upon us? And what would be the economic and market consequences from here if that is—or isn't—the case? The answers to these questions are Top of Mind.

To start to answer them, we ask Dr. Eric Topol, Founder and Director of the Scripps Translational Science Institute, and Jeffrey Shaman, Director of the Climate and Health Program at Columbia University's Mailman School of Public Health, how much comfort we can have that Omicron's milder nature is a harbinger of things to come, how well our immunity wall post Omicron is likely to hold up against future variants, and how close we are to reaching an endemic phase.

Topol argues that Omicron was one of the most extraordinary curveballs in modern virology, and its dozens of new mutations that have resulted in an immensely more transmissible variant with significant ability to evade prior immunity has given us a new sense of the virus's sheer unpredictability. So despite its seemingly milder nature—which he says is, in itself, a misperception—he takes no comfort in what it bodes for future variants. Indeed, he sees the jump in Omicron's immune evasion compared to Delta as underscoring the lurking potential for a new variant that more fully evades our vaccines and prior immunity, effectively blowing through our immunity wall.

Shaman generally agrees that it's wishful thinking to view the more benign nature of Omicron as an indication of things to come, as he doesn't see any mechanism for the virus to evolve to be milder. But he believes that exposure through vaccines, boosters, and prior infections is likely to provide at least partial protection from future variants. And he and Topol both argue that Pfizer's new oral antiviral drug, Paxlovid, could be a game-changer given its strong efficacy against serious disease in clinical trials, and that it targets a part of the virus that doesn't seem to mutate, making it essentially variant-proof.

GS healthcare analysts Salveen Richter, Chris Shibutani, and Matthew Sykes provide more detail on the efficacy of vaccines and treatments in providing protection against Omicron, as well as new vaccines and treatments in the pipeline to protect against future variants. They agree that the new oral antivirals mark a significant breakthrough. And while they note that Pfizer expects Paxlovid demand to exceed supply during 1H22, the company aims to meet global demand for the antiviral later this year—with 120mn blister packs available by year-end.

However, both Topol and Shaman caution that given that we don't know what the next variant will bring, it's too soon to think that we can stop worrying about the virus. Although they believe that achieving a more endemic state for at least parts of this year is possible, Topol explains that its durability will remain in question because we've ruined our chances to reach herd immunity through mass vaccination, and so the only way we can really put the risk of severe consequences from a virulent mutation to rest is by having effective treatments, like Paxlovid, in every medicine cabinet or a pan-coronavirus vaccine—which isn't coming anytime soon.

Given the unpredictability of how the virus evolves from here, GS global economists Daan Struyven and Dan Milo then map out a range of virus scenarios and the implications for the global economy this year. Their base case of 4.4% global GDP growth in 2022 assumes a more endemic state of the pandemic will be achieved in most economies by the spring due to many factors that our medical experts discuss—surges in natural immunity, booster shots, and the rising use of oral antiviral drugs—as well as the expectation that many consumers will likely choose to learn to live more fully with the virus, and policymakers in most economies will aim to shift to a gradual phase-out of pandemic-related restrictions.

The major exception is China, where GS China economists Lisheng Wang, Helen Hu, and Hui Shan expect the government to maintain its zero-Covid policy (ZCP) through at least late 2022, leading to a 0.9pp drag on Chinese growth relative to their prior baseline. In a downside virus scenario in which a significantly worse new variant than Omicron emerges, Struyven and Milo see lower activity globally, 0.7pp below their baseline forecast, and higher inflation, partly due to what Wang, Hu, and Shan expect would be much more severe supply chain disruptions given the likelihood of a wider, or even a national, lockdown in China.

The key takeaway is that another virus curveball would likely have greater implications for inflation than for growth, potentially providing yet another reason to be worried about inflation—and the Fed's tightening cycle—this year. With the Winter Olympics looming, and a big political year ahead in China, the consequences of China's ZCP amid more transmissible virus strains could also be a major theme in 2022.

But while a focus on downside risks seems warranted given the medical realities of the virus, Struyven and Milo also lay out an upside virus scenario that could see growth marginally higher, and inflation pressures somewhat lower, owing to the rebalancing of demand from goods to services, and the accelerated recovery in goods and labor supply.

GS market strategists Dominic Wilson and Vickie Chang consider the market implications of such a scenario that entails more fully "moving on" from the virus from a policy and behavioral perspective. They see three main channels through which the market impact of such a shift could be felt—a boost to market growth expectations, faster supply relief, and favorable changes to the distribution of growth and inflation views—which they find could create a stronger basis for higher back-end/terminal rates and some associated steepening of yield curves, a weaker Dollar, a sharper rally in energy markets, a decline in equity volatility and skew, and potential support for carry trades. Check out more asset-by-asset color around these themes from our markets teams on pgs.18-19.

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Interview with Dr. Eric Topol

Dr. Eric Topol is Founder and Director of the Scripps Translational Science Institute, Professor of Molecular Medicine at The Scripps Research Institute, and a practicing cardiologist at Scripps Clinic. An expert in individualized medicine, his latest focus has been on the evolution of SARS-CoV-2. Below, he argues that Omicron has given us a new sense of the unpredictability of the virus, and while Pfizer's oral antiviral could be a game-changer, we don't yet have the tools we need to put concerns about the virus behind us in 2022.

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

Allison Nathan: You've described our recent experience with Omicron and SARS-CoV-2 more broadly as "lucky". Why is that?

Dr. Eric Topol: Although millions of people have become infected with the virus, and many are unfortunately still being hospitalized and dying from it, most people don't realize how extraordinarily lucky we've been—including with Omicron—for several reasons. One, even with the profound antigenic shift between Omicron and the ancestral strain—with around 50 mutations throughout the Omicron genome—our vaccines that were delivered in record time to provide protection against the ancestral strain are holding up remarkably well against Omicron when booster shots are administered. A third shot of the mRNA vaccine has been found to provide non-trivial protection against symptomatic infection, and 90% protection against severe disease, hospitalization, and death.

Two, the human cellular immune response has been remarkable. Given its profound antigenic shift, Omicron could've been seen by our immune systems as much more foreign than it has been, but broadening recognition by our memory T cells and specialist B cells is a major reason why protection from vaccines and prior infections has held up so well throughout the latest wave. Three, while the immunity wall that has been built by vaccinations, boosters, and prior infections has lessened the hit from Omicron, there's now abundant evidence that Omicron is also intrinsically less severe, in that it doesn't damage the lungs as much as prior variants. And four, Pfizer's development of Paxlovid, the first drug specifically designed to attack SARS-CoV-2, is a remarkable breakthrough. This small molecule moved from development to successful clinical trials in less than two years, a process that normally takes over a decade, and has an efficacy rate against hospitalization and death comparable to that of three vaccine doses. So there's much to be thankful for.

Allison Nathan: How concerned are you that our luck could run out in terms of a new variant potentially emerging that is both more evasive of our immunity wall and intrinsically more severe, and has the emergence of Omicron made you more or less concerned about that?

Dr. Eric Topol: I'd like to be optimistic, but I am concerned. The unpredictability of how we got from Delta to Omicron is scary even if Omicron has proven to be less virulent than Delta. Brilliant evolutionary virologists, whose job it is to figure out how viruses are going to evolve, mostly thought that the next variant would be some lineage of Delta. None of them pegged Omicron or anything like it as the next variant. So Omicron was a major curveball. It has dozens of new mutations littered throughout its entire genome, and not just in the spike protein that SARS-CoV-2 uses to attach to human cells, which gives us a new sense of how unpredictable this virus can be. These mutations have resulted in an immensely more transmissible variant that has more ability to evade prior immunity. With Omicron, protection conferred from prior infection is not nearly as good as was the case with Alpha, Beta, Gamma, and Delta. Vaccinated individuals whose immunity has waned over time have almost no protection against infection, with two vaccine doses providing the same or even less protection against infection than prior Covid infection and only 50% effectiveness against hospitalization. It takes three vaccine shots to really make a difference with this variant in terms of severe illness, hospitalization, and death.

While it's hard to imagine a more transmissible variant than Omicron emerging, if we keep going without the global vaccine equity needed to achieve containment and without people receiving boosters, we could see another variant that exhibits true immune escape, meaning that it mutates in a way that fully escapes detection by the antibodies produced by a vaccine or prior infection, effectively blowing through our immunity wall. So, while I would like to be optimistic that the emergence of Omicron will build up our immunity wall and we won't see a worse variant in the future, there's a lurking potential for a new Greek letter variant that truly evades our vaccines and our prior immunity. For this reason, the mentality of "just get it to get it over with" that some people have is ridiculous. There's no guarantee that becoming infected with Omicron will offer protection against the next variant. We also still don't understand the lingering aspects of becoming infected, or "long Covid", and we won't know them for a while.

Allison Nathan: But does it give you any comfort that Omicron appears to be more mild? Does that suggest that future variants are less likely to be severe?

Dr. Eric Topol: No. First of all, the idea that Omicron is mild is a misperception in many respects. Even if Omicron is 70% less severe, which is the upper range of what many studies have found, its enormous transmissibility means that it's basically a wash in terms of the number of people that wind up with severe disease given substantially more people are going to become infected. This is why places with zero–Covid policies (ZCP) like China are likely in for a lot of trouble right now. Even though China's vaccination rates are high, its Sinopharm and Sinovac vaccines have not held up well against Omicron, very few individuals in the country have been boosted so far, and the ZCP has resulted in little prior Covid immunity being built up

in the population. So I'm concerned that China is going to experience major Omicron outbreaks, and with such a large population, Omicron's toll in China could be severe.

And while I hope that Omicron will be the last stop along the way towards a milder, endemic state, that's largely wishful thinking and very unlikely. In the 1918 influenza pandemic, some evidence suggests that the last wave was a less severe one, but there were only three waves in total. We've already far exceeded that number in this pandemic. This virus is a different animal that has shown a striking ability to evolve, so we can't make the leap that this is the last wave, or that variants in future waves will be just as mild or milder. The virus will almost certainly evolve further. It's not clear what that evolution will bring, but with the jump in Omicron's immune evasion compared to Delta, the potential for a new variant that is more immune evasive and more severe, can't be discounted.

Allison Nathan: Is there a point at which we could put the risk of a very bad mutation—one that is more immune evasive and severe—behind us, and, if so, how close are we to that point?

Dr. Eric Topol: If we had a pan-coronavirus vaccine and large quantities of effective therapeutics, like Paxlovid, available, then we essentially wouldn't have to worry about another variant. Many labs have been able to find and isolate very potent antibodies, called broad neutralizing antibodies, which are effective against numerous coronavirus strains. So the science is there for vaccine manufacturers to develop vaccines that make the same antibodies. But right now drug companies are still focusing on developing variant-specific vaccines, which likely won't help much by the time they reach the general population, rather than making the $100 million+ investment in the clinical trials that would be required to test for safety and immunogenicity of pan-coronavirus vaccines. Only Walter Reed National Military Medical Center currently has a pan-coronavirus vaccine in clinical trials, and it's only in Phase 2. We need an Operation Warp Speed equivalent for a pan-coronavirus vaccine, but that's just not happening. And while Paxlovid could be a game-changer, Pfizer won't produce near enough blister packs this year for all of us to have it in our medicine cabinets so that we can stop worrying about another variant.

Allison Nathan: Why are you so optimistic about Paxlovid in terms of its ability to eventually put the risk from a very bad mutation to bed, especially when we don't know what the next variant will bring?

Dr. Eric Topol: I like to refer to Paxlovid as a "just-in-time" breakthrough, because, unlike vaccines and monoclonal antibodies, it doesn't rely on our immune response. That's very important in the context of Omicron, whose main distinguishing property from earlier variants is that it has profound immune-evasive features that render vaccines and most monoclonal antibodies, with the possible exception of GSK-Vir's Sotrovimab, much less effective. So depending on the immune response only to tackle this virus has been a failure, already requiring more frequent vaccine boosters than we originally hoped would be the case.

Instead of relying on inducing an immune response, Paxlovid stops virus replication entirely, by binding to the virus's main protease, Mpro, which is an enzyme that acts early in the virus's lifecycle to help it replicate, and therefore directly inactivating the virus at its choke point. In the two clinical trials of Paxlovid that have been conducted so far, it has reduced viral loads tenfold within the first few doses. And by targeting Mpro, Paxlovid is basically variant-proof, because Mpro is a part of the virus that doesn't mutate—in the two years since the pandemic began, only one mutation has been found in this portion of the virus's genome. So Paxlovid doesn't see Omicron any differently than Alpha, Beta, Gamma, or Delta, and likely won't see any future variants differently barring an unusual mutation down the line. Now, we only have two small trials at this point; we'll know more when it gets out into the real world. But so far Paxlovid seems to be an immune-independent treatment that will not be affected by variants and has very potent and rapid transmission block capabilities. Scientists just couldn't design a better way to get at SARS-CoV-2 than this.

