



EYE ON THE MARKET OUTLOOK 2022

Reflation: Endgame

These superheroes all contribute in their own way to a rise in prices, wages, economic growth and asset prices. See inside cover for details. In this year's Outlook, we look at the consequences of reflation for equity markets that are already pricing in plenty of good news. Special topics include China and the regulatory purge, dividend investing, real assets (commercial real estate, timber and infrastructure), investments in fintech and cybersecurity firms, ESG impacts on portfolios and the high cost of Brexit.

By **Michael Cembalest**

Chairman of Market and Investment Strategy for J.P. Morgan Asset & Wealth Management

Our Reflation: Endgame cover

This year's cover depicts how these superheroes all contribute in their own way to a rise in prices, wages, economic growth and asset prices:



Politicians creating the largest stimulus on record

COVID monetary and fiscal stimulus across the developed world was 2x-3x larger than similar stimulus after the Global Financial Crisis, and that's before including 2021 bills and proposed US infrastructure and reconciliation spending. One by-product: \$1 trillion in positive US wealth effects from rising stock markets, rising home prices and increased refinancing by homeowners.



Vaccine resisters

The US has one of the largest unvaccinated populations in the developed world at 30%. This cohort increases community spread, reduces the labor supply, sustains the shift to goods spending and creates the need for more gov't spending to support employment and incomes. A recent survey: 37% of unvaccinated US workers said they would quit if faced with employer-mandated vaccination or testing.



Work from home employees

Due to COVID, services spending collapsed and goods spending surged, driving goods price inflation to the highest levels since the 1970's. Categories with 20%+ spending increases vs pre-COVID levels: household, telecommunications and computer equipment; home furnishings and power tools; recreational goods and clothing. Many are import-intensive and semiconductor-intensive, worsening supply chain bottlenecks.



Labor force drop-outs and switchers

Several million people dropped out of the labor force, or shifted sectors or states. The Census Bureau estimated in December that 2.5 million people were not working due to concerns about getting or spreading COVID. Job switching out of manufacturing and agriculture into self-employed transportation and construction has tightened the labor force as well. One consequence: excess job seekers in some states and excess job openings in others.



A large jump in retirees

COVID drove a surge in US retirement with roughly 1.5 million more people leaving the labor force than usual from January 2020 to August 2021. Academic research points to an increased pace of retirement when 401k account and housing values are rising sharply.



Healthcare regulators in Asia, the US and Europe

Lockdown rules are still much tighter in Asia, leading to underutilized factories, supply chain shortages, etc. In China, COVID protocols are amongst the tightest in the world. In the US, Kaiser estimates that ~2.5 million people left a job in late 2021 due to vaccination requirements enacted by healthcare regulators and/or company policy.



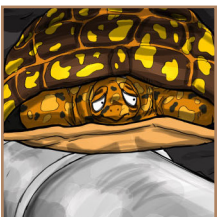
Working mothers facing childcare constraints

The reopening of schools improved this issue, but the Census Bureau still estimated in December that more than 5 million people were not working due to child care constraints. Most of these people are working mothers: female labor force participation rates declined twice as much as male participation rates since February 2020.



Missing immigrant workers

Visas issued to immigrants and temporary workers collapsed during the pandemic, resulting in 700,000 fewer workers in the US labor supply. This follows on the pre-COVID Trump era when net immigration fell to its lowest levels since the 1980's. Another factor driving wage inflation higher.



Oil, natural gas and coal producers

Thermal energy producers have reverted into their shells, reducing capital spending on new projects by 75% from peak levels. Global demand for thermal energy is unchanged, leading to energy price inflation and food price inflation as well given rising demand for biodiesel.

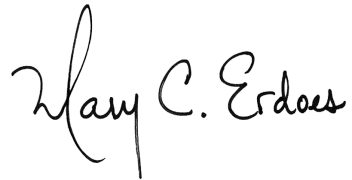
MARY CALLAHAN ERDOES
Chief Executive Officer
J.P. Morgan Asset & Wealth Management

In the midst of what has felt like a persistent pandemic, I hope you are staying strong, hopeful and optimistic. It is that optimism in the face of adversity that comes into focus in my investment partner Michael Cembalest's 2022 Outlook, *Reflation: Endgame*.

For the past 19 years, Michael has looked beyond the headline news to thoughtfully craft unique market insights for the year ahead. In this year's Outlook, even with inflation metrics near their highest levels in two decades and an evolving investment and monetary policy landscape, Michael and his team will show you why they are optimistic for continued global growth—and why you should be, too.

As always, helping you better position your portfolios for the future is our top priority. We hope you enjoy this piece, and we wish you good health, happiness and success in 2022.

Happy New Year,

A handwritten signature in black ink that reads "Mary C. Erdoes". The signature is fluid and cursive, with the first name "Mary" being more prominent and the last name "Erdoes" following in a similar style.



Greetings and Happy New Year. In this year's Eye on the Market Outlook, my team and I cover the elephant in the room: the consequences of reflationary dynamics which appear to have moved beyond what the Fed expected a few months ago. While I have never seen a superhero movie, their marketing posters gave us the idea for the cover: who and what are the drivers of the largest inflation spike in many years. In the Executive Summary, we cover goods supply shocks, labor market shortages and commodity price spikes, and their implications for inflation and equity markets in 2022. We follow up with a review of US equities at a time of pent-up household and corporate demand but also high valuations; the real assets which comprise a growing share of many client portfolios; and three policy issues affecting portfolios in 2022 and beyond, including the regulatory purge in China.

Michael Cembalest
Chairman of Market and Investment Strategy
JP Morgan Asset Management

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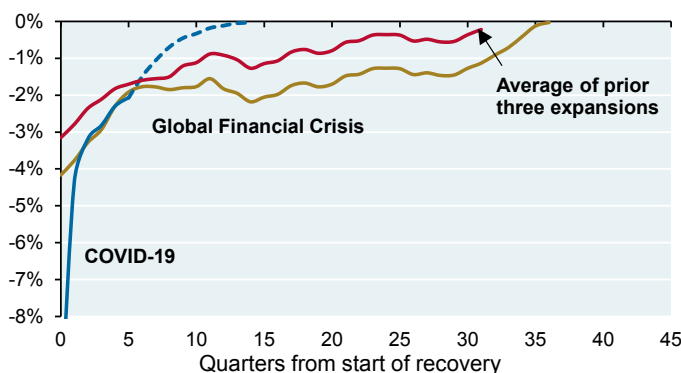
Reflation: Endgame

Executive Summary

The superheroes on the cover have all contributed in their own way to a reflating world: higher nominal growth, higher wages, higher prices and rising asset prices. While the COVID recession was deeper, the global recovery is on track to eliminate spare capacity at a much faster pace than after prior recessions. Global inflation is close to the highest level in 20 years, driven by surging goods prices and changing consumption patterns due to COVID, the inability of a just-in-time corporate sector to respond, soaring government debt¹, monetary policy that dwarfs anything seen after the Global Financial Crisis a decade ago, and energy policies which reduce the supply of thermal energy much faster than they reduce demand.

Global output gap (spare capacity measure)

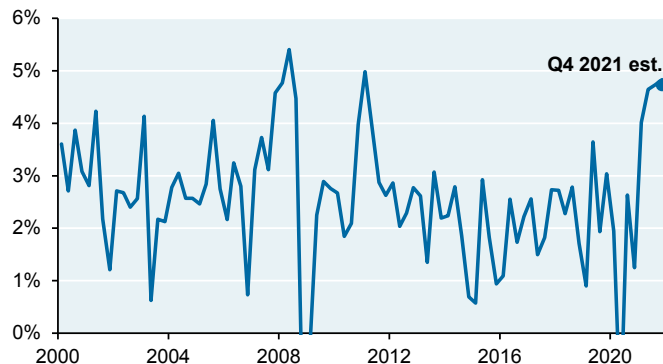
%, actual GDP relative to potential GDP



Source: JP Morgan Economic Research. Q3 2021. Dotted line = forecast.

Global headline CPI inflation

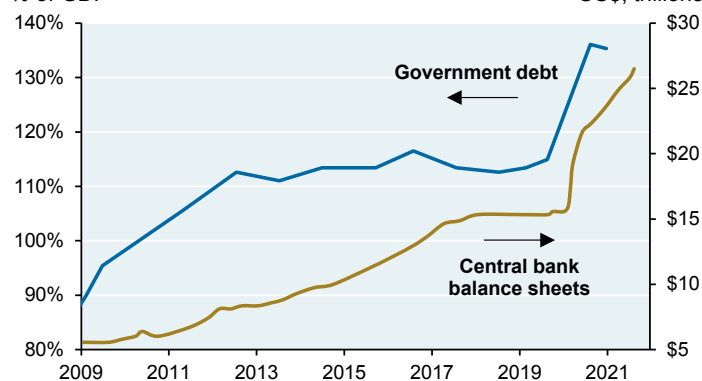
%, annualized quarterly change



Source: JP Morgan Economic Research. November 2021.

Dev world government debt & central bank balance sheets

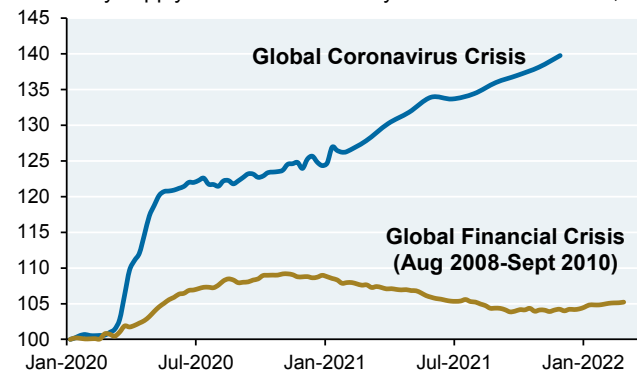
% of GDP



Source: JP Morgan Economic Research. November 2021.

Faster growth in the US money supply this time around

M2 money supply + institutional money market fund balances, index



Source: St Louis Fed, ICI, J.P. Morgan Asset Management. Nov 2021.

For the latest developments on COVID, Omicron, immunity escape, vaccine efficacy, booster shots and vaccinated vs unvaccinated outcomes by state, please see our COVID web portal linked above in the header

¹ In mid-December, the CBO reported that if temporary provisions in the “Build Back Better” bill were made permanent, it would add \$2.75 trillion to the deficit as opposed to adding \$158 billion as written. The latest negotiations point to a smaller bill given objections by Senator Manchin (D-WV). Even so, any revised smaller bill might still rely on temporary provisions which could be inflationary if made permanent.



While leading manufacturing indicators have been weakening, we don't interpret them as we normally would (i.e., a worrisome decline in demand). This time around, widely reported supply chain shocks are responsible. That's why we're optimistic that with gradual resolution of supply chain delays, global growth will rebound.

US manufacturing PMI

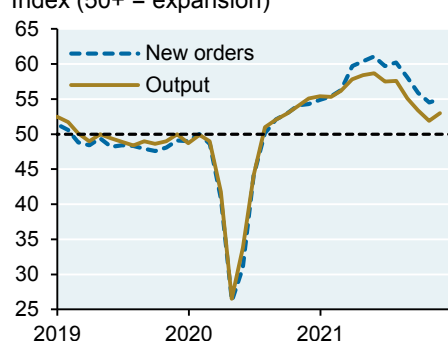
Index (50+ = expansion)



Source: Bloomberg. November 2021.

Dev markets manufacturing PMI

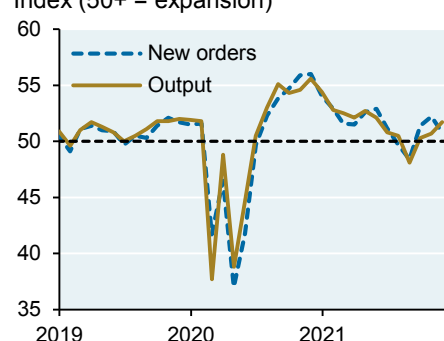
Index (50+ = expansion)



Source: Bloomberg. November 2021.

Emerging markets manufacturing PMI

Index (50+ = expansion)

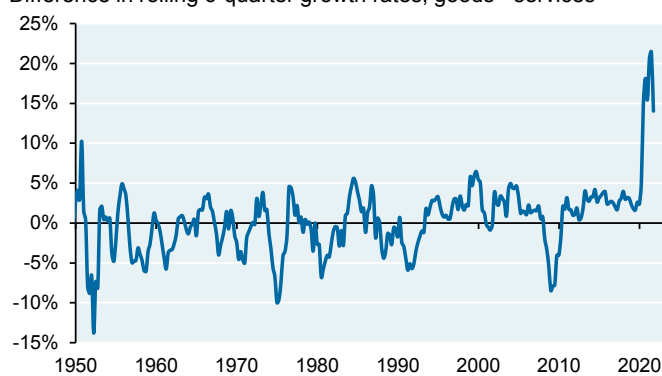


Source: Bloomberg. November 2021.

One important trend we're monitoring: the surge in goods spending vs services which sparked the supply chain mess in the first place. In the US and Europe we're already seeing a shift back to services, and inventory growth already contributed to US Q3 2021 GDP growth. But in the meantime inflationary pressure is broadening, confirmed by the November US PCE report showing the largest increase in rental inflation in 20 years and a large number of categories whose prices are rising > 4%. While COVID spending shifts triggered supply chain delays, there are **structural issues in the US which made them a whole lot worse** (see next page).

A surge in US goods spending

Difference in rolling 6-quarter growth rates, goods - services



Source: BEA, JPMAM. Q3 2021.