Allison Nathan: Given all of this, is it tenable that we could get to a point sometime this year where we see a durable normalization of economic activity and still have health outcomes that are acceptable?

Dr. Eric Topol: It's unlikely. There were two routes we could've gone to achieve this. One was getting enough people vaccinated. But the uptake of vaccines and boosters in countries like the US has been profoundly disappointing. Only 63% of people in the US are double vaccinated, which is about 60th on a list of countries in the world, and only 25% of people are triple vaccinated, compared to well over 50% in countries like the UK and Israel. Such low vaccination rates stem from anti-science and anti-vax behaviors, and for those reasons we'll never achieve a much higher rate in the US even with government mandates, which took their own hit recently with the Supreme Court decision to block vaccine mandates for large private companies. So, while some countries with higher vaccination and booster rates than the US are better-positioned, we've ruined our chances to get to a more endemic state via this route in the US. And many countries around the world that unfortunately have relatively low vaccination rates largely owing to vaccine inequity are in the same boat.

The other route we could've gone, as I mentioned, is the development of a pan-coronavirus vaccine, which, even if only around 60% of the US population chose to receive it, would meaningfully add to the existing immunity wall. This, combined with ample availability of effective therapeutics like Paxlovid, would have put us in the position of no longer having to be preoccupied with the virus as we have been for the last two years. But neither of these looks likely this year. So, while I haven't fully lost hope that we could be in a better state in terms of the virus sometime this year, maybe even by March or April, the durability of that depends on whatever comes after Omicron, because we haven't successfully used the tools we have to put the risk of a worse mutation behind us. We should have the highest regard for what future variants may be able to do, because this virus has already thrown us one of the most extraordinary curveballs in the history of virology, and there's no reason to think it couldn't do so again.

Interview with Jeffrey Shaman

Jeffrey Shaman is the Director of the Climate and Health Program at Columbia University's Mailman School of Public Health, where he studies the survival, transmission and ecology of infectious agents. Below, he argues that while existing immunity from prior infection, vaccines and boosters should provide some continued protection against SARS-CoV-2, we shouldn't discount the prospect of more virulent variants and virus waves in 2022, and potentially beyond.

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

Allison Nathan: Will the Omicron wave currently spreading around the world come crashing down as quickly as it rose? What have we learned from South Africa's experience with Omicron, and is it applicable to the US and elsewhere?

Jeffrey Shaman: It's not assured that the Omicron wave will crash as quickly as it rose because people tend to be less cautious as they start to see cases decline, which could prolong the outbreak. The heterogeneous spread of this variant also suggests that even as the wave subsides, Omicron may be able to sustain itself by reaching communities that it hadn't reached before.

In South Africa, cases shot up late last year and have since come down rapidly, although they remain above pre-Omicron levels so far. And in many important respects, much of what we're seeing in the US and elsewhere so far mirrors South Africa's experience: a steep rise in cases to record-high levels, the virus moving through very rapidly—with huge swaths of the population that were protected against Delta showing susceptibility to Omicron—and, importantly, far lower rates of severe disease and death relative to previous variants.

But there are also several critical differences between South Africa and the US—its immunity landscape, demographics, and seasonality—which suggest the US experience could be distinct. Around 26% of the population in South Africa is fully vaccinated, compared to roughly 63% in the US, and the suite of vaccines utilized by each country has been different. South Africa experienced a large wave of the virulent Beta strain, whereas the US did not, indicating a different exposure history and immunity from prior Covid. South Africa is also much younger than the US, with less than 8% of the population 60 years or older, which carries consequences for potential severe disease manifestation. And they're in the middle of their summer, which seems to slow virus spread somewhat, while it's winter in the US. So the combination of older demographics and wintertime conditions may leave the US and other Northern Hemisphere countries more vulnerable than South Africa's experience suggests. That said, our models generally indicate that Omicron is likely close to or already peaking in the US, with some areas like New York City already on the backside of it, although places like India and Turkey are still on the upswing.

Allison Nathan: What makes the Omicron variant more transmissible and less severe?

Jeffrey Shaman: Two factors may contribute to its faster spread. One is that it exhibits a shorter latency, or the period between when people are infected with the virus and the point at which they become contagious. While the drivers of transmissibility are hard to pin down, early studies indicate that the Omicron variant replicates in human lung tissue even faster than Delta, which means people get to a higher viral titer, or concentration of infectious particles in their body, and become contagious earlier. All things equal, infected individuals are therefore going to shed more virus in their respiratory droplets, contributing to increased infectiousness and shortening the latency period. And because it's more transmissible than Delta, Omicron is able to infect people before Delta and therefore can start to displace it in the population over time, as we saw over the course of December, leading to more and more spread.

And two is the fact that Omicron has shown some ability to evade prior immunity, so there's a larger pool of people to infect because a big chunk of the population is protected against Delta but not against Omicron. In terms of its lower severity, Omicron appears to take root more in the upper respiratory tract than past variants—so a runny nose is a common symptom—and is therefore not inflicting as much damage to the lower respiratory tract, where it can mess with oxygen exchange and cause severe consequences, particularly the types of immune responses that are particularly fatal, like a cytokine storm.

Allison Nathan: Should the emergence of Omicron give us comfort that the virus is becoming more benign over time, making it less likely that we're going to see future variants that are both more infectious and more severe?

Jeffrey Shaman: No. Although I'm hearing this argument a lot right now, I don't see any mechanism for the virus to evolve to be milder. This argument is based on evolutionary theory that says that as a pathogen persists in a host, it evolves to become more transmissible and less virulent. One reason it evolves to become more transmissible is the dynamic that I just described with Omicron versus Delta: a more transmissible variant will run ahead of others—infecting more people before other variants have a chance to—and, provided that the variants provide some cross protection against each other, preventing other variants from infecting the same people. Through this mechanism, the more transmissible variant will eventually displace other variants, and its progeny will dominate. So, there's a pressure to be more transmissible, although this doesn't just happen willy-nilly. For example, influenza isn't particularly transmissible, and it hasn't evolved to become more transmissible perhaps due to an inherent limitation in how the virus interacts with its host. But SARS-CoV-2 is still new, and it's still finding ways to be more transmissible.

The flip side of the disease becoming more infectious is the idea that it will become less virulent because it's not in the variant's interest to kill its host before it has a chance to move to another host, which would limit its opportunity to spread. And, in the most extreme case, if it kills too many people, it will run out of hosts to infect at all. So, the virus is disadvantaged if it kills off the host population to the point where it can't sustain itself and transmit.

The problem is that this selective pressure towards reduced virulence isn't anywhere close to applicable for SARS-CoV-2 because it's shed before people are symptomatic and the lion's share of transmission takes place before people are even aware that they're sick, let alone before they're at death's door. While the virus has tragically killed a lot of people, crudely speaking, it's nowhere near depleting the total number of roughly 7.9bn available human hosts. So, the idea that the more benign nature of Omicron is a harbinger of things to come is wishful thinking. The reality is that the polygenetic tree that maps SARS-CoV-2 variants is so vast that it's very difficult to predict from which lineage other variants will emerge, or if there will be entirely new ones, as was the case for Omicron. But there will be pressure to select for a variant that will be successful, so why wouldn't it be one that more fully evades immunity and is more infectious? The truth is we have no idea where the next variant will come from and what it will look like in terms of its transmissibility and severity.

Allison Nathan: But even if there's no evidence to suggest that future variants will be less severe, will immunity from vaccines, boosters, and prior infections provide at least some amount of protection from severe disease?

Jeffrey Shaman: Yes, that's likely to be the case. Even with Omicron, the fact that the majority of the population has some immunity either from vaccination or prior infection may be another reason why the variant has been milder than prior variants, and that may also hold true for future variants. We are still learning about immunity persistence, but my feeling is that exposure through vaccines or prior infection should provide at least partial protection from future variants. In the case of Omicron, while the adaptive immune system isn't providing sterilizing immunity, meaning it isn't preventing infection or symptomatic illness altogether, it still seems to be providing some protection against severe, critical, and fatal outcomes as reactive T cells and memory B cells are engaged and produce antibodies that are able to clear the variant before disease becomes severe. So while there likely won't be any magical evolution or selection for milder variants, there may be more and more partial immunity protecting us against severe disease as essentially everybody is vaccinated or infected with one or multiple variants over time.

Allison Nathan: Given everything we've discussed, how close are we to moving into an "endemic" phase of the disease, and what does that really mean? Will we soon be able to treat SARS-CoV-2 more like the flu, where we can anticipate seasonal waves and learn to cope with them without much disruption to normal activity?

Jeffrey Shaman: Endemicity refers to the persistence of a pathogen within a community or population; the frequency of outbreaks, their severity and the burden that they impose on society is a disease's endemic pattern. We won't know the endemic pattern of SARS-CoV-2 until we have substantially more data. This is similar to how we think about weather versus climate patterns—you need a long stretch of weather data to determine the average climate of a location.

Whether the endemic pattern of this virus will devolve into something that we are conditioned for like the seasonal flu, or the endemic coronavirus OC43 that we all know of as a common cold, is the trillion-dollar question. We'd all love for that to happen so that we can get on with our daily lives without having to think about the virus, but it won't magically be the case. We should take seriously the idea that new variants could arise at a somewhat faster clip than the once-a-year seasonality we've been conditioned to for diseases like the flu, and may at times be serious and disruptive. That may be the case in the short term for SARS-CoV-2, as the virus continues to figure out what new variants it can spring on us. And it may even be the case over the long term—because it's so much more transmissible than the flu, it's possible that we could be looking at multiple outbreaks of coronavirus annually for the foreseeable future. That's not to say that will definitely happen, but it is a possibility we should be prepared for.

Allison Nathan: The market is generally behaving like the worst of the virus is behind us as we enter into an endemic phase, though. Practically speaking, is it reasonable to think that we could achieve something much closer to normality in terms of activity and behavior this year?

Jeffrey Shaman: It's possible, at least for parts of the year. As we've discussed, prior exposure and vaccines are likely to continue to confer partial protection against infection and even more so against severe disease, especially if boosters continue to be rolled out. And new oral antiviral therapeutics, such as Pfizer's Paxlovid, could be real game-changers. In Phase 3 clinical trials, Paxlovid was shown to reduce mortality by around 90% when administered within five days of people becoming symptomatic. If we layer this on top of existing vaccines and immunity, and provided the virus doesn't develop resistance to it, then we could reach something more like an equilibrium where we can start to live with the virus.

But it's too soon to think that we'll be able to put the virus entirely behind us. We don't yet know definitively about the efficacy of the adaptive immune protection, and we can't predict whether another variant is going to emerge that's even more evasive of priority immunity, and potentially more severe. Mass vaccination has been critical to preventing severe disease, which would have been much more prevalent if the Alpha and Delta waves had occurred before people had been immunized. But, unfortunately, vaccination against SARS-CoV-2 is more like vaccination against the flu than against measles, which provides sterilizing immunity so that people can expect to never get the disease once vaccinated. There is no reason to believe that SARS-CoV-2 is close to being eradicated from circulation, and we must therefore remain vigilant.

Q&A on vaccines, treatments and testing



Salveen Richter, GS lead analyst for the Biotechnology sector, Chris Shibutani, GS Biopharmaceutical analyst, and Matthew Sykes, GS Life Sciences Tools & Diagnostics analyst, answer key questions on where we stand on vaccines, treatments, and testing for SARS-CoV-2

Q: What do we know today about the biology and molecular structure of Omicron and how it is affecting the efficacy of existing vaccines, boosters, and treatments?

A: Omicron has over 30 mutations in its spike protein compared with the ancestral strain, with 15 of those located in the receptor binding domain (RBD), the piece of the spike protein the virus uses to attach to cells and one of the main targets of neutralizing antibodies (nAbs). Studies have found that some of Omicron's mutations can lead the virus to bind more tightly to the human ACE2 protein, which may partially account for Omicron's increased transmissibility, and some of the mutations can lead to increased immune escape. This has had significant implications for vaccine efficacy. Moderna's (MRNA) Spikevax has been shown to produce markedly less nAbs against Omicron following two doses, per in vitro (lab) data, although a third dose has been shown to provide a recovery in nABs; the currently authorized 50µg booster dose increased neutralizing antibody levels against Omicron by ~37-fold and a 100µg booster dose increased neutralizing antibody levels ~83-fold, suggesting that there is good potential for Spikevax, in its approved and original form against the ancestral strain, to provide protection against severe disease from Omicron, although the durability of such protection remains unclear as of yet, with more data on this expected in coming weeks.

Omicron has also demonstrated some resistance to Pfizer (PFE)-BioNTech (BNTX)'s Comirnaty vaccine. Initial neutralizing titer data reported by the companies in December showed a >25-fold decrease in neutralizing antibody levels in the blood following two doses of Comirnaty for Omicron versus the ancestral strain. While a third dose led to an increase in neutralizing antibodies, neutralization was still 2.6-fold and 2.2-fold lower compared to that for the original and Delta strains, respectively, corroborating early reports from independent labs that suggested Omicron was more immune evasive than earlier variants.

These reductions in neutralizing activity observed in in vitro study data are reflected in emerging real world vaccine efficacy data. Recent data from the UK have demonstrated decreased peak vaccine effectiveness against infections for both the two-dose Comirnaty primary series (60-70% for Omicron vs. ~90% for Delta) and the third booster dose of both Comirnaty (~70% for Omicron vs. 90%+ for Delta) and Spikevax (~75% for Omicron vs. 90%+ for Delta). Vaccine effectiveness also waned faster for Omicron compared to Delta, dropping to ~10% vs. ~65%, respectively, after 25 weeks post-second dose and ~50% vs.~90%, respectively, after 10 weeks post-third dose for Comirnaty.

Treatments have fared somewhat better against Omicron. Both Merck (MRK) and Pfizer have said that, based on data they have collected from in vitro studies, they expect their respective oral antivirals to retain their original efficacy against the Omicron variant. For US-authorized monoclonal antibodies, in vitro data has been released for GSK-Vir's Xevudy (Sotrovimab) demonstrating a ~2-3-fold reduction in neutralizing antibodies for Omicron versus the ancestral strain, below the FDA's 5-fold threshold that would suggest lower levels of protection against the variant. The National Institutes of Health (NIH) has stated that the Xevudy in vitro data to date suggests it will retain neutralizing activity against Omicron, and thus the agency's updated treatment guidelines support its use in the wake of the Omicron surge. FDA and Oxford/Washington studies have found that AstraZeneca's (AZN) Evusheld (a long-acting antibody combination) also retains neutralizing activity against Omicron. Consistent with this, the NIH has also noted that in vitro data to date suggests that Omicron will remain susceptible to the cocktail, although it believes additional data are needed to further validate its use against Omicron. On the other hand, neutralizing antibody data from Eli Lilly's (LLY) bamlanivimab and etesevimab suggest that neither retained activity versus Omicron, and Regeneron's (REGN) REGEN-COV antibody cocktail (consisting of casirivimab and imdevimab) demonstrates diminished potency against Omicron. However, Regeneron has confirmed that multiple next-generation monoclonal antibodies targeting SARS-CoV-2 that may enter clinical trials in 1Q22 are active against Omicron and Delta, in addition to other variants of concern.

Q: What progress has been made on the development of/need for combination, variant-specific, multivalent, and pan-coronavirus vaccines, and what is a realistic timeframe for having each widely available?

A: There is value for both consumers and vaccine developers in a high-efficacy combination flu and SARS-CoV-2 vaccine. Moderna anticipates that its development candidate, mRNA-1073, will be in clinical trials soon, and in a best case scenario it could be available to the general population by fall 2023 in some geographies. This falls into the company's larger strategy to produce a pan-respiratory viral vaccine by adding additional viruses in a stepwise fashion. In addition, Novavax (NVAX) is currently running a Phase 1/2 clinical trial for a vaccine that combines the recombinant protein-based Covid-19 and NanoFlu vaccine candidates.

In terms of variant-specific vaccines, Pfizer, BioNTech, and Moderna all anticipate the need for seasonal boosters across broad swathes of the population to contend with emerging variants and protect against seasonal waves and their associated systemic

disruptions. Moderna anticipates that boosters will likely need to be administered again in the fall of 2022, with the frequency of administration beyond that largely dependent on age and co-morbidity factors in addition to the virus's antigenic shift, with annual boosters likely necessary for high-risk individuals. However, Pfizer/BioNTech currently do not have sufficient data to say definitively whether a variant-specific vaccine or repeated boosts of their original vaccine would be more beneficial. As such, the companies are developing an Omicron-specific vaccine, and are already manufacturing at-risk ahead of potential regulatory authorization for it to be available by March, but further observation of the pandemic's dynamics will be needed to determine the need for it. Moderna believes that a booster dose of Spikevax is currently the best way to address Omicron, although the company is also continuing to develop an Omicron-specific variant vaccine (mRNA-1273.529), which should enter clinical trials in coming weeks, with data likely to be available around March for Moderna to share with regulators to figure out next steps.

Companies are also exploring the development of multivalent vaccines, which target more than one variant but in a specific way for each, for example by including the spike protein for both Delta and Omicron. Pfizer and BioNTech have had multivalent vaccines in development for prior variants of concern, although recent BioNTech commentary suggests it is too early to say if those would be beneficial compared to repeated boosters. Moderna is also evaluating multivalent vaccines in the event that a variant emerges that exhibits characteristics of multiple previous ones (i.e., mRNA-1273.213, which covers Beta and Delta). Pan-coronavirus vaccines, on the other hand—which try to elicit broad antibodies that could neutralize any variant—have not been a particular focus for Moderna or Pfizer/BioNTech, as the regulatory pathway for such vaccines is currently unclear and scaling up manufacturing for the new technology that would be required has its challenges.

Q: How significant of a development is the recent authorization of oral antiviral drugs—Pfizer's Paxlovid and Merck's molnupiravir—and when will these therapeutics be widely available?

A: Pfizer's development of Paxlovid and Merck and Ridgeback Biotherapeutics' development of molnupiravir (known as Lagevrio outside the US), which both received FDA Emergency Use Authorization (EUA) in December, mark a significant breakthrough in efforts to combat the pandemic. In a study of patients at high risk of developing severe Covid-19, Paxlovid showed an 89% and 88% reduction in the risk of hospitalization or death from Covid-19 when given within three and five days, respectively, of symptom onset, while molnupiravir reduced the risk of hospitalization or death from Covid-19 in high-risk patients by 30% when given within 5 days of symptom onset. In an analysis conducted while Paxlovid was still in clinical trials (called an interim analysis), the drug showed a 70% reduction in the risk of hospitalization among patients considered at "standard risk" for developing severe Covid-19 (we expect updated data once the trial is completed by March.) Both Paxlovid and molnupiravir are also currently in clinical trials to evaluate whether they are effective at preventing symptomatic infection in people who have been exposed to Covid-19 within their household but have yet to contract the disease, and the companies expect to have data on this in 2Q22.

Merck has produced approximately 10 million courses of molnupiravir to date and has said that it expects to produce another 20 million this year. And Pfizer has stated that it will produce 120 million courses of Paxlovid this year, with approximately 6-7 million courses available by March, 30 million available by June, and 75 million by September. The company has noted that while they expect Paxlovid demand to exceed supply during 1H22, they expect to be able to meet global demand by 2H22.

Q: What progress has been made on the testing front? Where do things currently stand in terms of test availability and how effectively are diagnostic tests able to identify different SARS-CoV-2 variants?

A: The testing landscape has significantly evolved since the start of the pandemic. Covid resulted in a sizable increase in funding for diagnostics and substantially accelerated development in the space. While lab-based PCR testing remains the gold standard, rapid antigen testing, either in a point of care (POC) setting like a hospital or doctor's office or at home, has ramped up as the decentralization of testing has accelerated. The recent introduction of at-home molecular testing capabilities from companies like Cue Health are a significant advancement that allow patients to test themselves with an accurate and easy to use device. Many at-home rapid antigen tests, including Abbott's BinaxNOW, have been able to detect the Omicron variant. Current PCR and molecular Covid tests are also able to distinguish between different variants, with the largest PCR testing companies like Thermo Fisher, PerkinElmer, and Danaher all announcing after the Omicron variant was identified that their tests could detect the variant.

The key issue on the testing front remains supply and cost, particularly for antigen testing. While staffing shortages and throughput and lab capacity constraints during significant spikes in demand have led to longer-than-usual-turnaround times for PCR test results, we don't see a major need for a significant increase in PCR testing supply given the capacity expansion of the last two years. But supply constraints are very pronounced for at-home antigen testing, and in response the NIH and the Biden Administration have recently announced several measures to facilitate production capacity and make tests more affordable. In October 2021 the NIH invested $70mn from the American Rescue Plan to accelerate Covid test developers' progress through the regulatory authorization process. On January 10, the Biden Administration announced that insurance companies and group health plans will be required to cover the costs of over-the-counter, at-home Covid-19 tests, so that individuals with private health coverage can receive them for free starting January 15. In light of these recent government actions and overall strong demand for testing, we expect a significant increase in antigen testing supply over the next several months.

Virus scenarios for the global economy

Daan Struyven and Dan Milo assess two-sided virus risks for the global economy in 2022, with implications for growth, inflation, and the normalization of central bank policy

When the first reports about Omicron emerged from South Africa in November, we cut our global GDP forecast moderately on the assumption that its economic impact would resemble that of the Delta variant earlier in the year. On balance, this still looks about right, as Omicron is more transmissible than we had expected but also less severe. This supports our baseline expectation for a modest virus hit of around 0.3pp to global growth in 2022 primarily concentrated in Q1, though we see more significant downside in China given the challenges of maintaining its zero-Covid policy (see pgs. 14-15).

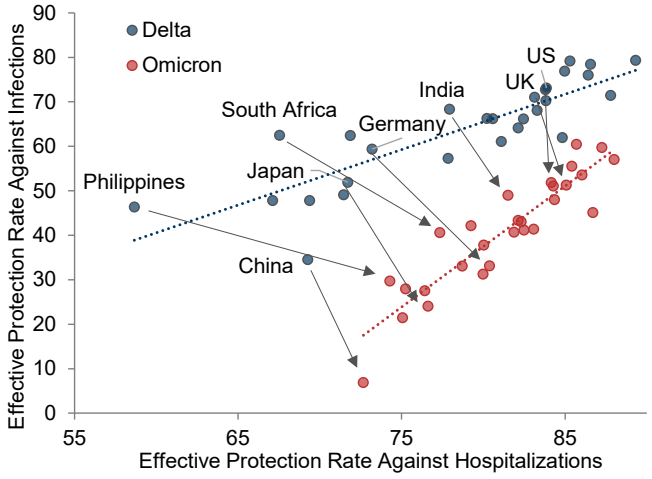
Beyond the latest Omicron wave, a critical question for this year is whether the world is able to transition to a more endemic, manageable stage of the pandemic. In our baseline, we expect this will be achieved in most economies by the spring given surges in natural immunity and boosters shots, the rising use of antiviral drugs, the gradual phase-out of restrictions in most economies outside of China, and the expectation that most consumers will likely learn to live more fully with the virus. But with considerable uncertainty surrounding the virus still lingering, and the prospect of more virulent variants ahead, we look at scenarios for the virus and the global economy in 2022.

Omicron's large hit to infection immunity

Omicron's increased ability to evade immunity provided by prior Covid infections or vaccines has reduced effective infection protection rates—which we calculate as the population share with some prior immunity multiplied by the strength of this protection—by an average of nearly 25pp globally, contributing to the variant's much faster spread relative to Delta.

Large protection hit against infection, but not hospitalization

Effective protection rate against infections (y-axis), hospitalizations (x-axis), %



Note: We calculate this rate as pop share with some immunity from vaccination or prior infection, multiplied by strength of protection against each outcome. We also factor in a 40% reduction in intrinsic hosp risk from Delta to Omicron.
Source: Goldman Sachs GIR.

Specifically, we estimate that the effective protection rate against infections now stands at 50% in the US, UK, and India, 40% in the Euro Area, 20% in Japan, and just 5% in China. But despite diminished protection against infection, immune protection against hospitalizations has held up well, with a negative effect from lower vaccine efficacy offset by a positive effect from the variant's lower intrinsic severity. Effective protection rates against hospitalizations now stand at 85% in the US and the UK, 80% in the Euro area and India, 75% in Japan, and 70% in China.

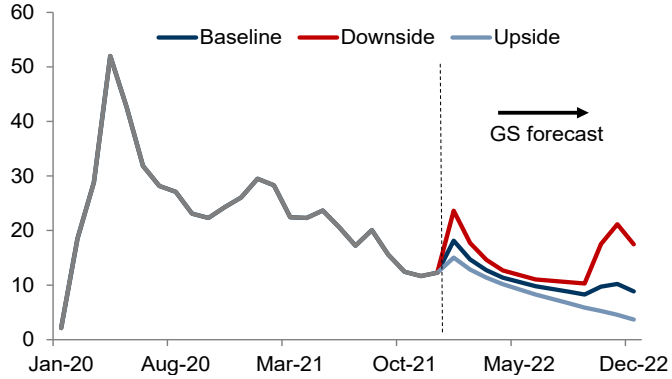
Baseline: A short-lived hit to growth, an upside risk to inflation

The combination of much faster virus spread and still high levels of immune protection against hospitalization implies that most economies are experiencing very large waves of Omicron infections, but with a much smaller share of cases resulting in hospitalizations and especially fatalities. As a result of these large infection waves, our GS Global Effective Lockdown Index (ELI)—a combination of official restrictions and actual mobility data from 46 economies, weighted by PPP GDP—has tightened by 8pp since its mid-December low. Fortunately, Omicron waves appear to be short-lived with confirmed cases now on a downward trend not only in South Africa, where the strain was first detected, but also in England, Canada, Ireland, and the US Northeast. If this pattern holds up elsewhere, the economic impact of the first Omicron wave should be largely behind us by the end of Q1, at least in the advanced economies.