A surge in Europe goods spending

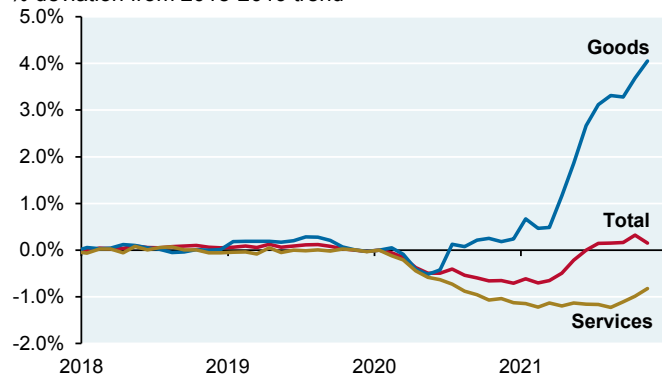
Difference in rolling 6-quarter growth rates, goods - services



Source: Eurostat, JPMAM. Q3 2021.

Global goods and services price level

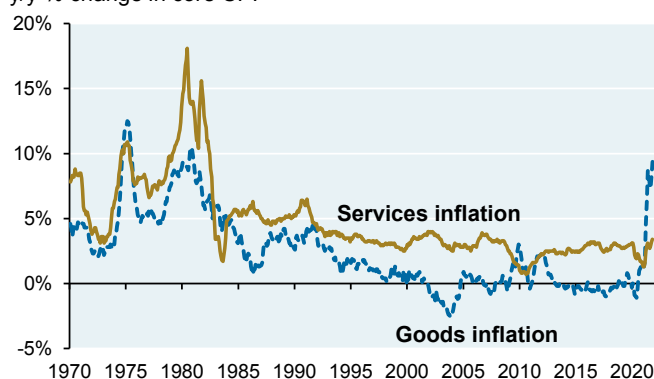
% deviation from 2018-2019 trend



Source: JP Morgan Economic Research. November 2021.

US goods vs services inflation

y/y % change in core CPI



Source: BLS, JPMAM. November 2021.



Supply chain problems: not just the byproduct of COVID and the surge in goods spending

Two years ago, Jamie asked me to prepare a report on structural issues that stand in the way of higher US growth. We looked at the opportunity cost of wars and elevated military spending; land use regulations which constrain density where it should be higher; state licensing requirements which impede labor mobility; the impact of racial inequality in education, lending and criminal justice; the high cost of gun violence, opioids and incarceration; and commercial litigation and class action costs.

COVID and the supply chain mess surfaced more growth constraints that can be added to the list. These structural issues may impede Biden's infrastructure projects as well.

- Containership problems in Los Angeles and Long Beach were exacerbated by **local regulations** that prevented the stacking of containers more than two at a time, ordinances preventing port owners from paving and consolidating plots they already own to accommodate more storage, and land use regulations that require two to nine years before warehouses can be built on empty land
- **No US port ranks in the top 50 globally in terms of cost or efficiency.** The Los Angeles port ranks #328 and the Long Beach port comes in at a dismal #333. Contracts that prevent port automation, labor costs, limits on operating hours, weekend closures and other factors are partial reasons. Note that the semi-automated port of Virginia is free of backlogs despite handling record volumes, and ranks #85. There was a "60 Minutes" episode in November that focused on the LA/LB ports that made no mention of their relatively poor productivity; I wonder why its producers didn't ask questions about the labor and automation issues involved
- **The Jones Act and Foreign Dredging Act** raise port handling and dredging costs and put pressure on trucks and rail to transport goods that should be carried by ship instead. Section 301 tariffs of 221% on imported Chinese truck chassis cut trucking capacity and exacerbate supply chain delays at an inopportune time
- **US rail projects take longer to complete** and are more expensive than projects elsewhere. US rail projects with minimal tunneling take six months longer to complete than non-US projects, while underground rail can take 1.5 years longer. Domestic rail projects also cost 50% more on a per-mile basis than in Europe and Canada, and 250% more in New York City. One example: a Metro Line in Toulouse, France was built underground at \$176 million per mile while Houston's Green Line is at-grade and cost \$223 million per mile
- Despite a worsening US trucker shortage that has existed for many years, **the US effectively bars Mexican trucking companies from operating in the US.** The number of American trucks available for inland delivery is reduced since many of them are picking up cargo at the Mexican border
- From 1960 to 1994, the real unit cost of construction materials and construction workers in the US was unchanged yet real interstate highway spending per mile rose by 400%. What changed: **the power of local governments and/or citizens groups to delay or block development.** Environmental Impact Statements used to be 10 pages; due to litigation, the current EIS is more than 600 pages plus appendices that can exceed 1,000 pages, and can take 4.5 years to complete. No ground can be broken on federal or private projects until an EIS makes it through the legal gauntlet. One California public policy nonprofit argues that the state's environmental protection law is often used inappropriately to delay or stop transit and sustainable transportation projects that would have significant benefit to the environment, such as solar farms, infill housing and mass transit

Sources: Cato Institute; Wall Street Journal; Eno Center for Transportation; Niskanen Center; World Bank/IHS Markit; Congressional Research Service; George Washington School of Public Policy; Yale Law School

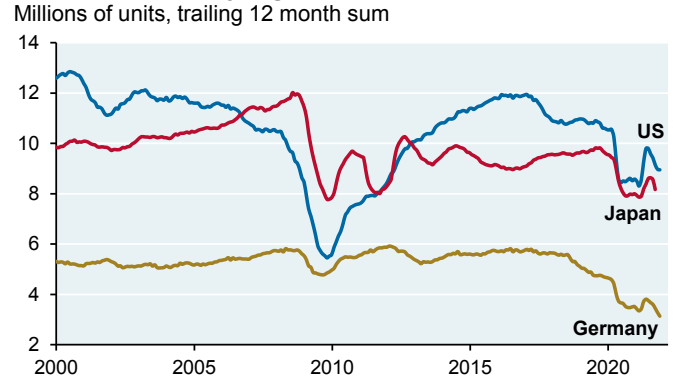


Anchored, loitering and slow-speed containerships in the vicinity of Los Angeles and Long Beach ports are still hovering at the highest levels on record, waiting to unload ~750,000 20-foot equivalent containers with \$30 billion in imported goods. Other supply shock measures we're tracking: manufacturer delivery times, auto production and backlogs, freight rates, trucking demand and air cargo rates. One consequence: the US NFIB survey shows the largest % of firms reporting inadequate inventories since 1975, and by a very large margin. There are preliminary signs that US auto and regional delivery times are improving from very delayed levels.

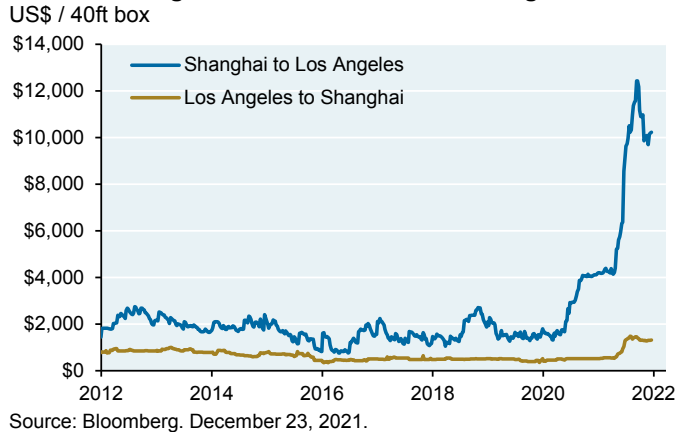
Global manufacturing delivery times



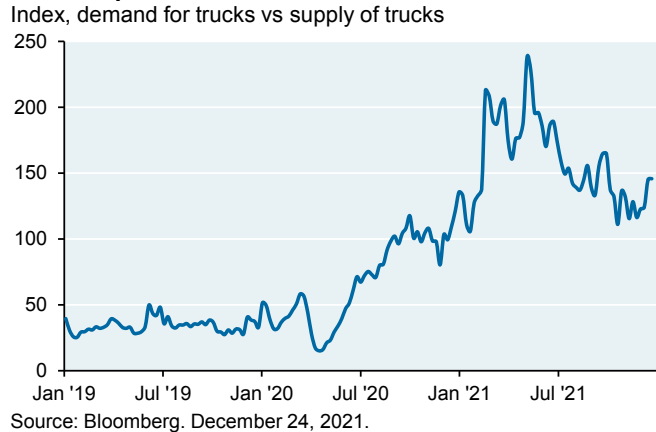
Auto production by region



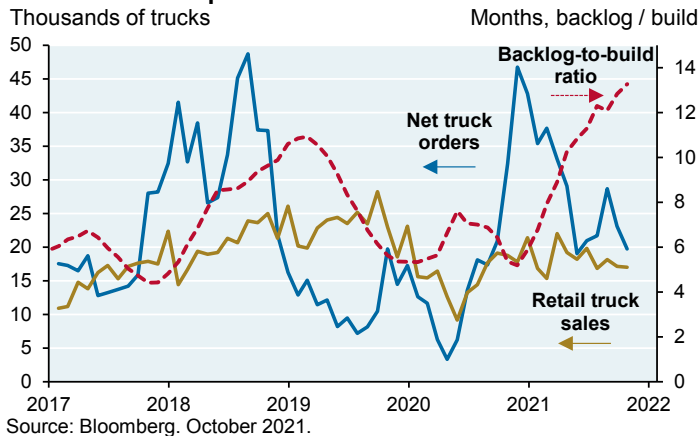
Container freight rate between LA and Shanghai



Truckstop market demand index



US class 8 truck purchase trends



Air cargo rates: Shanghai to North America

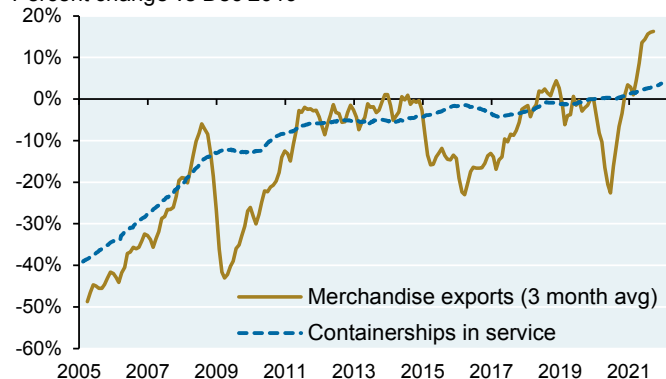




The global supply shock is more a consequence of surging demand than of weak output; in most sectors, output is quite strong (just not strong enough to meet soaring demand). Global goods production, world exports, containerships in service, LA port throughput, US truck tonnage and global semiconductor shipments are **all well above trend**. So are US housing completions.

World exports vs shipping capacity

Percent change vs Dec 2019



Port of LA container import throughput

Index (100 = Dec 2019)



US truck tonnage hauled

Index (100 = 2015)



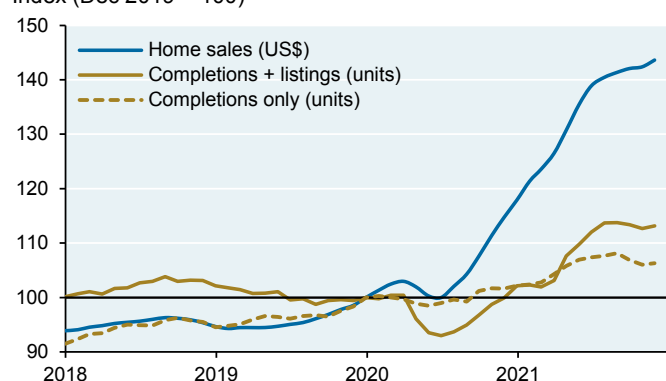
Global semiconductor shipment volumes

Billions of units



US housing: supply vs demand

Index (Dec 2019 = 100)

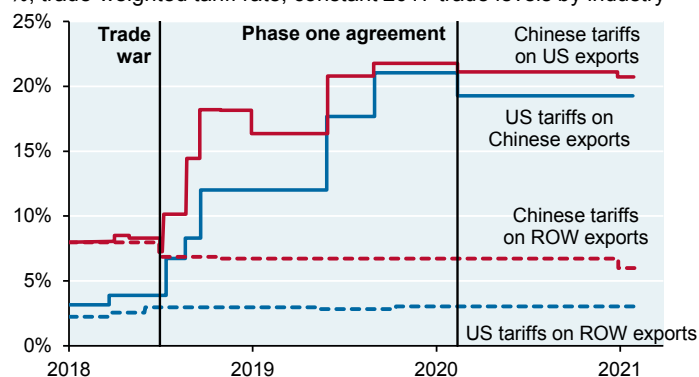




The strength in output and new orders is a positive sign, and we do not see long-lasting weakness in global demand despite rising tariffs and declining cross-border foreign direct investment. In theory, there could be tailwinds for growth and US/Chinese asset prices if the Biden administration reduced tariffs on China, perhaps justifying it as a means of reducing inflation and boosting employment and income. **But we consider this unlikely;** if anything, Senate Majority Leader Schumer has kept China issues on the agenda by advancing the US Innovation and Competition Act, which includes sanctions on China for human rights issues, its trade with North Korea and state-sponsored cyberattacks. In addition, China is only 62% compliant with its Phase One trade deal agricultural purchases from the US. The Trump tariffs illustrated below are estimated to have reduced US employment by 245,000 jobs, to have reduced annual US household income by \$675-\$2,000, and to have reduced S&P earnings by 7%-8%².

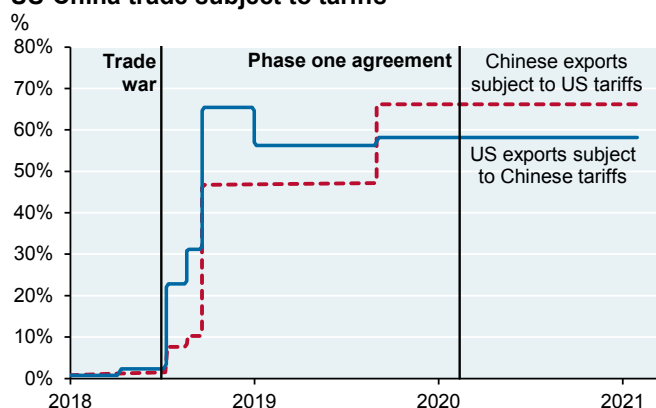
US-China tariff rates toward each other and rest of world

%, trade-weighted tariff rate, constant 2017 trade levels by industry



Source: Peterson Institute for International Economics. March 2021.

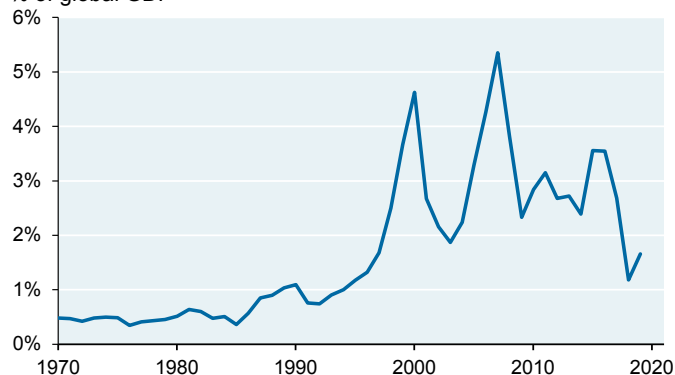
US-China trade subject to tariffs



Source: Peterson Institute for International Economics. March 2021.

Global foreign direct investment flows

% of global GDP



Source: IMF, World Bank. 2019.

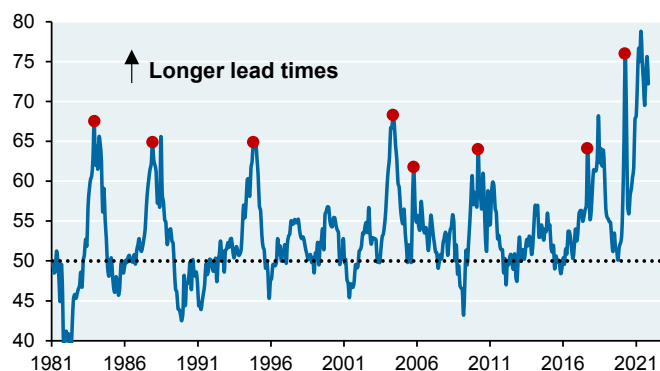
² Sources: US-China Business Council ("US-China Economic Relationship: A Crucial Partnership at a Critical Juncture", January 2021), National Foundation for American Policy, JP Morgan Global Markets Strategy.



How will supply shock delays get resolved? Supply shocks have happened before, with 8 highlighted in the first chart. They typically get resolved within a few months as capital spending catches up to demand. COVID is a complicating factor, but we expect that to happen this time as well. The second chart shows how automobile-related semiconductor capital spending is expected to double in 2022 vs prior trends. This is critical for supply chains given increased semiconductor values per car. According to Trend Force, capex by the top 10 semi foundries surpassed \$50 bn in 2021, up 43% y/y with another 15% increase in 2022, increasing global 8-inch and 12-inch wafer capacity by 6% and 14%. Increased vaccination in Asia will help supply chains as well.

US ISM supplier deliveries index

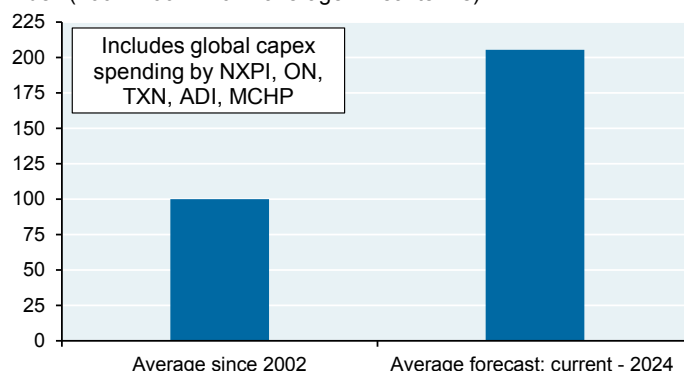
Index



Source: Bloomberg, JPMAM. Nov 2021. Red dots = start of supply disruption

Global automotive semiconductor capex

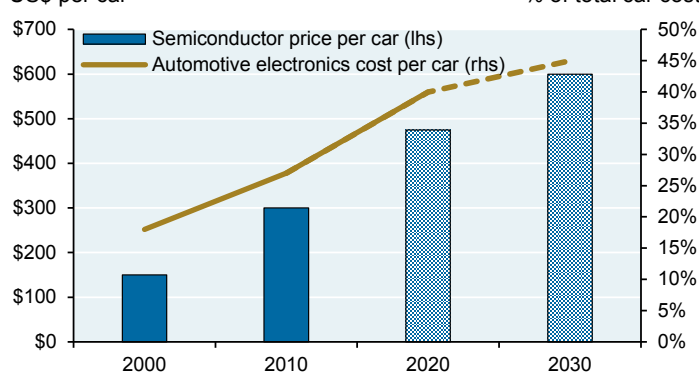
Index (100 = 2002 - 2021 average in real terms)



Source: GS, JPMAM. Q3 2021.

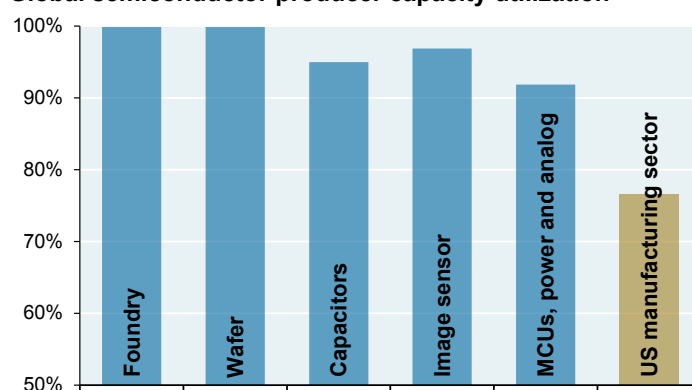
Contribution of electronics & semiconductors to car cost

US\$ per car



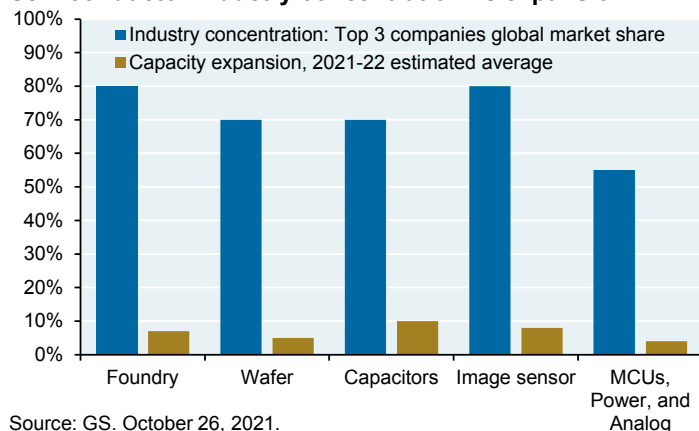
Source: Deloitte, IHS. April 2019. Dotted line & shaded bars indicate estimates.

Global semiconductor producer capacity utilization



Source: GS. October 26, 2021.

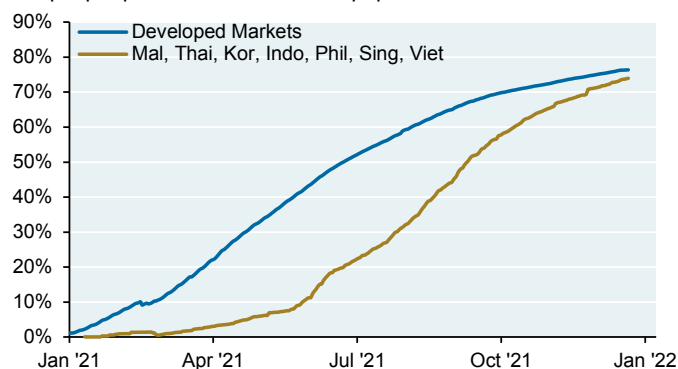
Semiconductor industry concentration vs expansion



Source: GS. October 26, 2021.

Regional GDP-weighted vaccination rates

Unique people vaccinated as % of population



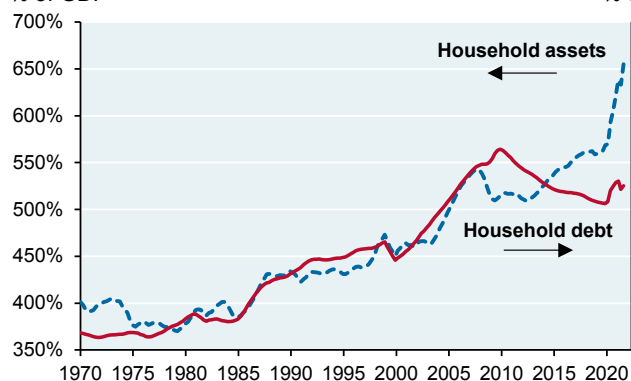
Source: OWID, JPMAM. December 28, 2021.



So, we believe that supply chain problems will be resolved in 2022 and 2023 through vaccination, more capital spending and a shift in spending from goods back to services. **As that's happening, developed world consumers are in good shape and should be able to support the economic expansion.** Developed world household balance sheets and savings rates look strong, and in the US, there's still a large gap between the strong pace of final sales and weaker inventory accumulation. US household debt service burdens are also at the lowest levels on record. The risk: as shown in the last chart, a large boost in US consumer spending came from the lowest credit quintile of borrowers, suggesting some sensitivity to the end of fiscal stimulus.

Developed World household balance sheets

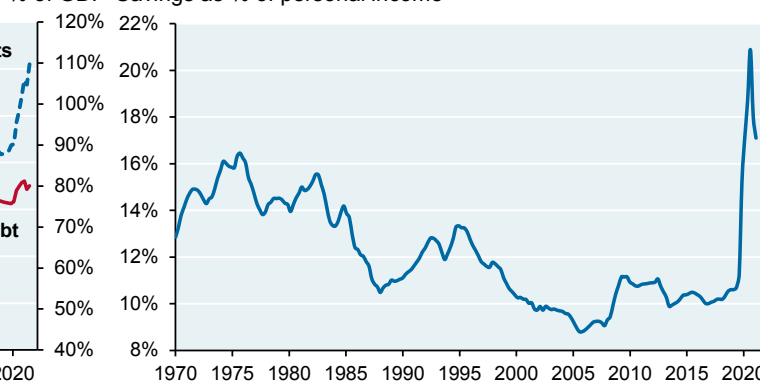
% of GDP



Source: BEA, ECB, regional statistical offices, JPMAM. Q3 2021.

Developed World household savings rate

% of GDP Savings as % of personal income



Source: BEA, regional statistical offices, JPMAM. Q3 2021.

US excess spending potential has piled up

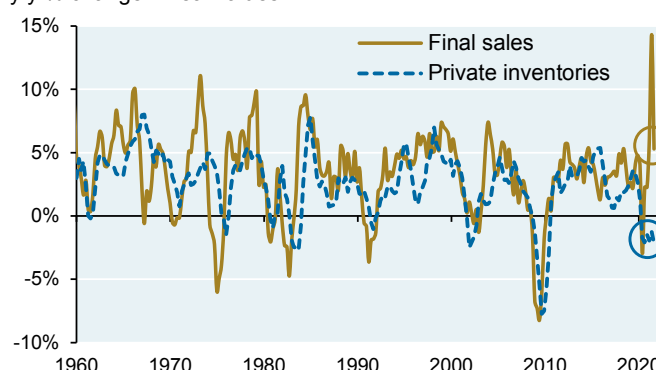
\$tn, rolling 4-quarter spending potential in excess of consumption



Source: Fed, BEA, JPMAM. Q3 2021. Spending potential: 65% of taxable income, 100% of transfer pmts, 10% of housing wealth and 1.5% of fin. wealth.

US unprecedented sales to inventory gap

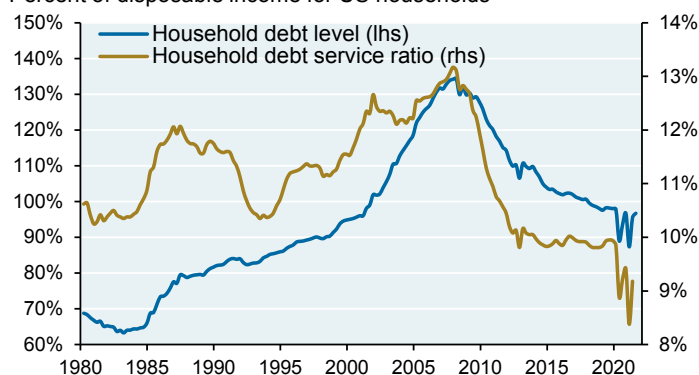
y/y % change in real values



Source: BEA, JPMAM. Q3 2021.

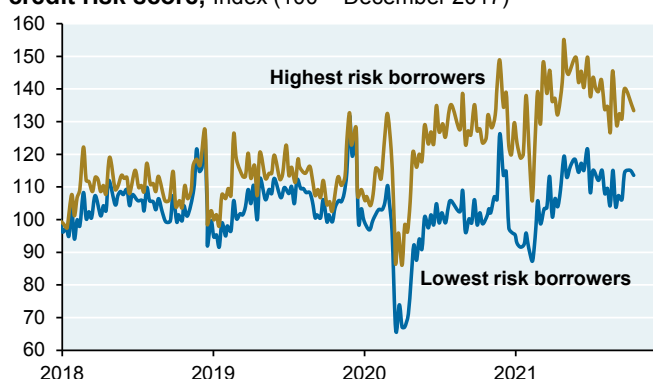
Debt levels vs debt service

Percent of disposable income for US households



Source: Fed, BEA, JPMAM. Q3 2021.

US consumer spending: transaction amounts by Equifax credit risk score, Index (100 = December 2017)



Source: Equifax, Commerce Signals, AEI Housing Center. November 17, 2021.



We expect goods-related supply chain issues to be resolved, and for goods price inflation to fall as the Fed has been expecting. However, US labor shortages appear to be a chronic issue, driving up wage inflation in tight labor markets. As we explained last October, worker shortages are the result of accelerated retirement vs trend, immigration declines, increased self-employment that draws labor away from where it's needed and COVID impacts (vaccinated people afraid to return to work, working parents unable to find child care and unvaccinated people fired/furloughed from their jobs). The latest data from the BLS shows US low skill wages rising at almost 7% per year.