Our global GDP forecast of 4.4% growth this year is broadly consistent with the stylized baseline scenario in which the global ELI remains stable for much of January, eases substantially in February, but tightens again modestly in Q4, though with a tightening half as large as during the Q1 Omicron wave. The downward ELI trend throughout 2022 reflects the fact that we expect most economies to transition to a more endemic stage in the spring. Although the timing is highly uncertain, the Q4 ELI uptick incorporates the fairly high probability that either winter seasonality, some reduction in immunity against infections, or a somewhat more transmissible/evasive future strain lead to another temporary episode of modest ELI tightening. We also incorporate our view that ongoing adaptation by consumers and businesses will continue to lower the impact of ELI tightening on GDP.

Our base case is for further, but bumpy, ELI easing in 2022

GS Global Effective Lockdown Index scenarios, index



Source: Goldman Sachs GIR.

Looking across the largest economies, our baseline outlook incorporates a larger Omicron hit to GDP growth in China than in the US and Europe. While our Q1 quarterly annualized growth

forecast remains close to potential in both the US and Europe, it drops 5pp below potential in China to just 0%. The large Omicron hit to China's low effective protection rate against Omicron infections will likely lead to outbreaks and significant restrictions in multiple provinces. As a result of the twin challenge of maintaining its zero-Covid strategy and containing the property sector stress, we forecast 4.5% China growth for the year, roughly 0.75pp below consensus.

We expect ongoing pandemic-related supply chain disruptions—exacerbated by Omicron—to boost US core inflation further to record-high levels through early 2022. However, in our baseline scenario, a moderation in US goods demand (as fiscal support fades and consumers switch back to services), and a rise in global goods supply drive core PCE inflation back below 3% by end-2022, more than offsetting a sharp acceleration in shelter inflation. We expect the Fed to respond to the very high inflation numbers by hiking four times this year, starting in March, and beginning to reduce its balance sheet. Despite the Fed's hawkish pivot over the last few months, our GS financial conditions index (FCI) has not tightened substantially. If the Fed wants to play a larger role in bringing down inflation—rather than mainly waiting for pandemic effects to fade—it would likely need to consider delivering 25bp hikes at consecutive meetings. Similarly, we expect policy responses to high inflation and pandemic capacity pressures through rate hikes from the Bank of Canada (BoC) in the near term, and the Bank of England (BoE) in early February, although any net inflationary pressures from Omicron would skew the risks toward a faster pace of tightening than our baseline of 4 (BoC) and 3 (BoE) hikes this year.

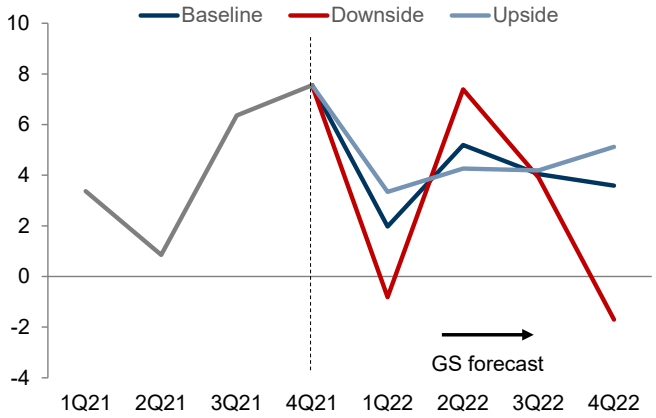
Downside scenario: a worse virus outlook could drive faster Fed normalization (via higher inflation)

In a downside scenario, global growth is 3¾% in 2022, 0.7pp below our baseline forecast, with global quarterly annualized growth dropping to nearly -1% in Q1, roughly 3pp below our current forecast, and to -2% in Q4, roughly 5½pp below our current forecast. This scenario assumes a larger Q1 wave than the baseline scenario, slower subsequent easing, and the emergence of a significantly worse new variant than Omicron that leads to Q4 tightening in our ELI similar to the Omicron tightening. A significantly worse variant than Omicron would feature a higher rate of spread, somewhat higher severity, and larger declines in immunity against both infections and severe disease. Although this variant would lower activity globally, we believe that it could have disproportionately large effects in China with lockdowns in many provinces.

In theory, the net impact of virus deterioration on overall CPI inflation is ambiguous with weaker demand in services and energy, but also weaker supply of labor, goods, and probably also services. But, in practice, we believe that the net impact would be higher inflation in economies such as the US. That's because the US already has very low inventories of durable goods, large infection waves could exacerbate already very significant labor shortages, and relatively smaller consumer fears (assuming the rise in severity and the decline in immunity against severe disease are not too large) should limit the hit to services demand. The combination in China of lower goods supply (due to widespread lockdowns) and potentially higher goods demand (due to potential fiscal measures supporting spending on durable goods such as cars) in the event of a downside scenario may further worsen the global pandemic imbalance between goods demand and goods supply.

Two-sided virus risks to growth in 2022

Global GDP growth under 3 ELI scenarios, qoq ar.



Source: Goldman Sachs GIR.

The impact of this downside scenario on macro policy varies across regions. On the hawkish end of the spectrum, we think that the Fed would normalize policy faster than in our baseline because the hit to activity would likely be relatively limited while inflation would likely move higher. With the maximum employment goal having been essentially met, we believe Fed officials are more sensitive to upside inflation risks than to downside growth risks, and see the level of inflation as the key driver of the speed of Fed normalization. On the dovish end of the spectrum, we would expect significantly more macro policy stimulus in China due to a larger hit to activity, the concurrent property sector challenge, and relatively low inflation.

Upside scenario: past the peak, faster normalization ahead

Finally, in an upside scenario, global growth in 2022 as a whole is 4¾%, 0.3pp above our baseline forecast. This scenario assumes the ELI Q1 Omicron peak is already behind us, faster trend ELI easing than in the baseline, and only a small Q4 wave (for instance due to seasonality), as well as rapid further adaptation. In this scenario, the large immunity that has been built up during the Omicron wave and faster-than-expected adaptation drive faster-than-expected easing in the trend ELI.

Conceptually, the net impact of this scenario on inflation is again ambiguous. In practice, we believe that inflation in countries such as the US in this "rapid normalization" scenario would likely be lower than in our baseline because downward price pressures from the rebalancing of demand from goods to services and the accelerated recovery in goods and labor supply likely more than offset upward price pressures from stronger services and energy demand. As a result, and given the policy focus on inflation, the pace of Fed tightening may be somewhat slower than in our baseline.

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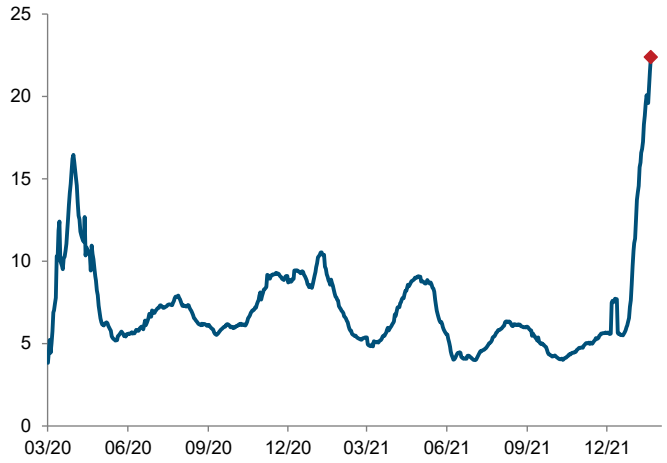
Where are we today…

Positive testing rates have increased globally…

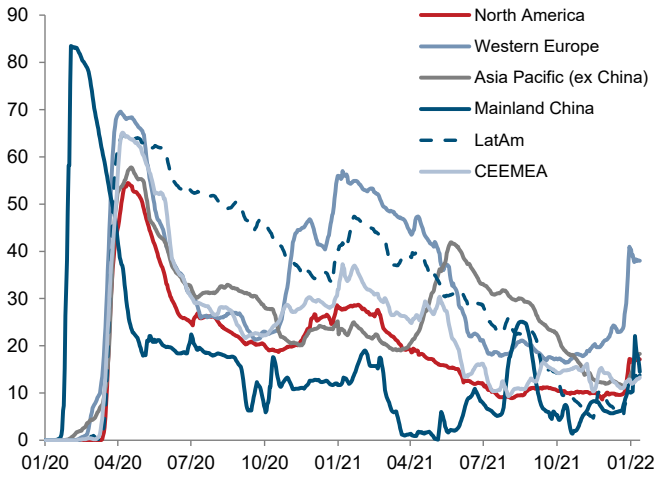
Global positive testing rate, 7DMA, %



Note: Values for the latest two weeks include imputed testing volumes.
Source: Our World in Data, Goldman Sachs GIR.

…and virus restrictions have tightened in response

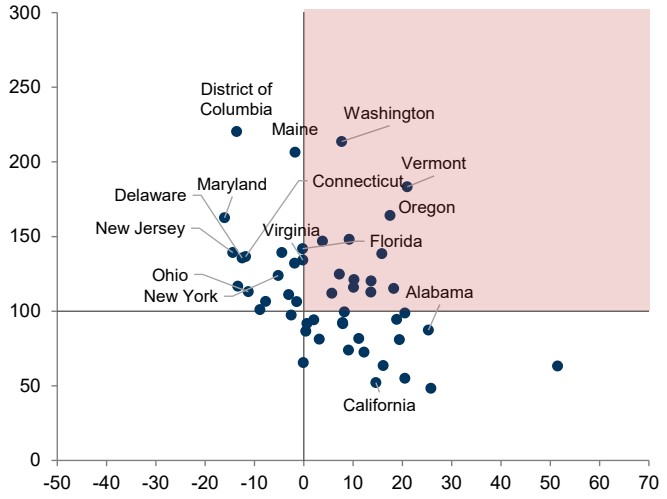
GS Effective Lockdown Index, PPP GDP weighted, 7DMA



Source: University of Oxford Covid tracker, Google LLC "Google Covid-19 Community Mobility Reports"; https://www.google.com/covid19/mobility/ Accessed: 1/12/2022, Wind, Goldman Sachs GIR.

Hospitalizations in many US states are above previous peaks…

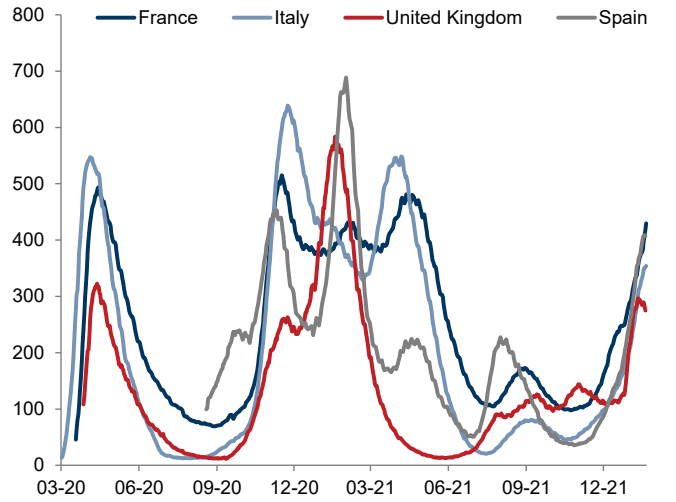
% change in currently hospitalized since last week (x-axis) vs. currently hospitalized as % of last winter's peak (y-axis)



Note: Red box indicates states where hospitalizations have risen from last week and are above pre-Omicron peaks.
Source: CDC, Goldman Sachs GIR.

…and have increased across Europe, although they have so far remained below previous peaks

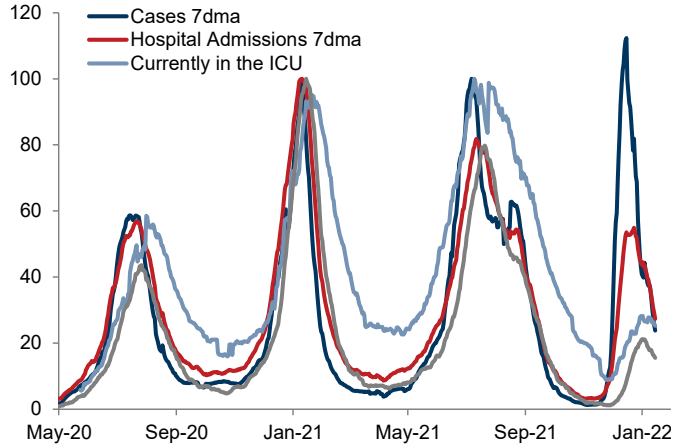
Daily population hospitalized for Covid per million



Source: European Centre for Disease Prevention and Control, Sante Publique France, Presidenza del Consiglio dei Ministri Dipartimento Della Protezione Civile, United Kingdom National Health Services, Goldman Sachs GIR.