The charts below show the tightest labor markets in 30-40 years. Other labor market indicators also show tight conditions: all-time highs in workers saying jobs are plentiful, rising job openings and voluntary quits, and all-time lows in layoffs. Record highs in job openings are not just in leisure & hospitality but also manufacturing, transportation, warehousing, retail, professional business services, education and health. Hourly earnings and employment costs are rising 4%-5%, close to the highest levels seen in the last three decades.

The infrastructure and pending reconciliation bills could deploy up to \$2 trillion, directly as government purchases and indirectly via tax cuts and transfers. At a time of very tight labor markets, where are the workers going to come from, what impact will this have on wages and what impact will it have on the Fed?

Worker shortages

Millions of workers



Source: BLS, Census, GS, JPMAM. October 2021.

US small businesses with hard to fill job openings

% of small business survey respondents



Source: Bloomberg, NFIB. November 2021.

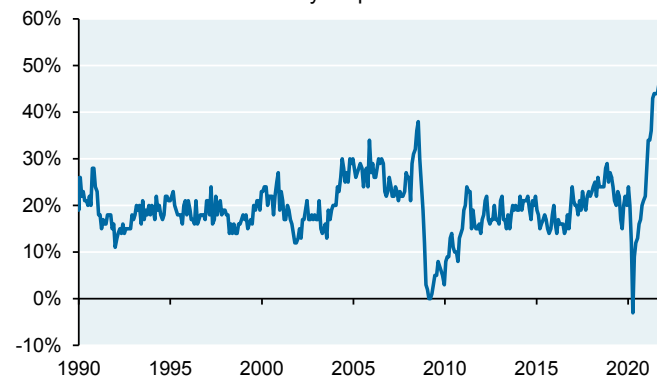
US small businesses planning to raise worker compensation, % of small business survey respondents



Source: Bloomberg, NFIB. November 2021.

US small businesses planning to raise prices

Net % of small business survey respondents



Source: NFIB, JPMAM. November 2021.

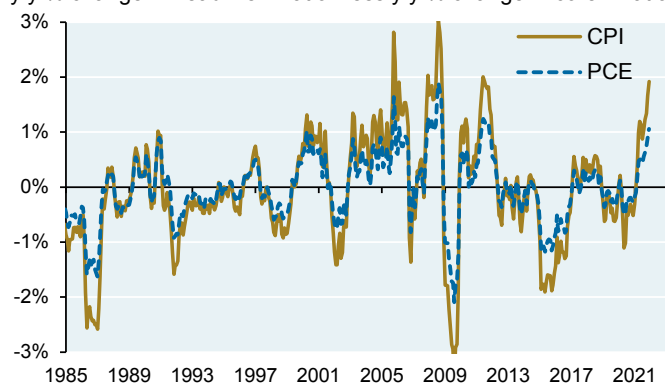


Energy-related inflation may be sticky as well. The gap between headline and core inflation is rising. One reason: **the collapse in investment in oil & gas production at the same time that global demand for fossil fuels has barely declined** (fourth chart below). An extreme version of this paradigm is found in Europe whose electricity prices are soaring given renewable energy policy that is changing faster than fossil fuel demand, and given Europe's reliance on Russia for half of its thermal energy needs.

JP Morgan Commodities Research expects global oil demand to grow by 3.5 million barrels per day (mbd) in 2022 and reach 99.8 mbd, slightly above 2019 levels and a record high, and expects global oil demand to average 101.5 mbd in 2023. **But in this new era, US and Global rig counts are rising very slowly now.** As a result, JPM Research expects Brent oil prices to average \$80-\$90 in 2022 and 2023. Separately, JP Morgan's Global Equity Research team has their own forecast in which oil prices hit \$125 in 2022 and \$150 in 2023.

Headline less core inflation

y/y % change in headline inflation less y/y % change in core inflation



Source: BLS, BEA. November 2021.

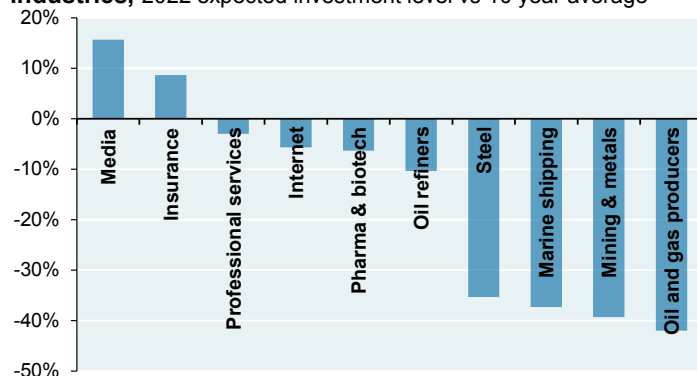
GSCI commodity index

Index



Source: Bloomberg. December 28, 2021.

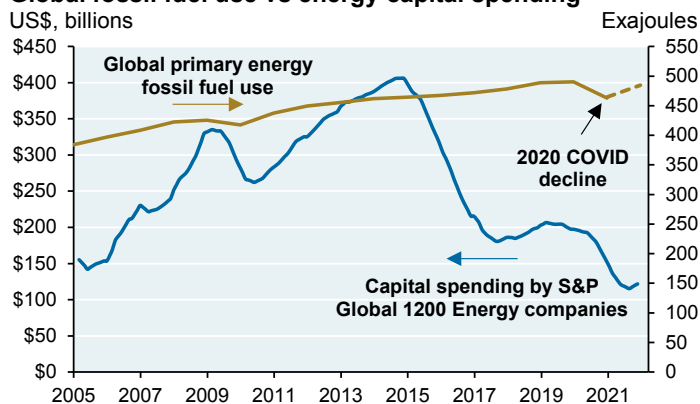
Collapse in global investment in energy-intensive industries, 2022 expected investment level vs 10 year average



Source: GS, JPMAM. November 10, 2021.

Global fossil fuel use vs energy capital spending

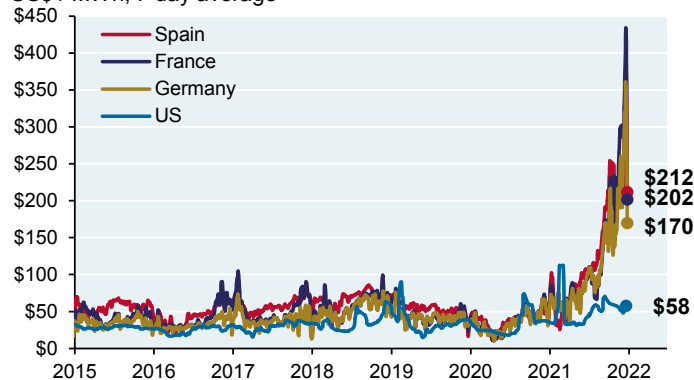
US\$, billions



Source: BP, Bloomberg, IEA, JPMAM. Nov 2021. Dotted lines = estimates.

US vs Europe: Day ahead electricity prices

US\$ / MWh, 7 day average



Source: Bloomberg. December 29, 2021.

European electricity price vertigo

Falling investment in thermal energy
Unreliable supply of Russian natural gas
Start of a very cold winter in Russia and Europe
Lower than expected wind speeds
Emergency repairs of French nuclear plants
Rising CO₂ permit prices

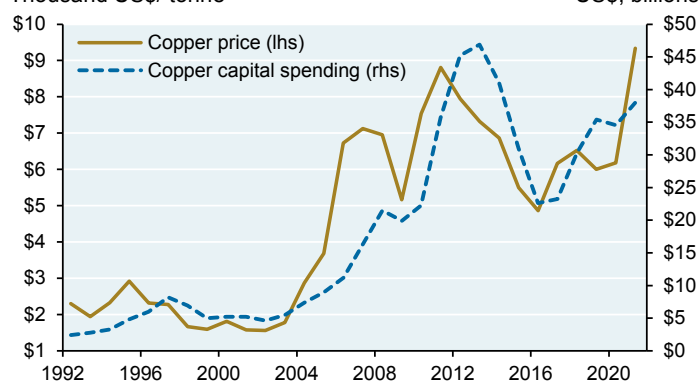


On the other hand, industrial metals inflation should subside. Copper, aluminum and nickel inventories as a % of demand are close to the lowest of the last 20 years. However, capital spending on new production typically follows higher prices, and we expect that happen again. Demand for copper may remain high despite slower real estate construction in China since the transition to renewable energy for power, electrified heat and for electric vehicles requires a lot more copper (see tables). But unlike oil & gas, we do not envision the same structural impediments to new capital spending on industrial metals.

Food price inflation is also elevated. While less severe weather and more planting should help resolve some of the corn and wheat shortages shown in the second chart, rising **biodiesel demand** is creating a feedback loop which pushes cereal and vegetable oil prices higher, which in turn pushes meat/dairy prices higher as well.

Copper price vs capital spending

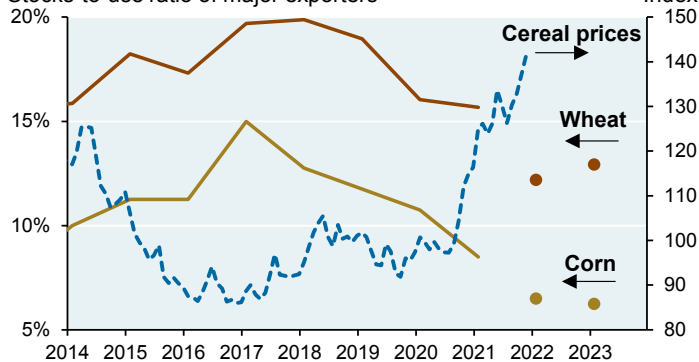
Thousand US\$/ tonne



Source: JP Morgan Commodities Research, Wood Mackenzie. June 2021.

Cereal prices rising as supply remains tight

Stocks-to-use ratio of major exporters



Source: Bloomberg, USDA, JP Morgan Commodities Research. November 2021. Dots = JPM forecasts.

Tons of copper per megawatt of electricity

Gas	1.0
Coal	1.0
Nuclear	1.5
Onshore wind	3.9
Grid energy storage	4.0
Solar farm	5.5
Offshore wind	10.5
Solar rooftop	11.4

Source: World Bank, Université Grenoble Alpes, Copper Development Association. 2020.

Pounds of copper per vehicle

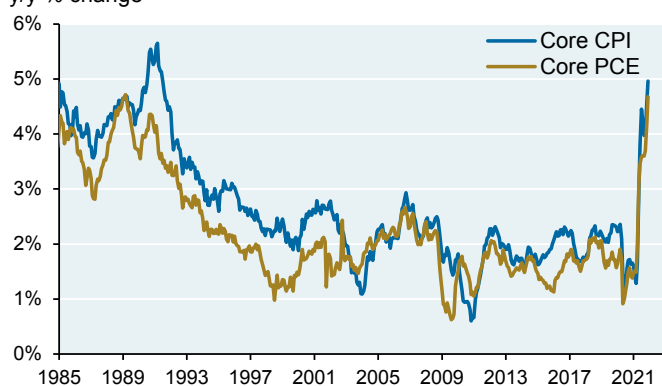
Conventional (ICE)	34
Hybrid (HEV)	85
Fuel cell (FCEV)	121
Plug in hybrid (PHEV)	132
Battery electric (BEV)	183

Source: Copper Development Association, Argonne National Laboratory. 2020.

Bottom line: the Fed is now facing the largest challenge yet to its “transitory” description of inflation dynamics. We agree that goods price inflation will roll over, in which case CPI and PCE measures will as well. But we believe that wages and commodity prices will remain high since their supply/demand curves have shifted.

Core CPI and PCE inflation

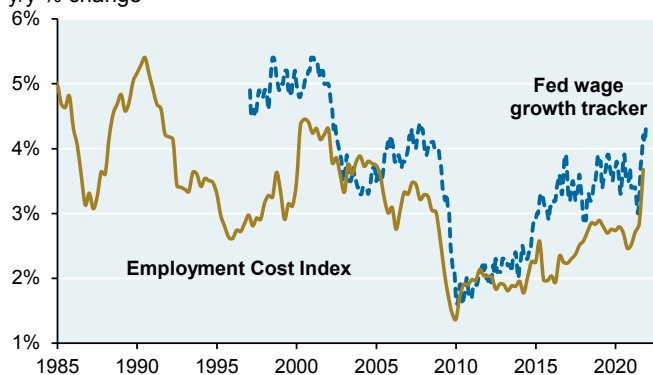
y/y % change



Source: BLS, BEA. November 2021.

US wage growth

y/y % change



Source: BLS, Atlanta Fed, Bloomberg, JPMAM. November 2021.



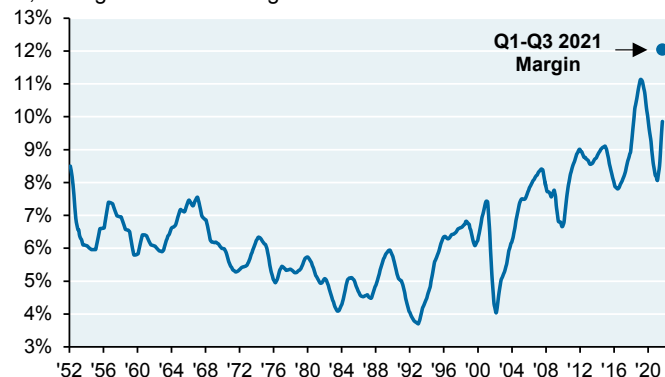
What's next for US equity markets

For the S&P 500, we expect 10%-14% earnings growth in 2022 as trend growth returns and as the Fed begins to raise rates. P/E multiples should contract as this occurs, delivering total returns of 7%-10% including dividends. In other words, another version of 2021 when earnings rose by 36% and P/E multiples fell by 6.1%. If this were to occur, it would be the 16th year out of the last 20 in which stocks outperform bonds, during which time cumulative returns on stocks and bonds have been 697% and 111%, respectively. Increased buybacks and dividends should help; US companies have a lot of spare accumulated cash (see p. 17).