In South Africa, a smaller share of infections has resulted in hospitalizations and fatalities…

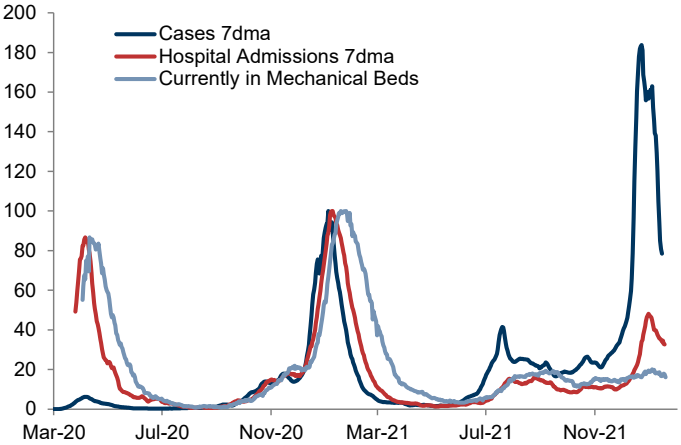
South Africa, % of pre-Omicron peak



Source: NICD, Goldman Sachs GIR.

…as well as in London, along with an even lower share in ICU/mechanical bed usage

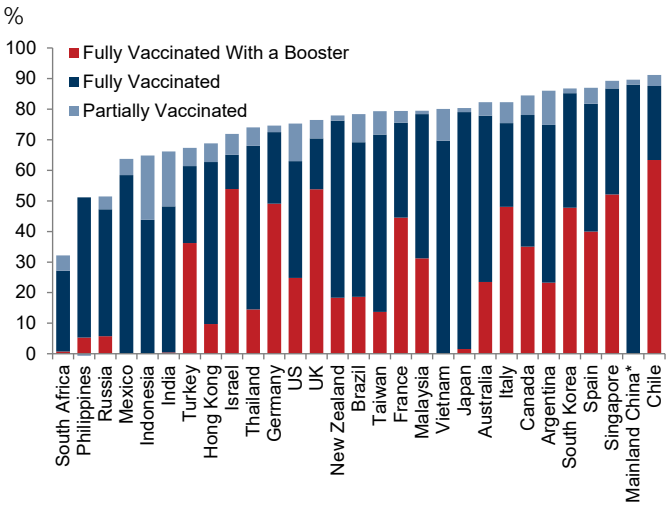
London, % of pre-Omicron peak



Source: UK Health Security Agency, Goldman Sachs GIR.

…in the global pandemic?

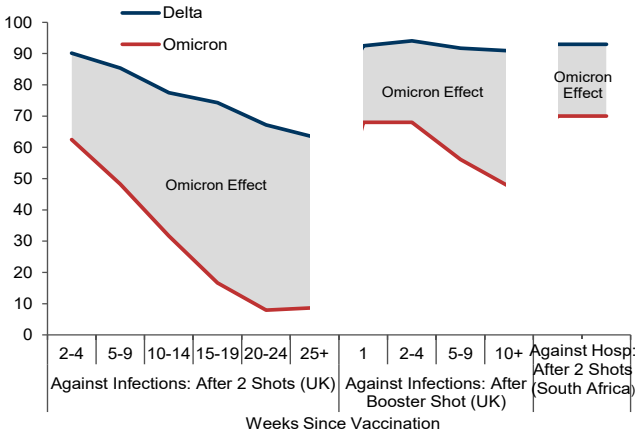
Many economies have high vaccination rates…



Source: Our World in Data, Goldman Sachs GIR.

…but vaccine protection took a large hit with Omicron

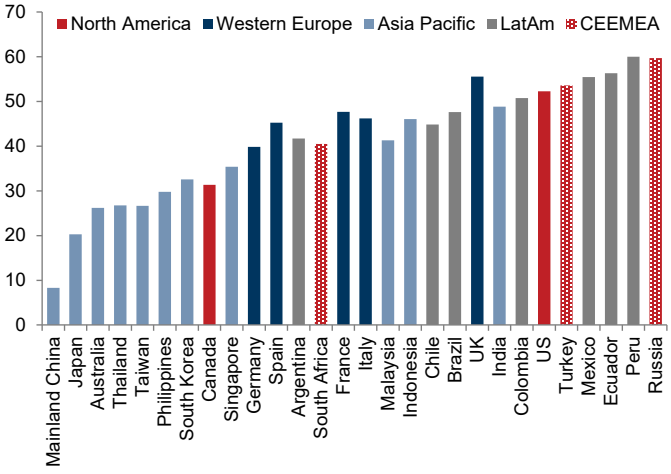
Pfizer vaccine efficacy, %



Source: UKHSA, Discovery Insurance Group, Goldman Sachs GIR.

Omicron has reduced protection rates against infections…

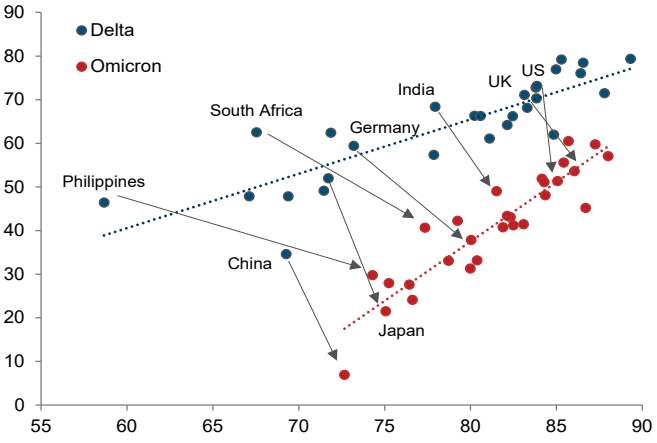
Effective protection rate against infections, %



Note: We calculate this rate as pop share with some immunity from vaccination or prior infection, multiplied by strength of protection against each outcome. We also factor in a 40% reduction in intrinsic hosp risk from Delta to Omicron.
Source: Goldman Sachs GIR.

…by an average of nearly 25pp across economies

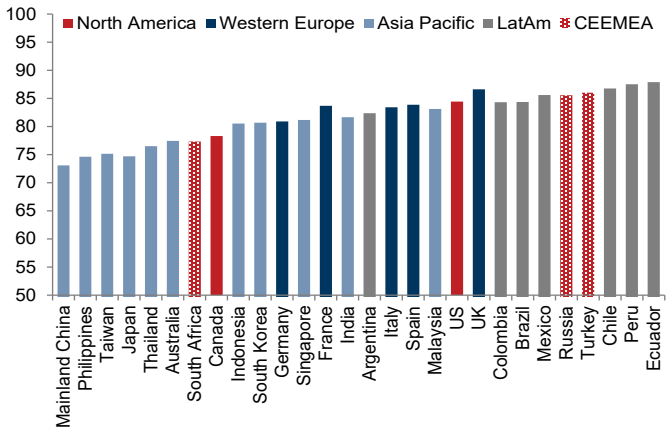
Effective protection rate against hospitalizations (x-axis) vs. effective protection rate against infections (y-axis)



Note: We calculate this rate as pop share with some immunity from vaccination or prior infection, multiplied by strength of protection against each outcome. We also factor in a 40% reduction in intrinsic hosp risk from Delta to Omicron.
Source: Goldman Sachs GIR (protection rates reflect January 5 values).

Protection rates against hospitalizations have held up well…

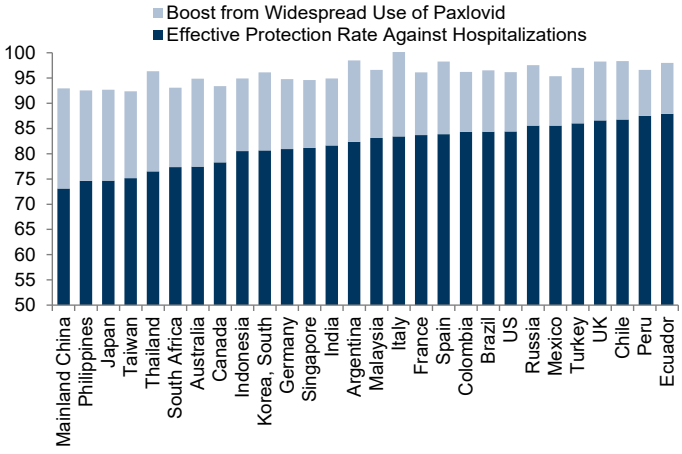
Effective protection rate against hospitalizations, %



Note: We calculate this rate as pop share with some immunity from vaccination or prior infection, multiplied by strength of protection against each outcome. We also factor in a 40% reduction in intrinsic hosp risk from Delta to Omicron.
Source: Goldman Sachs GIR.

Special thanks to GS global economics analyst Dan Milo for charts.

…and widespread Paxlovid use would likely sharply boost them



Note: We assume an 85% reduction in hosp risk due to Paxlovid for those w/ no immunity, and a further 70% Paxlovid-driven reduction in hosp risk for those with some immunity from vaccination or prior infection.
Source: Goldman Sachs GIR.

FAQs on China's zero-Covid policy

Lisheng Wang, Helen Hu, and Hui Shan

answer questions about China's zero-Covid policy and its implications for growth, policy, and global supply chains

China's Covid-19 situation has evolved over the past several weeks as the Omicron variant has reached the country's shores. Local Omicron transmission was first confirmed in Tianjin city on January 9, but has since spread to multiple cities across several provinces. This has led an increasing number of local governments to tighten restrictions as the Chinese government sticks to its zero-tolerance Covid policy (ZCP). Here, we address frequently asked questions about the ZCP and its implications for growth, policy, and global supply chains.

Q: How likely is the Chinese government to change its ZCP this year?

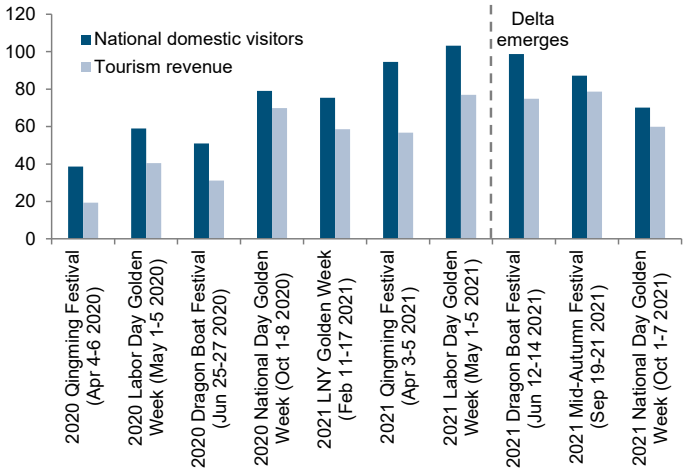
A: Unlikely. China's ZCP has been a key pillar of the country's efforts to contain the coronavirus and maintain domestic economic activity near normal levels since the initial Covid-19 outbreak and nationwide lockdown in early 2020. Taking the past two years as a whole, the ZCP has broadly met policymakers' objectives, as people in most parts of the country have been able to enjoy a relatively normal life despite sporadic local lockdowns, and effective virus controls have allowed Chinese manufacturers to meet surging goods demand from overseas. At the same time, the costs of maintaining the ZCP appear to be increasing as the virus continues to mutate and more transmissible variants emerge. Since the Delta variant entered China mid-last year, local outbreaks have become more frequent and the recovery of close-contact services such as tourism has stalled. Maintaining the ZCP amid the much more transmissible Omicron variant may be even costlier.

Despite these higher costs, we expect the Chinese government to maintain the ZCP through at least late 2022, as the costs of China switching to a "living with Covid" policy (LWC) may be even higher given China's large population and low vaccine efficacy (particularly against infections). While studies of early Omicron wave data show reduced probability of hospitalization or death associated with the Omicron variant relative to the Delta variant, China's huge population base (1.4bn in 2020) means that even a relatively low fatality rate could imply a very large number of deaths—on the order of hundreds of thousands if we assume that 20% of the population becomes infected after the shift to a LWC policy (the ratio of cumulative Covid cases to total population is currently 23% in the UK and 20% in the US).

The government would not accept such an outcome, in our view, especially during a politically important year like this one, in which the 20th Party Congress is set to take place. In the event that hospitalization and fatality rates for Omicron are found to be extremely low and/or new vaccines and treatments make significant breakthroughs that materially reduce infection, hospitalization, and fatality rates in the coming months, the prospect of gradually phasing out ZCP would seem more likely. But in the absence of such developments, we expect the ZCP to remain in place until at least after the Party Congress in October/November.

The costs of maintaining ZCP have risen since the Delta variant entered China mid-last year

% of pre-pandemic levels



Source: Ministry of Culture and Tourism, data compiled by Goldman Sachs GIR.

Q: How much will Omicron drag on Chinese growth?