Despite rising labor, intermediate goods and raw materials costs, S&P 500 profit margins defied expectations in 2021 and rose vs pre-pandemic levels (12.3% in Q3 2021 vs 11% in 2019). Many companies simply passed cost increases on to consumers. Profit margins in the national accounts (all private and public companies) rose as well to record highs in 2021. We think input cost increases will be harder to pass along in 2022, and margins may fall by 1% or so back to 2017-2019 trend levels.

S&P 500 ex-financials and REITs net profit margins

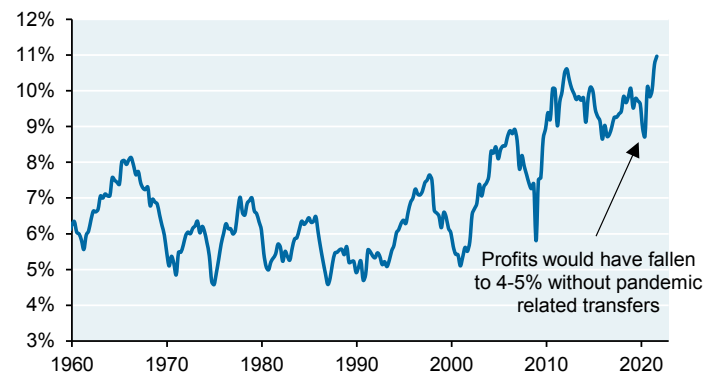
%, trailing 12 month average



Source: Empirical Research Partners. November 2021.

US after-tax corporate profits

% of GDP

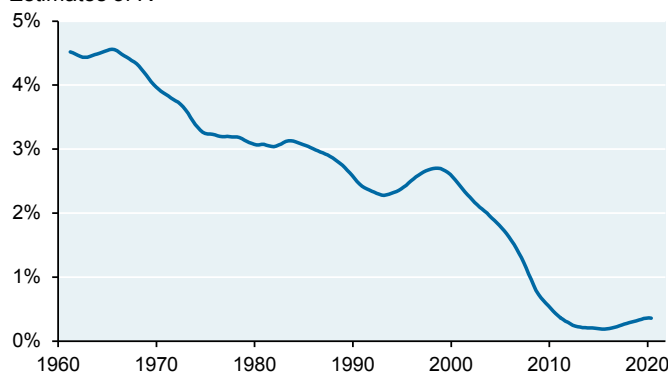


Source: BEA, JPMAM. Q3 2021.

While the Fed is expected to raise policy rates next year and slow the pace of its asset purchases, we think the most important question to ask is this: **what is the Fed's endgame, positive real rates or just real rates of around zero?** We believe it's the latter. As illustrated on the left, the Fed now uses an approach which yields much lower equilibrium real policy rates. Most of the reason for this decline: aging demographics, slower trend growth and income inequality which offset the rise of government debt³. **As a result, maybe real yields crawl back to zero at some point, but that's as far as we could see them going in the US or Europe.** Also, while the Fed is expected to scale back its asset purchases, our economists still expect another \$1 trillion in developed market central bank balance sheet expansion through December of next year.

Estimated US equilibrium real policy rates

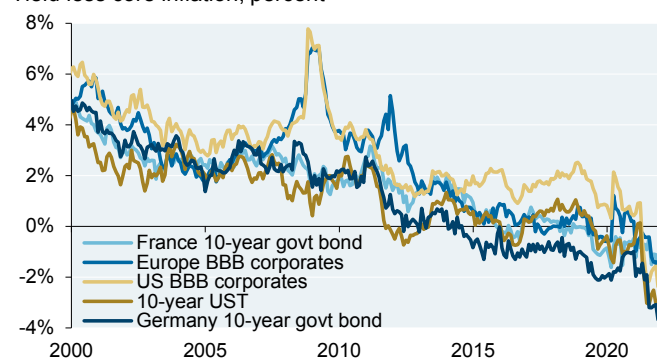
Estimates of R*



Source: NY Fed. Q2 2020.

US and Europe real yields

Yield less core inflation, percent



Source: Barclays, BLS, Bloomberg, JPMAM. December 28, 2021. UST is yield to maturity; other indices are yield to worst.

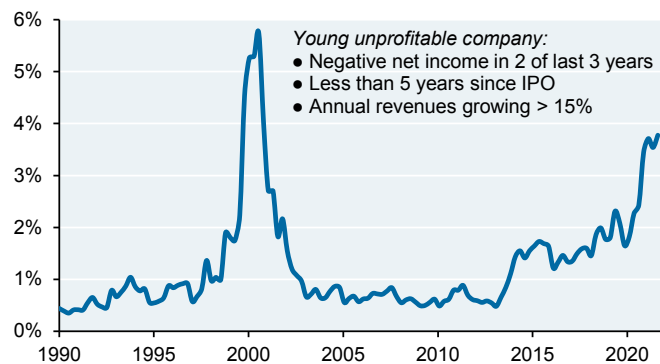
³ "On falling neutral rates, fiscal policy and the risk of secular stagnation", Summers and Rachel, 2019

**Be prepared for intermittent selloffs, since market internals are less favorable than they were last spring:**

- Young and unprofitable companies make up the largest share of market cap since 1999; Bridgewater estimates \$200 bn in “YUC” supply in 2022 from primary/secondary issuance and insider lockups expiring
- There were a lot of highly valued, crowded-trade stocks which fell by 35% or more in 2021, which is unusual for a year when market returns were ~25%; another development we have not seen since the late 1990’s
- A rising number of companies are now more sensitive to changes in liquidity conditions and monetary policy than their counterparts that are more sensitive to changing economic growth
- There’s a high concentration of S&P 500 market cap and total return that is reliant on a handful of stocks; excluding the top 5 stocks, the NASDAQ was actually down 20% through mid-December
- Signs of weakness in momentum/liquidity plays (fintech, renewable energy, IPOs and SPACs)

Market cap of young unprofitable companies

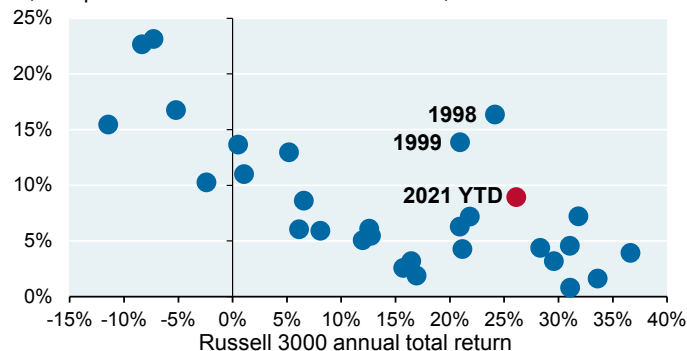
% of total market cap



Source: Factset, J.P. Morgan Asset Management. Q3 2021.

Share of poorly performing stocks vs overall market return

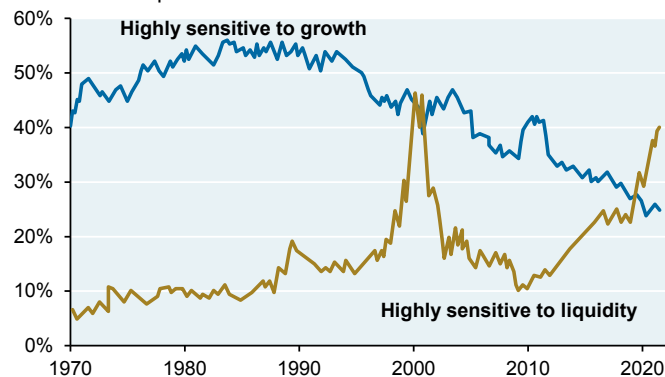
%, companies with returns of -35% or worse, annual data since 1990



Source: Factset, Bloomberg. December 28, 2021. Includes top 50% market cap companies of the CRSP Index of US large, mid and small cap stocks.

US equity market sensitivities

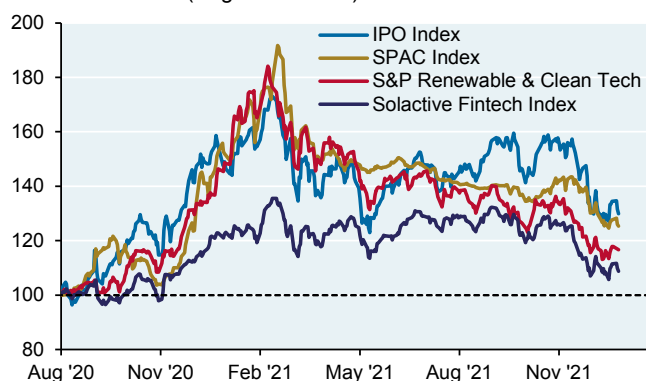
Share of US equities



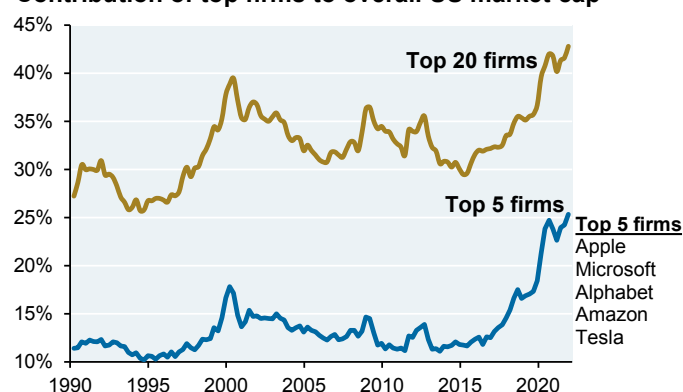
Source: Bridgewater. December 10, 2021.

Signs of weakness

Total return index (Aug 2020 = 100)



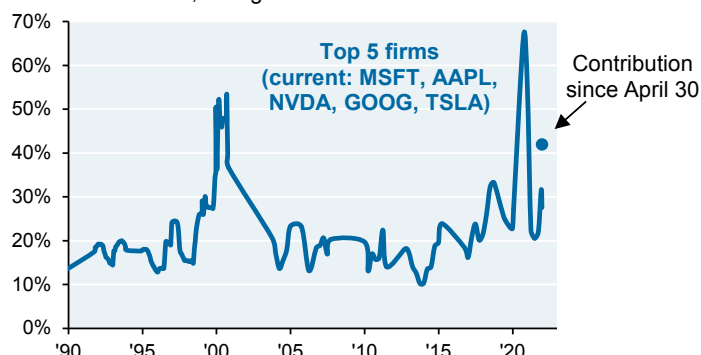
Source: Bloomberg. December 29, 2021.

Contribution of top firms to overall US market cap

Source: Bloomberg, JPMAM. December 29, 2021.

Contribution of top 5 firms to overall US market return

% of market return, rolling 12-months



Source: Bloomberg, JPMAM. December 28, 2021. Data reflects periods of greater than 10% annual market return.

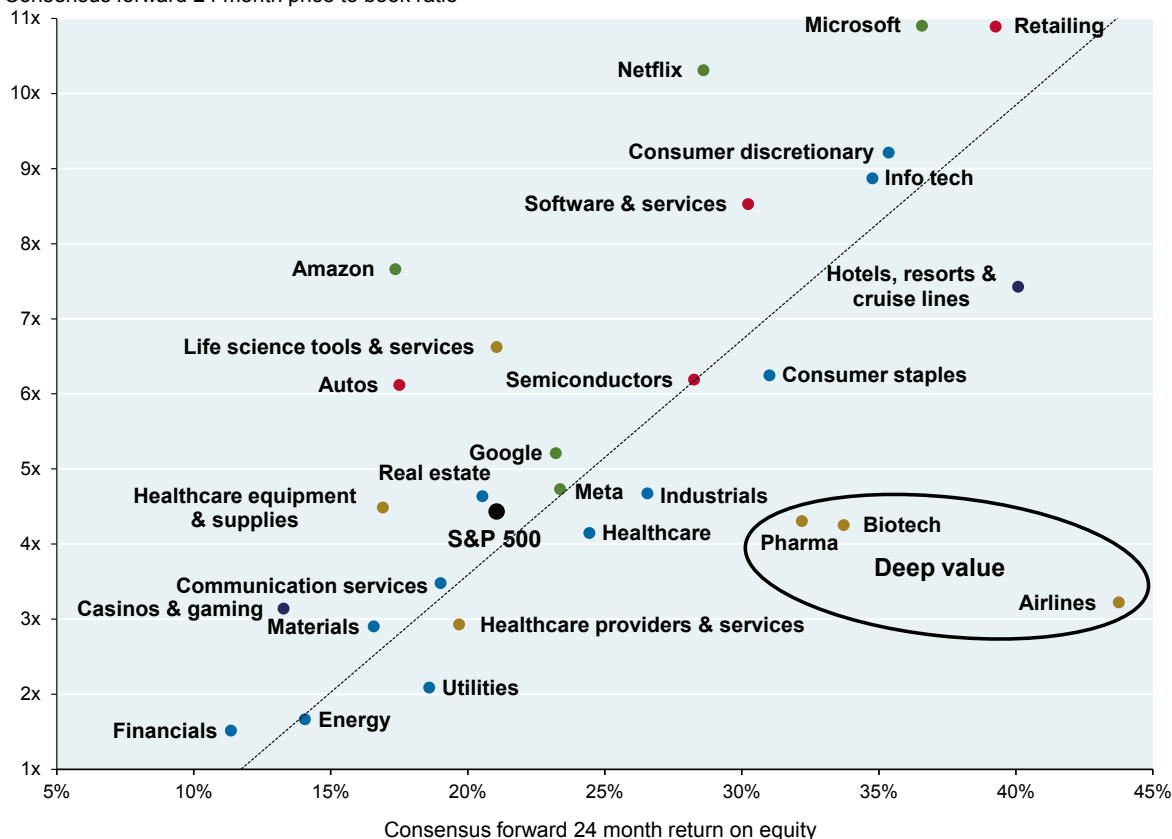


As shown below, there is general order to the S&P 500 valuation universe: the higher a sector's projected return on equity, the higher its price/book valuation. **Looking for deep value? There isn't much other than large cap pharma, biotech and airlines.**

- **Large cap pharma:** a reconciliation bill if passed could allow the Medicare system to negotiate prices for the first time since the 1960's when it was created. The bill as written would apply to older drugs that have no generic competition (10 drugs starting 2025, 100 drugs starting 2030). The bill would also cap drug price increases at the rate of inflation, and be applied to the entire drug market including private and employer health insurance programs. However, drug companies would still set prices on new drugs. A bigger headwind: concern about the 2025-2028 patent cycle and a potential downward cliff in earnings. Our pharma team thinks this is a pessimistic view given large cap pharma pipelines and balance sheet strength
- **Biotech.** Biotech stocks were decimated in 2021, with a median return of -23%. Even so, our biotech team is cautious given a potential reconciliation bill with drug price provisions, clinical setbacks on gene therapy with the death of young patients, fallout from the controversial approval of Biogen's Alzheimer's drug Aduhelm (no room here to list all of its problems), a flood of new issuance (some from companies that haven't even begun human trials yet) and a lack of M&A activity. Real catalysts are needed here, not just low valuations. One positive sign: biotech companies have \$500 bn of cash on hand for deals and R&D
- **Airlines:** valuations for consumer discretionary, autos and retailing are already back to normal using this framework. The biggest outlier: airlines, even when looking at income projections out two years. Business travelers make up 12% of passengers but 75% of revenues, resulting in a 25% decline in revenue per seat mile from 2019 to 2021. While Delta expects business travel to be back to pre-COVID levels by 2022/2023, McKinsey does not expect that to happen until 2024 and also projects a 20% structural decline in business travel, offset by an increase in lower-value leisure trips. High and rising industry debt is also a big concern

S&P 500 valuations vs return on equity

Consensus forward 24 month price to book ratio



Source: Factset. Dec 29, 2021. Blue = sectors, red = industry groups, gold = industries, purple = subindustries, green = megacap tech stocks.



PUBLIC EQUITIES: DIVIDENDS, CYBERSECURITY and FINTECH

[1] Equity dividends: like it or not, dividends are a critical component of yield based investing

For investors seeking yield, the landscape is as barren as ever. Our Strategic Investment Advisory Group published a paper on this last fall, exploring the likelihood of continued financial repression and its implications for investors. Given prevailing rate trends, investors are increasingly reliant on equities for return and income. Even though equity dividend yields are close to their lowest levels in many years (the S&P 500 dividend yield is just 1.3%), around two-thirds of the income in 60:40 portfolios are now derived from equities, with dividend opportunities even more attractive outside the US. Note that dividend measures for equities do not incorporate gross buybacks, which in the US and Europe can contribute meaningfully to returns.

Equity income in 60:40 portfolios

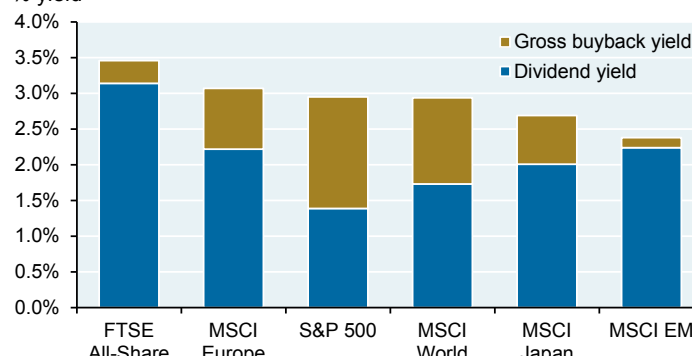
Dividends as % of total portfolio income



Source: Bloomberg, Datastream, JPMAM. Nov 2021. Based on MSCI ACWI / S&P 500 dividend yield and yield to maturity of Barclays Global / US Agg.

Equity index yields

% yield

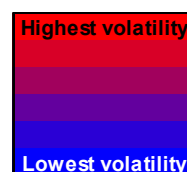


Source: Bloomberg, Datastream, JPMAM. September 2021.

The table shows US, European, Japanese and Emerging equity market sectors with the highest dividend yields. The color scheme indicates each sector's volatility over the last 3 years, with red representing the most volatile sector and blue the lowest. Some high dividend yields exist in oil & gas where price volatility can quickly overwhelm a dividend oriented strategy. Yield oriented investors in volatile sectors need to be prepared for long holding periods through difficult times.

Dividend yield by industry group

Industry group	US	EUR	JPN	EM	Average
Mortgage REITs	10.00%	na	na	na	10.00%
Tobacco	6.45%	6.18%	6.05%	na	6.23%
Marine	na	1.48%	9.12%	na	5.30%
Oil, Gas & Consumable Fuels	3.78%	4.86%	4.38%	4.95%	4.49%
Gas Utilities	2.82%	5.34%	3.02%	5.34%	4.13%
Diversified Telecommunication	4.22%	4.35%	3.52%	4.38%	4.12%
Construction & Engineering	na	4.17%	3.62%	4.19%	3.99%
Insurance	1.65%	4.31%	4.35%	4.08%	3.60%
Electric Utilities	3.14%	3.88%	2.94%	4.03%	3.50%
Banks	2.44%	3.18%	4.34%	2.93%	3.22%
Multi-Utilities	3.02%	3.36%	na	3.13%	3.17%
Telecommunication Services	0.00%	5.71%	3.49%	na	3.07%
Equity Real Estate Investment	2.70%	2.58%	3.49%	2.33%	2.78%
Water Utilities	1.66%	3.66%	na	na	2.66%
Metals & Mining	1.95%	4.11%	3.32%	1.20%	2.64%
Paper & Forest Products	na	2.47%	2.51%	2.88%	2.62%
Capital Markets	1.53%	2.10%	4.30%	1.92%	2.46%
Containers & Packaging	2.16%	2.40%	na	2.40%	2.32%
Construction Materials	0.63%	3.35%	na	2.89%	2.29%
Chemicals	1.87%	2.28%	2.46%	2.48%	2.27%
Energy Equipment & Services	1.81%	2.48%	na	2.48%	2.25%
Pharmaceuticals	1.87%	2.46%	2.15%	2.43%	2.23%
Media	1.02%	2.17%	1.43%	4.17%	2.20%
RE Management & Development	0.00%	2.47%	2.74%	3.50%	2.18%
Household Durables	1.42%	3.69%	1.91%	1.55%	2.14%



Source: Bloomberg. December 29, 2021.

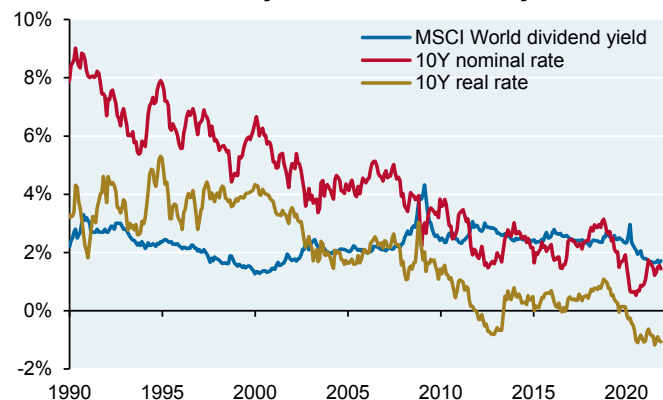


For investors in US equity markets, dividends have not been a critical part of total return. For the 10 year period ending 12/31/2020, US large cap stocks had an annualized total return close to 14%; only 2.1% of this return came from dividends. However, this same was not the case in international equity markets. Investors in portfolios linked to the MSCI EAFE Index (Europe, Australasia, Far East) earned annualized total returns of just 6%, with 3.3% coming from dividends (more than half of the return). Dividends contributed an even larger share of returns in emerging markets (dividend return of 2.84% out of an annualized return of just 4%).

While there is plenty of dispersion in dividend contributions to total returns by region, longer time frames show more similarity. Since 1929, dividends have contributed 38% of total returns in the US. Data doesn't go back as far for non-US markets; developed international equity market data begins in 1986. Over this time period, dividends contributed 33% of total returns, and since 2001, Emerging Market dividends have contributed 29% to total returns. In other words, over the long run, dividend contributions to returns are more similar by region.

While implied dividend yields might seem low compared to history, we believe that MSCI World dividend yields will exceed nominal and real yields on US gov't bonds. That has been the case since the Global Financial Crisis, a trend we expect to continue. Payout ratios appear sustainable, and companies have plenty of cash on their balance sheets.

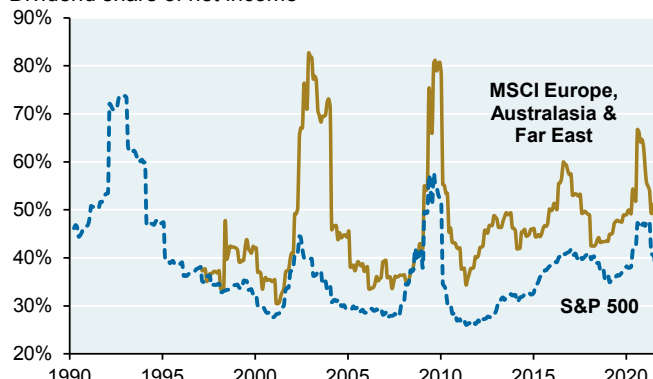
MSCI World dividend yield vs US 10Y bond yield



Source: Factset, Bloomberg, JPMAM. November 2021.

Dividend payout ratios

Dividend share of net income



Source: Factset, JPMAM. November 2021.

Corporate sector cash balances

Cash / total assets ratio



Source: Factset, JPMAM. November 2021.

**[2] Cybersecurity investing: innovation and evil collide, providing opportunity for investors**

Cybercrime is a depressing and nihilistic manifestation of human nature and a reminder that progress does not come without associated costs. Almost every month we read about another significant data breach and in December 2021, the cybersecurity community discovered the Log4Shell vulnerability⁴, described by some as the single largest and most critical vulnerability to date.

- **February 2021:** A breach at a third-party cloud provider allowed hackers access to Kroger's Human Resources data and pharmacy records, resulting in ~1.5 mm records breached (names, phone numbers, addresses, dates of birth, Social Security numbers, prescriptions and health insurance information)
- **May 2021:** Colonial Pipeline carries 45% of East Coast petroleum, diesel and jet fuel and was compromised by hackers who stole 100 gigabytes of data, threatening to release it unless a ransom was paid. Gas prices rose and shortages took place until Colonial Pipeline paid a ransom in Bitcoin
- **July 2021:** The US, EU, UK, and NATO jointly attributed a Microsoft Exchange Server breach to affiliates of the Chinese government's Ministry of State Security. In response, US intelligence agencies released a cybersecurity advisory to disclose additional vulnerabilities stemming from China-affiliated attackers
- **August 2021:** T-Mobile disclosed a breach exposing personal information that affected over 40 million customers; the attacker identified an internet-facing router in a corporate data center and offered the data for sale in a criminal forum

The cybersecurity industry has room to grow if the latest projections of cybercrime, online migration, corporate/government spending and current vulnerabilities are correct⁵:

- Annual cybercrime costs are expected to grow from \$6 trillion today to \$10.5 trillion by 2025
- Global cybersecurity workforce needs to grow 89% to effectively defend critical corporate assets
- 44% of workloads are expected to be on the cloud by the end of 2021, and 55% by 2022
- 82% of organizations claim traditional security tools don't work or have limited functionality
- 77% of remote employees use unmanaged devices
- 85% increase in phishing attacks targeting remote enterprise users⁶

Unsurprisingly, cybersecurity spending is expected to grow from \$140 billion in 2021 to \$180 billion by 2024, including \$2 billion in the 2021 COVID-19 relief bill and another \$2 billion in the infrastructure bill. **Nature abhors a vacuum, so a growing number of companies are trying to address the vast array of cyber risks facing an increasingly online world.** Some notable capital raised in 2021:

- **July 2021:** Riskified achieved a \$3.3 billion valuation through its IPO. Its products are part of the "chargeback guarantee category" of fraud prevention, referring to vendors that accept liability for disputed transactions
- **September 2021:** Snyk, a development operations security platform, raised \$605 million in a round that carried a valuation of \$8.6 billion; ForgeRock (access management) achieved a \$2 billion valuation via IPO
- **November 2021:** Cloudflare and Crowdstrike, the two leading cloud based cybersecurity companies which went public in 2019, now have a combined market cap of over \$125 billion
- **Other 2020 / 2021 unicorns:** SentinelOne, Verdaka, Arctic Wolf, Cato Networks, BigID, Armis Security, Coalition, Wiz, OwnBackup, Axonius, Socure, Orca Security, Lacework and Aqua Security

⁴ **Log4j** is an open source logging framework that reportedly allow requests to servers without checking responses, allowing attackers to execute Java code and/or leak sensitive information

⁵ **Sources:** Cybersecurity Ventures; ISC2 Cybersecurity Workforce Study; American Rescue Plan; Wedbush Securities; Cybersecurity Insiders' Cloud Security Report; Pitchbook Security Report; Warburg Pincus

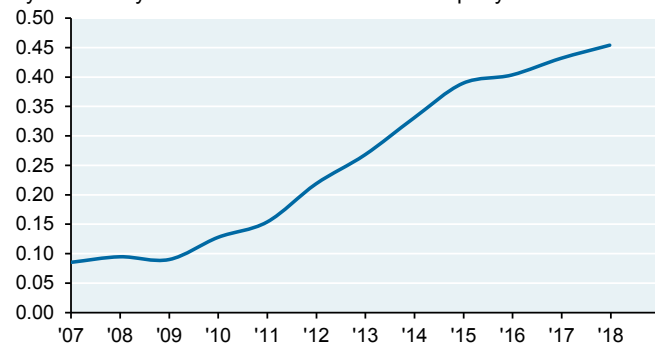
⁶ I am sorry to report that **I failed a firmwide phishing test** this year (for the first time) when I clicked on an attachment from an email I thought was from DHL to reschedule a delivery.