A: We expect an additional 0.9pp growth drag relative to our prior baseline. Since the more transmissible Omicron variant may require more activity restrictions to sustain the ZCP, our baseline expectation is that local lockdowns affect multiple provinces this winter, similar to the outbreak in August 2021. As such, we expect China's Effective Lockdown Index (ELI), our proprietary measure of domestic policy restrictions and mobility, to tighten to an average of 20 in 1Q22, up from an average of 6 over the last year, translating into an additional 0.9pp hit to full year GDP growth relative to our prior baseline that assumed recurring, but small, local outbreaks rather than outbreaks in multiple provinces. This new baseline assumes that the negative impact is mostly concentrated in Q1, with the expectation that outbreaks can be brought under control more quickly after the winter months and that booster vaccinations will be more widely deployed over time.

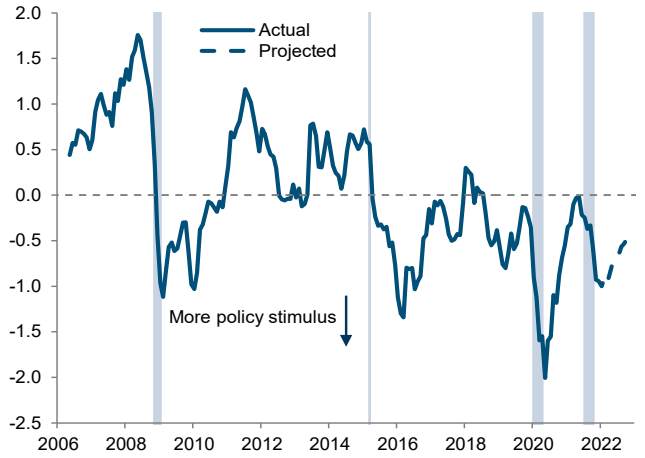
Q: To what extent will policy easing offset virus-related growth headwinds?

A: We estimate that about half of the growth drag will be offset by further policy easing. We believe that demand-side stimulus on the fiscal front is likely to be more effective and more immediate than monetary easing in offsetting growth headwinds given anemic private demand. In terms of the specific policy measures, we maintain our call for a 50bp RRR cut in 1Q22 and expect the PBOC to cut policy interest rates by another 10bps by the end of 2Q22 following its January rate cuts; the PBOC may also inject more long-term liquidity into the economy via various lending facilities. For fiscal policy, we expect the augmented fiscal deficit to widen from 11% of GDP in 2021 to 13% in 2022, compared to 16.5% in 2020. The combination of more accommodative monetary policy and more fiscal stimulus would lead credit growth to accelerate noticeably, with TSF stock growth expected to rise from 10.3% for end-2021 to 11% for end-2022.We also expect moderately easier housing policies this year, although we don't expect major demand stimulus in the property sector as the government maintains its long-held stance of "housing is for living in, not for speculation". And we see increasing possibility that the government may consider measures to boost the

consumption of durable goods similar to the reduction in taxes for auto purchases implemented in 2015/16. In terms of timing, we expect policy-driven public investment to become more visible in or after March this year, when some near-term constraints such as Covid-related restrictions and heavy-industry manufacturing production cuts around the Beijing Winter Olympics are set to ease. On net, these offsetting measures to the virus drag leave our 2022 full year GDP growth forecast for China at 4.5%.

We expect further macro policy easing to offset some of the growth drag from additional Omicron-related restrictions

China domestic macro policy proxy, z-score



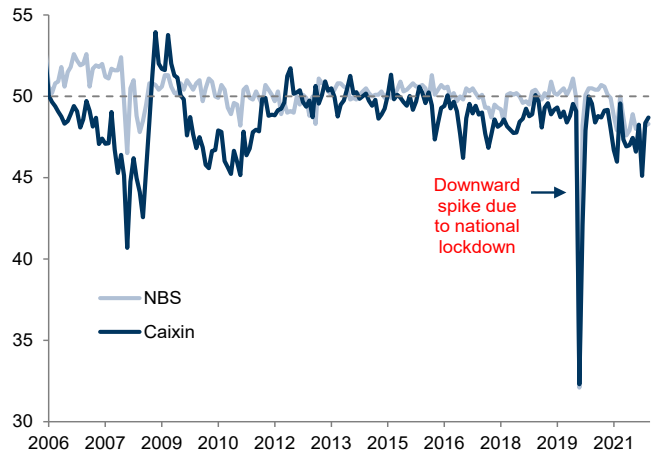
Note: Shaded areas represent periods when CAI 3mma growth was below 5.5%.
Source: Wind, Haver Analytics, CEIC, Goldman Sachs GIR.

Q: Will Omicron-related restrictions in China cause significant supply chain disruptions?

A: Unlikely. Local lockdowns under the ZCP will affect production and transportation as mass testing and quarantine disrupt normal work and travel restrictions disrupt logistics and shipment. But outside of the initial national lockdown in early 2020, the experience of the past two years suggests that such disruptions tend to be localized and contained to certain products. While China has experienced multiple episodes of local outbreaks during the Covid pandemic, delivery times have remained mostly within historical ranges.

Supply chain disruptions have tended to be relatively limited over the course of the pandemic

China PMI: Manufacturing Suppliers' Delivery Times



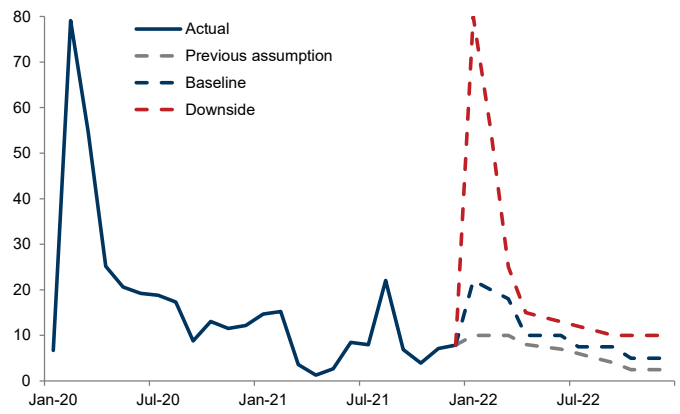
Note: Levels above 50 indicate a contraction.
Source: CXN/IHSM, CFLP/NBS/Haver, Goldman Sachs GIR.

Q: What would a downside virus scenario look like for growth, policy offsets, and supply chain disruptions?

A: We expect significant impacts to all three. In a severe downside scenario in which community transmission of Omicron occurs in most provinces, a national lockdown may be necessary to stop the virus' spread. In this case, we estimate our ELI would increase sharply to a peak of 80 in January, comparable to levels reached during the initial Covid-19 outbreak across the country in February 2020. However, we expect that the hit to GDP from a lockdown of comparable severity this time around would be lower than during the national lockdown in early 2020, reflecting adjustments made by households, businesses, and policymakers such as more established work-from-home capabilities, more online vs. offline shopping, a less one-size-fits-all approach when imposing lockdowns, etc. Nonetheless, we expect the growth drag would still be significant, on the order of 2.3pp relative to our baseline. In this scenario, we expect Beijing to more boldly step up its monetary easing and demand-side stimulus.

We estimate restrictions would tighten to levels reached during the initial virus outbreak in a downside scenario

GS China Effective Lockdown Index



Source: University of Oxford Covid Tracker, Wind, Goldman Sachs GIR.

That said, this scenario would likely see much more severe supply chain disruptions, closer to what was observed during the previous national lockdown in 1Q20. And the impact of such disruptions would likely be felt intensely as, unlike at the beginning stages of the Covid pandemic, global demand today is strong, inventories are low, and supply chain stresses and inflationary problems in the rest of the world are already acute. So any additional production disruption originating from China's Omicron-related shutdowns could have outsized effects in the current environment.

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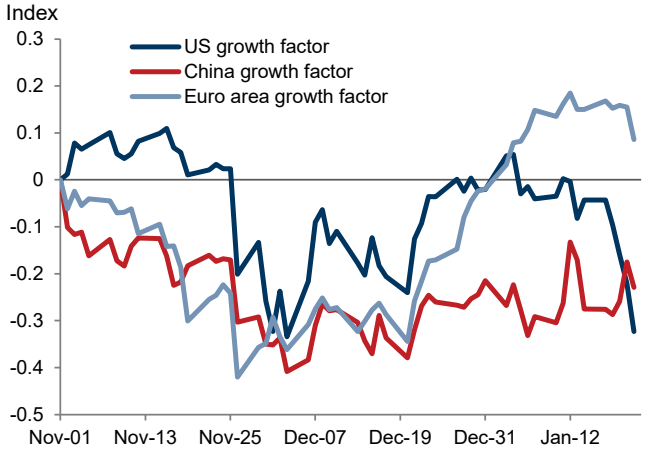
Markets: "moving on" post-Omicron

Dominic Wilson and Vickie Chang argue that "moving on" from SARS-CoV-2 after Omicron could result in steeper yield curves, a weaker Dollar, and a decline in equity vol/skew

In recent weeks, the market has relaxed about the growth outlook in the US and Euro area, and has reversed much of the initial downgrades to growth expectations it made at the start of the Omicron wave. The recent rally in commodities, outperformance of cyclical equities, and weakness in the USD are all consistent with rising global growth expectations as the variant has proven to be intrinsically milder than prior strains, and the Omicron wave appears to be peaking in the US. Indeed, the market has seemingly begun to move on to worrying about the implications of the Fed's hawkish shift in a normalizing environment rather than the virus.

The market has relaxed about the global growth outlook over the past month, particularly in the US and Euro area



Note: Recent downturn in US growth factor reflects market pricing a more hawkish Fed rather than lower growth.
Source: Goldman Sachs GIR.

Although medical experts caution that the unpredictable nature of Omicron should serve as a stark reminder that virus-related uncertainties are not yet behind us (see pgs. 4-5 and 6-7), suggesting a range of potential economic scenarios for 2022 (see pgs 10-11), the Omicron wave has nonetheless opened up the possibility of a deeper normalization in behavior and activity even in the face of future waves, either because higher effective immunity after this wave provides greater protection against infection and severe disease going forward, or because policy/individual behavior shifts towards accepting virus risks and letting life go about more normally. While this scenario is more optimistic than our global economists' baseline, we think it is important to consider what it would mean for markets, especially since investors may price towards this view if the Omicron wave subsides more rapidly than expected and validates some of the more "laissez-faire" approaches to dealing with it, and because markets have far less experience with upside scenarios in this pandemic than downside ones, which are, unfortunately, well-worn territory at this point.

We see three main channels through which the market impact of this shift would potentially be felt: (1) A boost to market growth expectations as the remaining normalization in activity is accelerated, at least in economies where post-Omicron effective protection rates are high enough; (2) Faster supply relief, at least in some areas, with potential implications for inflation risks; (3) Favorable changes to the distribution of growth and inflation views, dampening one of the sources of left tail risks to growth and right tail risks to inflation.

A growth booster

A further shift towards "moving on" from Covid-related restrictions even in the event of further virus outbreaks would likely involve an upgrade to the market's growth expectations, as investors price a more rapid path towards a full normalization of activity. Areas that have lagged so far, including services activity more broadly and travel/tourism in particular, would likely especially benefit. While our market views already envisage a comeback in these areas, the repricing would probably be accelerated in this scenario.

To benchmark the market consequences of such a growth upgrade, we assume that global growth expectations would rise roughly in line with our economists' "upside scenario", and use our macro factor framework to consider the asset market implications of two versions of this upside scenario based on the breadth of activity normalization. While both versions embed upward growth revisions in the US and Europe, we consider a case where upgrades to China's growth outlook lag the major developed economies and a case in which they exceed them. That's because China currently has the lowest effective protection rates of the major economies, and our China economists believe that the risk of ongoing restrictions in the face of virus risks is likely to remain high over the near term (see pgs. 14-15). Unless the medical or policy realities change beyond the Omicron wave, this means that China could lag any broader shift towards greater normalization. But the flipside of that is a shift in the policy approach in China or the medical reality of the virus could result in bigger gains in China than in the US or Europe in terms of the pricing out of growth risk.

In both versions of our upside scenario, we would expect further upward pressure on equity indices, commodities, and bond yields, and, on balance, a weaker Dollar. Within equity markets, cyclical sectors and indices would generally be expected to outperform, and some modest steepening of yield curves, led by longer-term rates, would be likely. A faster normalization in services and travel spending would potentially benefit oil and the energy sector more broadly, as well as tourism-sensitive economies like Thailand, Malaysia, and New Zealand. If China were to account for a more significant part of the normalization in activity, the case for commodity upside would strengthen further, the magnitude and breadth of Dollar downside would likely be higher, and broad EM equity indices would have scope to outperform, which would not be the case should China instead lag. In that case, European equity indices would be the clearest beneficiary.

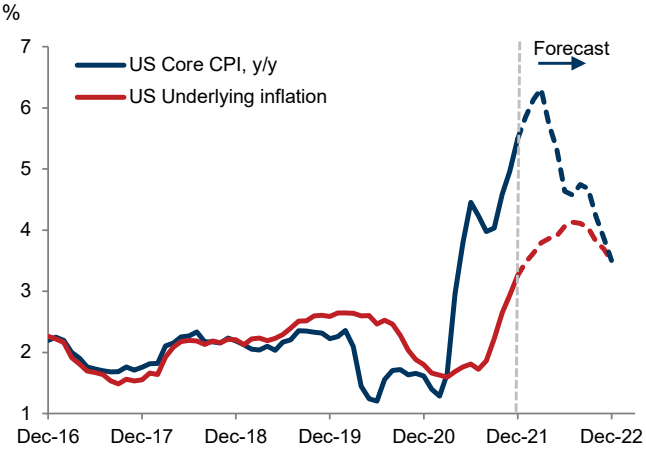
Supply chain relief

A scenario of persistently lower virus risks to activity beyond Omicron could also alleviate some of the supply constraints that have dominated the macro picture, particularly over the past year. To an even greater degree than the demand side, the nature of that supply relief would depend on the reasons why virus risks were falling. We see three potential channels of

relief. One, a faster normalization of services activity could reinforce the rotation away from goods spending and alleviate some related inflationary pressure. Two, the perception of lower risks around face-to-face activity might reduce some of the labor supply constraints in sectors where workers have been more reluctant to return. A more persistent reduction in rates of illness would reinforce that trend more broadly, as Omicron has shown that even milder illness still has an outsized impact in creating labor shortages. And three, a more benign virus outlook could increase the prospect of goods supply chain relief, although that will depend significantly on virus management in China and the Asia-Pacific region more broadly, as even if the medical risks from the virus are lower, the risk of ongoing goods supply disruptions could remain elevated if policy remains conservative.

Such supply relief has various implications for inflation and asset markets. Although the balance of forces is more ambiguous than on the growth side, our global economists' upside scenario that assumes a faster normalization in activity also assumes some inflation relief as supply constraints are eased. We have highlighted before that both equity and bond markets have looked through these more "transitory" inflation pressures to a significant degree already, pricing more closely in line with a measure of "underlying" inflation that excludes those supply-constrained goods. And broad supply relief, particularly if it eased labor supply constraints, might reduce risks to underlying inflation itself.

Broad supply relief, particularly if it eased labor supply constraints, might reduce risks to underlying inflation



Note: Underlying inflation is adjusted to average core CPI inflation over 2016-2019.
Source: Haver Analytics, Goldman Sachs GIR.

We would expect that to have a positive effect on global equity valuations as the growth-inflation trade-off improved. It would also be a source of downward pressure for yields, though our simple models suggest that relief would likely be most pronounced at the front end of the yield curve, with the curve tending to steepen as a result. Goods supply relief on its own would probably have less of an impact, since markets largely anticipate it at this point, but at the margin would probably push in the same direction. As a result, there may be some scope for markets to price a slower pace of rate hikes than they currently are, at least at the very front end of the curve, particularly in economies like the US and the UK where rates have risen sharply as markets have priced a more aggressive central bank response to near-term inflation pressures.

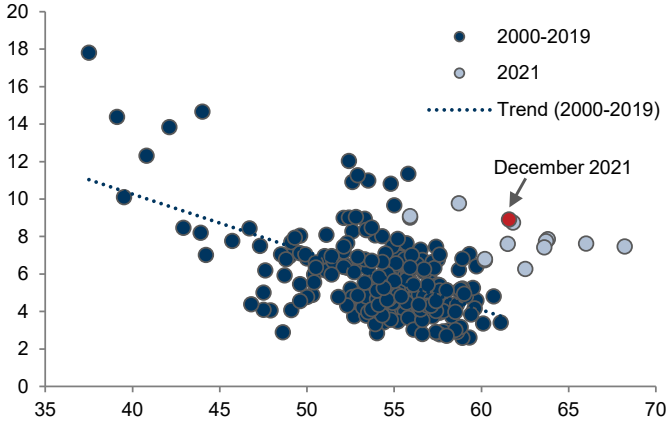
Redistributing risks

Alongside an upward shift to the level of growth expectations, we may see the market put reduced weight on the downside tail risk of further sharp growth disruptions if it expects that significant virus-related damage to the economy is behind us. We have shown that both the level of US equity volatility, and even more so the level of equity skew (the relative pricing of upside and downside tail risk) are higher than normal given the strength of the economy. This is one indication that the market continues to put a higher-than-normal weight on possible downside risks re-emerging. If the market were to price the distribution of economic outcomes more in line with a normal recovery, we would expect implied volatility to fall and equity skew to normalize further.

Beyond the impact on volatility itself, this dynamic would reinforce the case for a decline in the equity risk premium (already a central assumption in our US equity outlook). If the market also reduced the weight it puts on the risk of further supply-driven inflation pressures and relaxed its pricing of a rapid pace of Fed tightening, this mix might encourage a broader search for carry. There is also some evidence that elevated downside tail risks may hold risk-free rates down, so a favorable shift in the distribution of growth views could potentially drive the market to price a higher terminal rate closer to the level that we ultimately expect.

Demand for downside protection is high relative to the strength of the underlying economy

ISM Composite (x-axis) vs. SPX 3m 25-delta skew (y-axis)



Source: Haver Analytics, Goldman Sachs GIR.

Steeper curves, weaker Dollar, lower skew

The conclusion that a potential shift towards a fundamentally more benign post-Omicron virus picture would be a tailwind to equities, cyclical assets, and yields is unlikely to surprise most investors. What is more interesting, in our view, is that the three dynamics we outline here could together create a stronger basis for higher back-end/terminal rates and some steepening of yield curves, a weaker Dollar, a sharper rally in energy markets, a decline in equity volatility and skew, and potential support for carry trades.

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Snapshot of our asset views and virus risks

How big of a driver do you expect the virus will be for your asset class in 2022, and how much risk would downside/upside virus scenarios (see pgs. 10-11) pose to your 2022 views?

Equities

Peter Oppenheimer, Tim Moe & Team

- Most clients are looking through the latest Omicron wave based on the view that the virus will soon become endemic. The recent sharp move higher in rates and the central bank hiking cycle is—and will likely continue to be—a key driver for equity markets in 2022. For this reason, the emergence of a new variant this year requiring additional lockdowns and restrictions would be a significant surprise and likely force a sizable rebalancing in equities.
- **Global equities:** We expect the global equity market (MSCI Global) to rise by 15% over the next 12m driven by higher earnings, including global EPS growth of 8% in 2022, though valuations should remain relatively flat. This includes returns of 16% in the US (S&P 500), 12% in Europe (STOXX Europe 600), 14% in Asia (MSCI Asia-Pacific ex-Japan) and 17% in Japan (TOPIX). We would expect little difference in the global earnings outlook between our economists' baseline and upside virus risk scenarios. In their downside virus scenario, we would expect flat EPS growth globally in 2022 based on the sensitivity of EPS to GDP (where every 1pp change in GDP results in a roughly 10pp change in EPS). At the global level, we believe the virus risks to equities currently look relatively balanced, though the prospect of inflation upside from a worse-than-expected outbreak in China is important to watch.
- **China equities:** China equities look more vulnerable than other regions to virus-related risks in 2022, especially in the event that maintaining China's zero-Covid policy requires wider lockdowns, and we recently downgraded our MSCI China (MXCN) 2022 EPS growth forecast to reflect these risks. That said, given attractive valuations, the prospect of further policy easing, and likely regulatory moderation, we expect the MXCN to rise by 21% to 105 by end-2022 and continue to recommend an overweight stance on offshore China equities. A worse virus scenario that necessitates wider national lockdowns could shave roughly 15% from this rise, but a better scenario that sees lockdowns avoided could realize about 6% further upside.

Commodities

Jeff Currie, Damien Courvalin, Nicholas Snowdown & Team

- **Oil:** Although the virus trajectory will be an important driver of oil demand in 2022, at this point we expect a limited Omicron hit to global oil demand outside of China of 0.7 mb/d in Jan/Feb and view virus risks as mostly manageable in 2022. While the hit to Chinese oil demand will be large due to its zero-Covid policy (-0.5 mb/d in 1H22), we see it offset by strong oil demand in 4Q21, gas-to-oil substitution and supply disappointments. We expect these factors to leave the oil market in deficit, leading OECD oil inventories to draw down to their lowest level since 2000 by the summer, at the same time that excess OPEC+ spare capacity will decline to historically low levels. We believe that a substantial rally to $90/bbl in long-end prices will be required to rebuild spare capacity and inventories, and have therefore recently raised our 12m Brent spot crude oil forecast to $105/bbl. In the event of our China economists' downside virus scenario, we would expect roughly twice as large of a hit to global oil demand in 1H22 (around -1 mb/d).
- **Metals:** We expect a relatively limited impact on industrial metals fundamentals from Covid in 2022, as has been the case over the past 18 months. Perhaps the most critical impact of Covid on metals has been to reinforce a complete lack of new investment in metals supply by making new project activity much more challenging, which has left markets in a position where peak supply in copper, aluminum and zinc is just 2-3 years away and cannot be deferred until well after that point even if new investment were to emerge today. Overall, we believe that macro and micro fundamentals are aligned for a repricing of metals toward scarcity, and forecast 12m S&P GSCI Industrial Metal returns of 25%, and aluminum prices to rise to $3,500/t, copper to $12,000/t, zinc to $4,000/t and nickel to $24,000/t on this horizon. A downside virus scenario that sees a disruption in travel ahead of the Chinese New Year could actually have a restraining influence on a softer seasonal inventory build trend typical during this period of the year, which would be net bullish for the complex.

Rates

Praveen Korapaty, George Cole & Team

- We expect inflation, central bank policy responses, and the global supply/demand picture for long-term fixed income securities to be the key areas of focus for US rates in 2022. In terms of virus risks, the waning growth impact from each subsequent wave has allowed markets and policymakers to more comfortably look through virus-related concerns. But we think the virus could play a larger role in 2022 via inflation, especially if it results in further supply chain disruptions due to zero-Covid policies (particularly in East Asia), which could put upward pressure on front-end yields given the Fed's recent focus on inflation risks.
- In our baseline, we expect 10y US Treasury yields to rise to 2% by year-end 2022. We see the US yield curve flattening, with long-end yields moving higher gradually as rate hikes reset the front-end of the curve.

Rates (cont.)

Praveen Korapaty, George Cole & Team

- The net impact of the downside virus scenario would likely be informed by the impact on inflation. A pure growth slowdown without an inflation impact would typically suggest downside risks to yields across the curve and bull steepening of the yield curve. However, more inflation with less growth would likely see front-end pricing remain relatively better supported, while longer-dated forwards would be biased lower, imparting stronger flattening pressure on the curve than our baseline forecast (which has 2s10s at 65bp for at year-end). The upside case would likely support near-term rate hike expectations, but may also correspond to more risk being priced further out the curve. The implications of this scenario would be clearer for the outright level of yields (higher) than it is for curve shape relative to our baseline.

G10 FX

Zach Pandl & Team

- We expect FX markets this year to be increasingly driven by axes of differentiation in a more divergent world (e.g., monetary policy, terms of trade, carry) as the Covid recovery likely shifts from a global shock to more variable domestic outcomes. Thus, the importance of the virus trajectory for FX depends on the extent that it impacts the inflation outlook and, therefore, monetary policy—barring any significant rise in the severity of future variants.
- In our baseline, we expect mild Dollar depreciation this year, including range-bound performance vs EUR and JPY. Strong global growth and a gradual repricing of Fed expectations should allow the Dollar to weaken amid a hiking cycle.
- In a downside virus scenario, we would expect to see a stronger Dollar on the back of a more negative risk backdrop and reversal of the recent rise in growth expectations. However, if the severity of the virus increases to the extent that the Fed shifts back to a more dovish policy stance than current expectations, which would depend on the inflation outlook, the Dollar would likely weaken. In an upside virus scenario, we would expect greater room for Dollar depreciation if it translates to stronger-than-expected global growth without additional inflationary pressures and prompts faster Fed rates hikes than is currently priced.

Emerging Markets

Kamakshya Trivedi, Caesar Maasry & Team

- We expect pandemic-related issues to take a secondary role relative to the fast-moving interest rates market and central bank hiking cycle. Nevertheless, virus-related issues, particularly China's zero-Covid policy, can continue to pressure EM growth views and asset performance. Consequently, our top trades tend to focus on fairly risk-neutral implementations.
- In our baseline, we forecast a challenging macro environment for EM assets for the bulk of 2022, but there are select opportunities, particularly in EMs where central banks have tightened policy well ahead of DM peers. Our growth forecasts point to an improvement of EM over DM towards the end of 2022 and into 2023.
- Virus-driven lockdowns would likely delay this potential period of EM growth outperformance. Currently, we find that EM equities are priced modestly below our growth forecasts (~4.1% priced vs. our 2022 forecast of 4.7% GDP growth across EM). Chinese equities have considerable room to run if policy continues to move in an accommodative direction.
- A benign virus outcome would likely pave the way for EM currency stability given relatively low valuations and high carry.
- China's zero-Covid policy poses further downside growth risks around potential upticks in infection curves. Further supply chain disruptions could also exacerbate inflationary dynamics and potentially propel interest rates higher, a dynamic that tends to drive EM asset underperformance. Conversely, investor focus on an eventual "end of the pandemic" would likely entail a re-rating of travel and tourism-related markets, including ASEAN, Egypt, and Greece. We see attractive risk/reward in the risky assets of these markets in 2022.