When did cybercrime start to rise? The first chart shows a proxy for cybersecurity risks drawn from company disclosures. Cyber risks existed before the financial crisis but were generally small; they started to accelerate in 2011. The second chart shows actual global cybersecurity spending, with estimates to 2024. Part of the reason for the rapid rise: **lower risks of being a cybercriminal vs risks associated with other criminal enterprises.**

Cybersecurity risk proxy

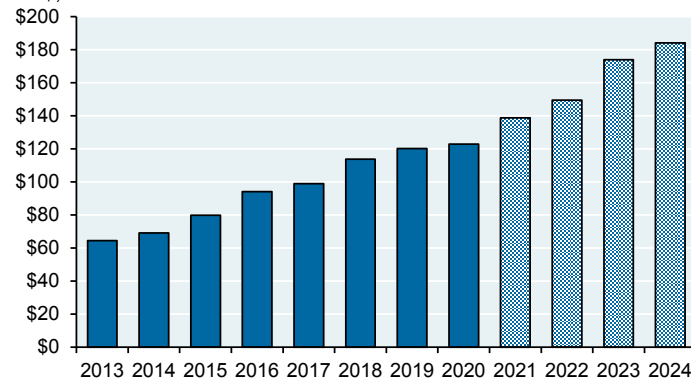
Cybersecurity risk measure derived from company risk disclosures



Source: "Cybersecurity Risk", Florackis et al., Chicago Booth/Swiss Finance Institute. December 2020.

Global security spend estimates

US\$, billions



Source: Warburg Pincus, CS, Gartner. May 2021. Dotted bars = estimates.

Here's a snapshot of the cybersecurity ecosystem. There's a broad range of cybersecurity vulnerabilities and companies aimed at addressing them. The largest cyber companies are often not as good at innovation as smaller ones, creating ample opportunities for consolidation. For context, cybersecurity venture capital funding is now on par with robotics, another "future shock" industry.

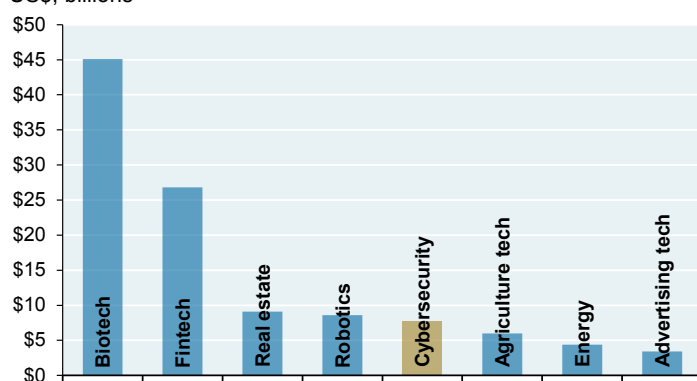
Information security ecosystem

Security operations	Network security	Data security	Application security	Endpoint security	Identity & access management
Managed security services	Cloud security	Database monitoring & loss prevention	Web application protection	Endpoint protection, detection & response	Access management
Log ingestion & security information and event management	Network detection & response	Data privacy & compliance	Cloud workload protection platforms	Internet of things & operational technology security	Fraud prevention
Vulnerability assessment & management	Secure networking	Data protection & encryption	DevOps security platforms	Anti-phishing platforms	Identity governance & administration
Security orchestration, automation & response			Web3 security		

Source: PitchBook, JPMAM. 2021.

2020 venture capital funding by sector

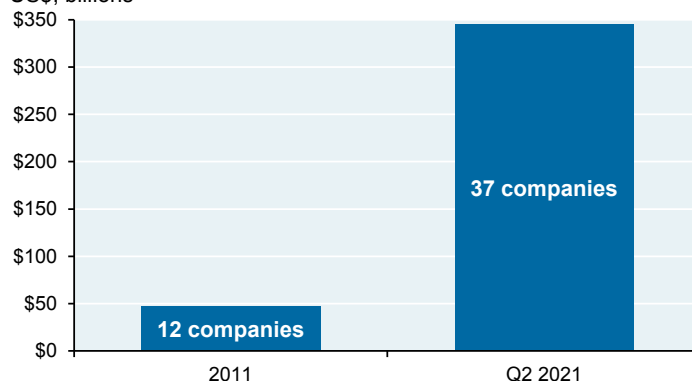
US\$, billions



Source: Crunchbase. 2021.

Market capitalization of public cybersecurity companies

US\$, billions



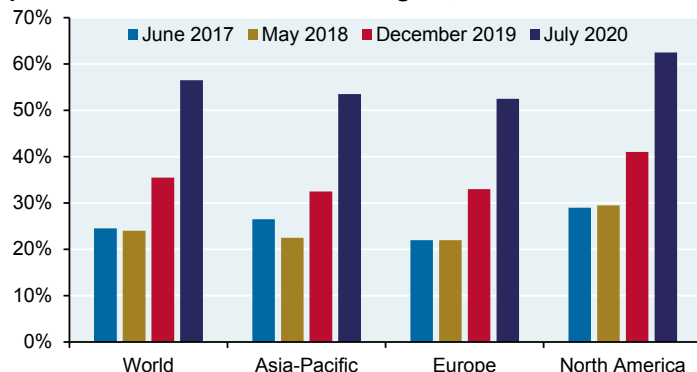
Source: Ten Eleven Ventures. Q2 2021.



COVID accelerated the transition to a more digitized world, which increases vulnerability. McKinsey found that corporate respondents were three times more likely than before COVID to conduct at least 80% of their customer interactions online⁷. Their product and service offerings were also digitized at twice the rate that they were before COVID.

Another major cybersecurity growth sector: energy. Electrification of transportation, industrial energy use and commercial/residential winter heating offers the potential for decarbonization if more wind, solar, hydro and nuclear are added to the grid. But it raises the stakes even further regarding the security of the electricity grid, since even temporary disruptions would cause even greater economic and physical distress.

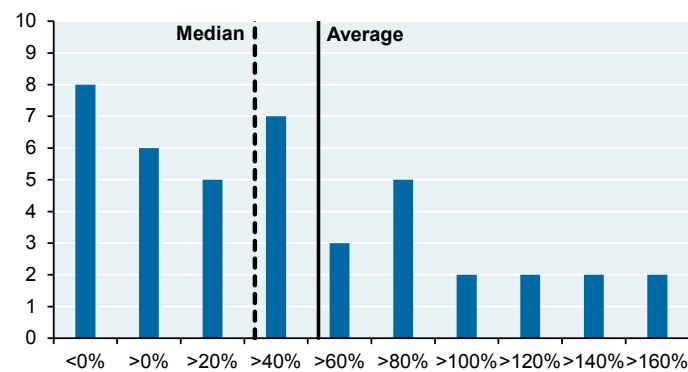
The COVID impact: rising share of customer interactions, products and services that are digital, %



Source: McKinsey. October 2020.

Distribution of cybersecurity total returns since Jan 2020

Number of companies in NASDAQ Cybersecurity Index (n=42)



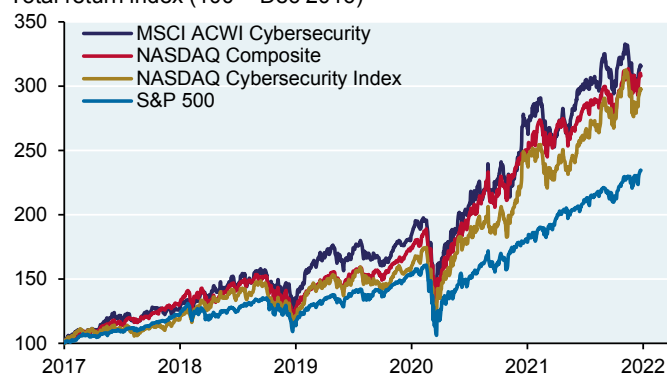
Source: Bloomberg. December 29, 2021.

Public cybersecurity indexes have performed well since 2017, either in line with or exceeding the NASDAQ.

As shown below (right), there has also been a growing number of cybersecurity firm exits by VC firms as the industry matures. However, as is typically the case with an emerging industry, dispersion across individual cybersecurity company returns is quite high (some big winners and losers). That is illustrated above: average returns are much higher than median returns.

Cybersecurity performance

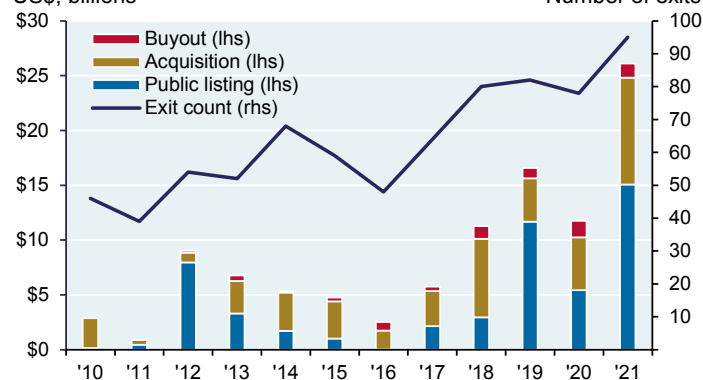
Total return index (100 = Dec 2016)



Source: Bloomberg, JPMAM. December 29, 2021.

Information security VC exits by type

US\$, billions



Source: Pitchbook. Q3 2021. Includes exits in North America and Europe.

⁷ "How COVID-19 has pushed companies over the technology tipping point and transformed business forever", McKinsey, October 2020



[3] F is for Fintech...and also for fear, fraud and foreclosure

There have been attractive opportunities in Fintech given greater reliance by businesses and households on internet based solutions and digital interfaces. In our wealth management business, we designed investment products that focus on both public and private Fintech companies. Fintech valuations are often higher than traditional banks despite having similar profitability. Fintech is a cycle-sensitive industry given its laxer underwriting standards; in an expansion with low household default rates and foreclosure/eviction moratoria (fourth chart below), Fintech *should* outperform traditional banks since they take more risk.

That said, the Fintech industry often relies more on regulatory arbitrage than on providing lower costs or greater speed of access⁸. How long will regulatory arbitrages exist? US regulators are often reluctant to infringe on sectors it sees as delivering innovation, but there are indicators emerging that Fintech does not always function the way it's expected to. **On the following pages, we cite three examples from the COVID period:** the disappearance of Fintech lenders during early stages of the pandemic; the very high estimated incidence of Fintech borrower fraud on PPP loans; and evidence that Fintech lending resulted in more poorly underwritten loans with greater risk of default. **This evidence from COVID builds upon prior research showing greater systemic risks from Fintech lending (see footnote on p.23).** We're watching to see what impact this might have on regulatory oversight of Fintech companies, and how their costs and business models evolve.

US fintech vs bank performance

Total return index (100 = Dec 2012)



Source: Bloomberg, JPMAM. December 28, 2021.

US fintech vs bank valuations

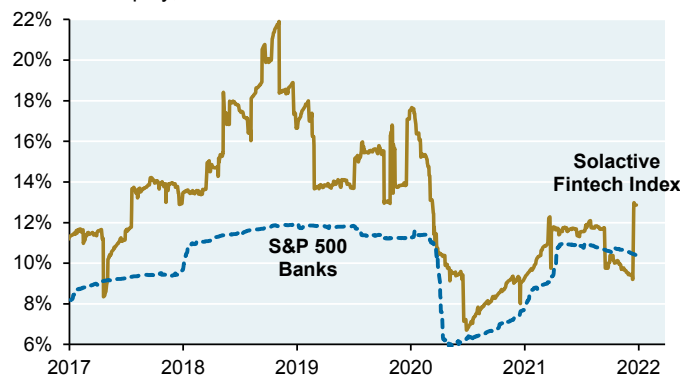
Price to book ratio



Source: Bloomberg. December 29, 2021.

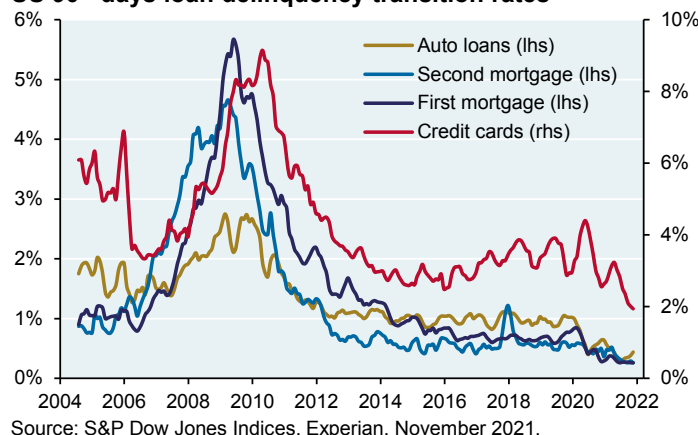
US fintech vs bank profitability

Return on equity, next 12 months



Source: Bloomberg. December 29, 2021.

US 90+ days loan delinquency transition rates



Source: S&P Dow Jones Indices, Experian. November 2021.

⁸ "Fintech, Regulatory Arbitrage and the Rise of Shadow Banks", Buchak (University of Chicago) et al, May 2018. This study found that around 60% of the increase in Fintech's share of mortgage lending can be attributed to regulatory arbitrage, and only 30% to improved technology and speed of access.