Credit

Lotfi Karoui, Amanda Lynam & Team

- The virus is likely to be one (of many) factors driving elevated dispersion at the sector and issuer levels. But other factors are more prominent contributors to our views across asset classes, such as current (rich) valuations, capital management policies that are likely to pivot more to shareholders, very strong balance sheet liquidity, and perhaps most significantly, the hawkish shift in monetary policy.
- In our baseline, we expect spreads will drift modestly wider in 2022 enough to push excess returns to the low end of their historical distribution. With new medical treatments available and increased access to vaccines and boosters, we expect the reopening sensitive sectors to eventually close their remaining (modest) underperformance gap in what is hopefully the final leg of the reopening.
- Risks are likely skewed to the downside given our preference for cyclical and reopening sensitive sectors vs. defensives.

Variants

Viruses continuously evolve as changes in their genetic code—known as **mutations**—occur during replication. A **variant** is a genome with one or more mutations.

Pango lineages is the established nomenclature system for naming and tracking SARS-CoV-2 genetic lineages*. A lineage is a genetically closely related group of variants derived from a common ancestor.

Variant of Concern (VOC) meets the definition of a VOI (see below section) and demonstrates an (1) increase in transmissibility or detrimental change in COVID-19 epidemiology; OR (2) increase in virulence or change in clinical disease presentation; OR (3) decrease in effectiveness of public health and social measures or available diagnostics, vaccines, and therapeutics. Current VOCs are listed below.

Mutations*** can occur anywhere on the virus's genome, including on the gene for the spike protein that SARS-CoV-2 uses to attach to human cells. Some mutations may help the virus bind more tightly to human cells or avoid some types of antibodies.

Omicron (Pango lineage: B.1.1.529)	Delta (Pango lineage: B.1.617.2)
Currently accounts for ~65% of all variant sequences submitted**	Currently accounts for ~35% of all variant sequences submitted
Earliest documented sample: Multiple countries, Nov 2021	Earliest documented sample: India, October 2020
VOC classification: November 26, 2021	VOC classification: May 11, 2021
Number of mutations: 48, including 30 on the spike protein	Number of mutations: 29, including 8 on the spike protein

Gamma (Pango lineage: P.1)	Beta (Pango lineage: B.1.351)	Alpha (Pango lineage: B.1.1.7)
Earliest documented sample: Brazil, November 2020	Earliest documented sample: South Africa, May 2020	Earliest documented sample: United Kingdom, September 2020
VOC classification: January 11, 2021	VOC classification: December 18, 2020	VOC classification: December 18, 2020
Number of mutations: 23, including 12 on the spike protein	Number of mutations: 18, including 8 on the spike protein	Number of mutations: 22, including 9 on the spike protein

Variant of Interest (VOI) is a variant (1) with genetic changes that are predicted or known to affect virus characteristics such as transmissibility, disease severity, immune escape, diagnostic or therapeutic escape; AND (2) identified to cause significant community transmission or multiple COVID-19 clusters, in multiple countries with increasing relative prevalence alongside increasing number of cases over time, or other apparent epidemiological impacts to suggest an emerging risk to global public health. Current VOIs are listed below.

Mu (Pango lineage: B.1.621)	Lambda (Pango lineage: C.37)
Earliest documented sample: Colombia, January 2021	Earliest documented sample: Peru, December 2020
VOI classification: August 30, 2021	VOI classification: June 14, 2021
Number of mutations: 21, including 8 on the spike protein	Number of mutations: 21, including 8 on the spike protein

Variant under Monitoring (VUM) is a variant with genetic changes that are suspected to affect virus characteristics with some indication that it may pose a future risk, but evidence of phenotypic or epidemiological impact is currently unclear, requiring enhanced monitoring and repeat assessment pending new evidence. Current VUMs are listed below.

Pango lineage: B.1.640	Pango lineage: C.1.2	Pango lineage: B.1.1.318
Earliest documented sample: Multiple countries, Sept 2021	Earliest documented sample: South Africa, May 2021	Earliest documented sample: Multiple countries, January 2021
VUM classification: November 22, 2021	VUM classification: September 1, 2021	VUM classification: June 2, 2021
Number of mutations: 30, including 13 on the spike protein	Number of mutations: 27, including 14 on the spike protein	Number of mutations: 22, including 6 on the spike protein

Pango lineages are assigned by the Phylogenetic Assignment of Named Global Outbreak Lineages (PANGOLIN), a software tool developed by Andrew Rambaut.
***% of global variant sequences as analyzed by GISAID according to genome sequences shared by originating and submitting labs; recent data may be skewed by small/variable sample sizes.*
****Mutation information is sourced from Outbreak.info, a project by several labs at Scripps Research.; characteristic mutations of Omicron and newer variants will likely change as more sequences are reported.*
Source: CDC, WHO (virus classifications/definitions), Scripps Research, GISAID, NYTimes, Goldman Sachs GIR.

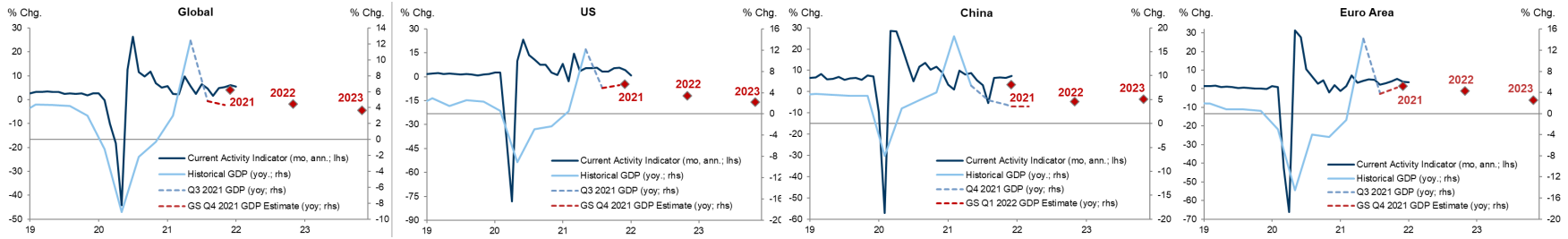
GS GIR: Macro at a glance

Watching

- **Globally,** we expect large Covid infection waves to weigh on services demand and labor supply in early 1Q22 across many economies. But we expect the Q1 hit to growth from the latest Covid wave to be followed by a rebound in Q2, and expect full-year growth of 4.4% in 2022, more than 1pp above potential, thanks to continued medical improvements, a consumption boost from pent-up savings, and inventory rebuilding.
- **In the US,** we expect below-consensus full-year growth of 3.4% in 2022, driven in large part by a sizable fiscal drag. But we expect further reopening of the service sector as health risks decline, a boost to consumer spending from pent-up savings and wealth effects, and inventory restocking to offset the fiscal drag by enough to keep growth above trend this year. We expect the current inflation surge to peak in Q1 and see core PCE inflation falling to 2.5% by end-2022, though the impact of Omicron on price normalization in the goods sector and strong wage growth pose upside risk. We expect the unemployment rate to fall to 3.4% by the end of 2022.
- **We expect the Fed** to hike rates in March, followed by additional hikes in June, September, and December, and risks are tilted toward more than four hikes this year, in our view. We expect balance sheet runoff will begin in July, with risks tilted to the earlier side. On the fiscal policy front, we think the odds of a scaled down reconciliation package look slightly less than even, which would also mean slightly less than even odds that Congress passes tax increases in 2022.
- **In the Euro area,** we expect growth of 4.2% in 2022 supported by pent-up savings, room to grow amid the virus recovery, and sustained fiscal support via the Recovery Fund and from the new German government, though near-term risks are skewed to the downside given the ongoing Omicron outbreak. We expect core inflation to fall sharply to 1.7% in January as base effects wash out and end 2022 at 1.3%.
- **The ECB** has stated its intention to end PEPP net purchases in March while providing an "APP bridge" to September 2022, though we expect it will maintain flexibility against downside risks via PEPP through flexible reinvestments and the option to reactivate net purchases. We continue to view a 2022 lift-off as unlikely, but some Council members appear open to a 2023 hike as focus is shifting to upside inflation risks.
- **In China,** we expect below-consensus real GDP growth of 4.5% in 2022 and see rising near-term growth uncertainty in light of the spread of the more infectious Omicron variant given China's zero-Covid policy. We expect macro policy to ease this year, with easier monetary policy, a wider augmented fiscal deficit, modestly faster credit growth, and easier housing policy settings, which we expect will cushion, though not fully absorb, the impact of renewed virus restrictions and the downturn in housing.
- **WATCH CORONAVIRUS.** The Omicron variant poses near-term risks to the global medical and economic outlook. Medical evidence suggests that Omicron is transmitting much more quickly than Delta, although a much smaller share of cases is resulting in hospitalizations. We expect most economies to transition to a more endemic stage of the pandemic in the spring, due to accelerated vaccinations, declines in the share of individuals without any form of immunity, and the widespread use of antiviral drugs.

Goldman Sachs GIR.

Growth



Source: Haver Analytics and Goldman Sachs GIR.
Note: GS CAI is a measure of current growth. 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

GDP growth (%)	2022		2023	
	GS	Cons.	GS	Cons.
Global	4.4	4.3	3.6	3.6
US	3.4	3.8	2.2	2.5
China	4.5	5.2	5.0	5.2
Euro area	4.2	4.0	2.5	2.5

Policy rates (%)	2022		2023	
	GS	Mkt.	GS	Mkt.
US	1.13	1.07	1.88	1.45
Euro area	-0.50	-0.34	-0.50	-0.10
China	2.00	2.14	2.00	2.21
Japan	-0.10	-0.01	-0.10	0.00

Markets

Interest rates 10Yr (%)	Last	E2022	E2023
US	1.75	2.00	2.30
Germany	-0.10	0.30	0.65
Japan	0.13	0.20	0.30
UK	1.09	1.60	1.80

Commodities	Last	3m	12m
Crude Oil, Brent ($/bbl)	88	93	105
Nat Gas ($/mmBtu)	4.00	3.45	3.55
Copper ($/mt)	9,984	10,500	12,000
Gold ($/troy oz)	1,838	2,000	2,000

FX	Last	3m	12m
EUR/$	1.13	1.13	1.15
GBP/$	1.36	1.36	1.35
$/JPY	114	117	115
$/CNY	6.3	6.35	6.2

Credit (bp)		Last	2Q22	E2022
USD	IG	100	105	115
	HY	312	335	360
EUR	IG	117	120	126
	HY	341	348	368

Equities

S&P 500	E2022		E2023	
	GS	Cons.	GS	Cons.
Price	5,100	--	--	--
EPS	$226	$224	$236	$246
Growth	8%	8%	4%	10%

Consumer	E2022		E2023	
	CPI (%, yoy)	Unemp. Rate	CPI (%, yoy)	Unemp. Rate
US	3.4	3.4	2.8	3.2
Euro area	3.0	7.1	1.3	6.9
China	2.5	--	2.1	--

Returns (%)	12m	YTD	E2022 P/E
S&P500	16.0	-8.0	20.0x
MXAPJ	14.0	0.0	14.2x
Topix	17.0	-3.0	14.1x
STOXX 600	12.0	-3.0	15.3x

Wage Tracker 2021 (%)			
Q1	Q2	Q3	Q4
4.1	2.1	3.8	4.5
--	--	--	--
12.1	12.6	7.7	--

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

Market pricing as of January 21, 2022.

Glossary of GS proprietary indices

Current Activity Indicator (CAI)

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

For more, see our CAI page and Global Economics 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.

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

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

Goldman Sachs Analyst Index (GSAI)

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

Macro-Data Assessment Platform (MAP)

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

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December 13, 2021

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November 17, 2021

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October 18, 2021

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May 21, 2021

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April 1, 2021

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January 28, 2021

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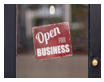

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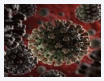

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2020's Black swan: COVID-19
February 28, 2020

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Investing in Climate Change
January 30, 2020

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2019 Update, and a Peek at 2020
December 17, 2019

Issue 84
Fiscal Focus
November 26, 2019

Issue 83
Growth and Geopolitical Risk
October 10, 2019

Issue 82
Currency Wars
September 12, 2019

Issue 81
Central Bank Independence
August 8, 2019

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Dissecting the Market Disconnect
July 11, 2019

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June 6, 2019

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May 9, 2019

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Buyback Realities
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