Strike One: High rate of probably fraudulent Fintech PPP loans

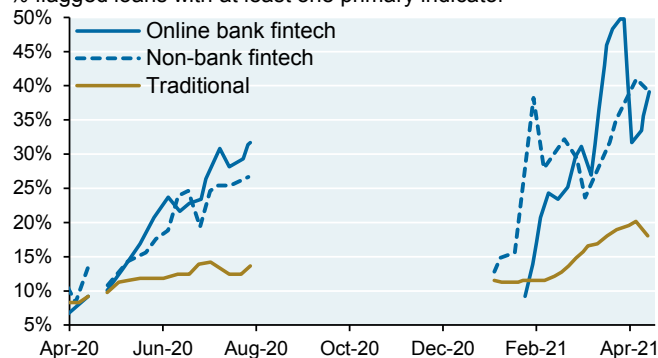
Fintech lenders started out with small PPP loan volumes, but eventually ramped up their market share to over 70% of PPP loans by April 2021. A big data analysis was applied to 10 million PPP loans, applying 4 primary indicators of potential fraud and 5 secondary fraud indicators. Primary fraud indicators include: non-registered businesses, multiple businesses at a single residential address, abnormally high implied compensation per employee, and large inconsistencies in jobs reported on PPP loans compared with information supplied to another government program. Secondary fraud indicators include a comparison of PPP loans within a given industry-county, and the number of establishments that actually exist within that industry-county.

Results:

- Fintech PPP loans were 4.7 times as likely to have a primary fraud indicator that is confirmed by an additional primary or secondary fraud indicator than traditional bank loans
- Nine of the ten lenders with the highest rates of suspicious loans in the analysis are Fintech lenders
- When grouped by industry and county, 35% of Fintech loans exceeded the number of companies that *actually exist* in that industry and county; 28% of Fintech loans exceeded industry-county establishment counts by a factor of more than two (!!)
- Some Fintech lenders had very high concentrations of questionable loans, with 45% subject to one or more of the fraud indicators
- Fintech PPP borrowers were 3.5 times more likely to have a felony record
- Few of these questionable Fintech PPP loans were detected by the Federal gov't or repaid
- Fintech lenders with the highest share of questionable loans in 2020 increased their market share in 2021. In the early stages of the PPP, about 10% of Fintech loans were potentially fraudulent; the percentage of suspicious Fintech loans increased to more than 40% by the end of round 3

Potentially fraudulent loans by lender type

% flagged loans with at least one primary indicator



Source: "Did Fintech Lenders Facilitate PPP Fraud?", Griffin, Kruger and Mahajan (UT Austin). August 2021.



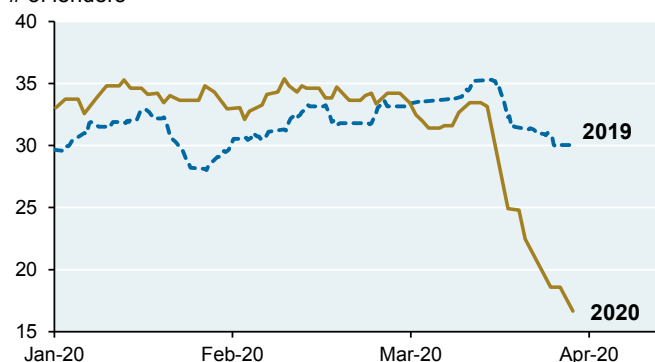
Strike Two: A collapse in US Fintech small business lending during COVID

Fintech small business lending collapsed during the early stages of the COVID recession while traditional banks kept on lending to US companies and households. Fintech lending did not revive until the PPP program took place, raising questions about Fintech lending during a recession in the absence of massive government support. Some facts and figures:

- Fintech lending to small business declined by 75% from Q4 2019 to Q2 2020. Out of 16 Fintech lenders that originated small business loans before COVID, only six were still originating loans in Q3 2020
- There's no evidence of an equivalent collapse in bank loans to small businesses during the same period (C&I loans increased by \$482 billion between March 11 and April 1)
- A collapse in Fintech lending to small businesses was a major factor reducing active small businesses by 22% from Feb 2020 to April 2020. The decline in Fintech lending took place despite the average Fintech loan applicant being of higher credit quality compared to the Fintech loan book from 2019
- The largest single factor explaining this result: financial constraints facing Fintech lenders

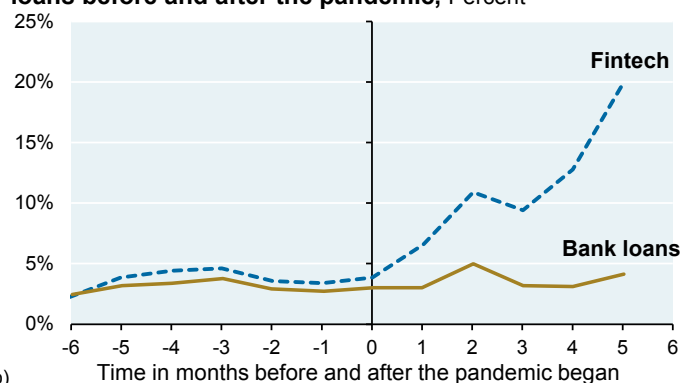
Active fintech lenders

of lenders



Source: "Why Did Small Business Fintech Lending Dry Up?", Ben-David (Ohio) et al. August 2021.

Delinquency rates for Chinese bank loans and fintech loans before and after the pandemic, Percent



Source: "Shadow Banking in a Crisis", Bao and Huang (Monash). Nov 2020.

Strike Three: Evidence from China on higher default rates for Fintech loans vs bank loans during COVID

In the US, PPP loans and other policy measures helped borrowers avoid default. As a result, there's not much empirical evidence regarding risk of Fintech loans vs bank loans during COVID. However, in China there were fewer protections for borrowers, so we can compare loans more readily. As shown above (right), the COVID shock resulted in a surge in Fintech loan delinquency rates while bank loan delinquency rates remained roughly constant. The gap is not explained by first time Fintech borrowers; many borrowers had both Fintech and bank loans, and had a higher propensity of defaulting on Fintech loans. This data is from China, but given what we know about US fintech lending before COVID⁹, I'm inclined to see these results as representative of what one might expect from US Fintech loans during a recession in the absence of government support.

⁹ Pre-COVID research on Fintech systemic risks:

- Consumers turning to Fintech lenders are more likely to spend beyond their means, sink further into debt and default more often than people with similar credit profiles borrowing from traditional banks. Source: DiMaggio (HBS) and Yao (Georgia State University), 2020.
- An analysis of the LendingClub platform found that borrower misinformation does not negatively impact underwriting decisions; and that incomplete income verification by the platform on loan applications negatively affects recovery rates. Source: "Fintech platforms: Lax or careful borrowers' screening", Serena Gallo (University of Campania), July 2021.



REAL ASSETS: COMMERCIAL OFFICE PROPERTY, INFRASTRUCTURE and TIMBER

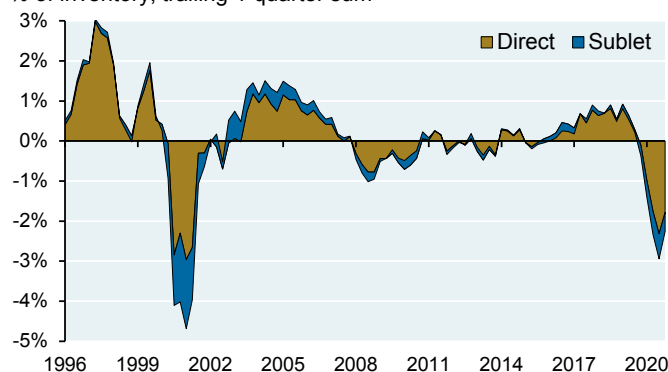
[4] US office market fundamentals: already improving despite COVID

We have written a lot about low office utilization rates in US office markets: ~45% in Dallas, Houston and Austin, and 20%-30% in NYC, SF, LA, etc (see page 26). There is clearly a wide bid-offer between employers and employees regarding work-from-home policies which has yet to be resolved. Even so, there are multiple signs in the US that office market fundamentals are improving.

Vacancy rates can be an incomplete measure of available supply given the long term nature of most office leases. In other words, how much “shadow” vacancy of unwanted space still under lease will also weigh on the market? By adding net direct vacancies plus new net sublet vacancies and dividing by total office inventory, we can assess office market stress compared to prior business cycles. As illustrated below, the stress in New York City right now is pretty intense: more than twice as high as during the Global Financial Crisis, although not nearly as bad as the aftermath of the tech crash in 2001. In Chicago, the current stress numbers are lower than NYC in absolute terms, and also more similar to both prior cycles.

New York direct and sublet quarterly absorption

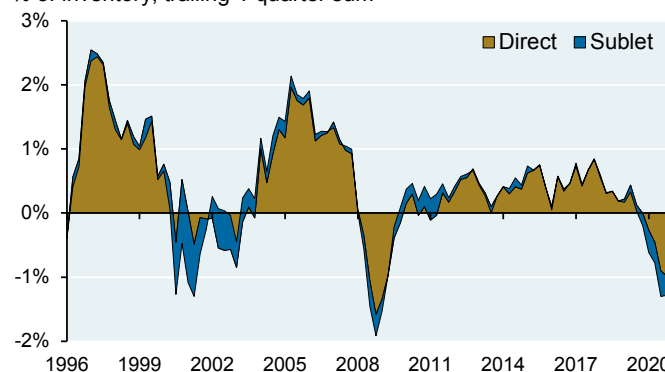
% of inventory, trailing 4-quarter sum



Source: Costar, JPMAM. Q3 2021.

Chicago direct and sublet quarterly absorption

% of inventory, trailing 4-quarter sum



Source: Costar, JPMAM. Q3 2021.

US office markets are very heterogeneous, so it's important to look at details. NYC, DC, Seattle, Minneapolis and Denver stand out as having higher stress than during the GFC, and for DC and Denver, the stress is worse than during the tech bust as well. One generalization does emerge: in almost all large US office markets, vacancy trends were already improving in Q3 2021 vs Q2 2021 despite the ongoing debate about the future of office work. In other words, Q3 2021 absorption data were almost all less negative than they were in Q2.

US office market stress

	Inventory (mm sq ft)	Direct plus sublet absorption as % of inventory				Q3 COVID multiple of GFC weakness	Q3 COVID multiple of tech bust weakness
		COVID (Q3 2021)	COVID (Q2 2021)	GFC	Tech bust		
New York - NY	979	-2.3%	-2.9%	-1.0%	-4.7%	2.2x	0.5x
Washington - DC	527	-1.6%	-2.0%	-0.3%	-0.6%	5.1x	2.6x
Chicago - IL	511	-1.3%	-1.3%	-1.9%	-1.3%	0.7x	1.0x
Los Angeles - CA	435	-1.5%	-2.2%	-2.1%	-1.4%	0.7x	1.1x
Dallas-Fort Worth - TX	423	-1.1%	-1.3%	0.3%	-0.3%	na	3.4x
Boston - MA	377	-1.4%	-1.8%	-0.9%	-2.9%	1.5x	0.5x
Houston - TX	356	0.0%	-0.8%	0.9%	-0.5%	na	0.0x
Atlanta - GA	344	-0.8%	-1.5%	-1.1%	0.6%	0.7x	na
Philadelphia - PA	326	-1.2%	-1.8%	-1.0%	-1.6%	1.1x	0.7x
Seattle - WA	236	-1.5%	-2.0%	-0.7%	-2.0%	2.1x	0.8x
Detroit - MI	204	-0.5%	-1.0%	-1.3%	-1.5%	0.4x	0.3x
Minneapolis - MN	203	-1.8%	-1.6%	-0.4%	0.0%	4.5x	na
Phoenix - AZ	201	-1.1%	-1.0%	-1.7%	1.1%	0.6x	na
San Francisco - CA	188	-2.7%	-3.9%	-2.7%	-6.3%	1.0x	0.4x
Denver - CO	184	-1.8%	-2.6%	-0.6%	-1.2%	2.9x	1.5x

Source: Costar, JPMAM. Q3 2021.

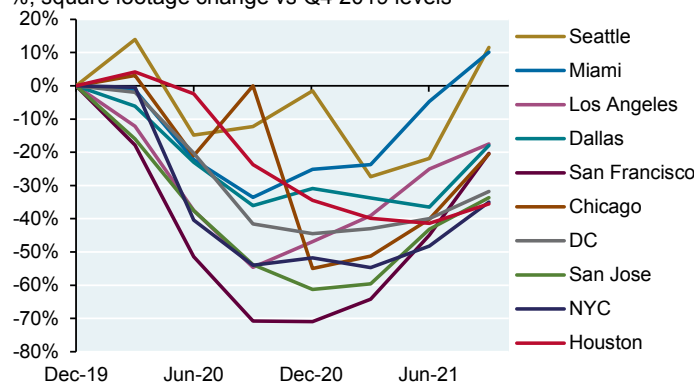


More evidence of a recovery in office markets despite COVID: leasing and lease terms

Leasing activity is arguably an even better leading indicator of what's going on than vacancy, since leasing can be tracked before the official start date of the lease itself. As shown on the left, office leasing trends are already improving for many of the large office markets, although Houston, NYC and DC are lagging. The other notable improvement: a lengthening of lease terms since Q3 2020, a sign that renters are becoming more confident in their long-term space needs assessments. **To reiterate: commercial real estate markets are already firming despite the fact that labor-vs-management disagreements over office utilization are still ongoing.**

Office leasing trends (quarterly)

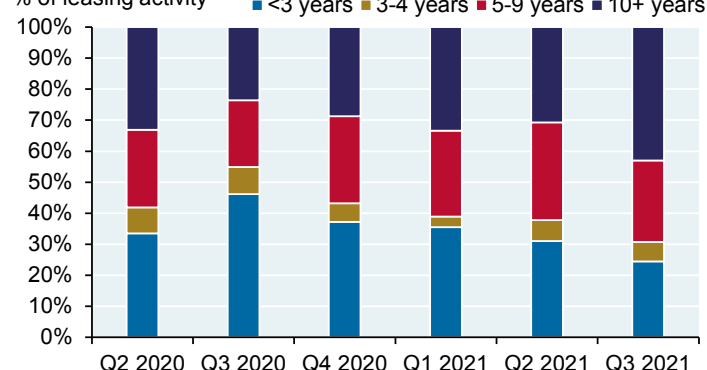
%, square footage change vs Q4 2019 levels



Source: CoStar. Q3 2021.

Longer leasing terms are increasing

% of leasing activity

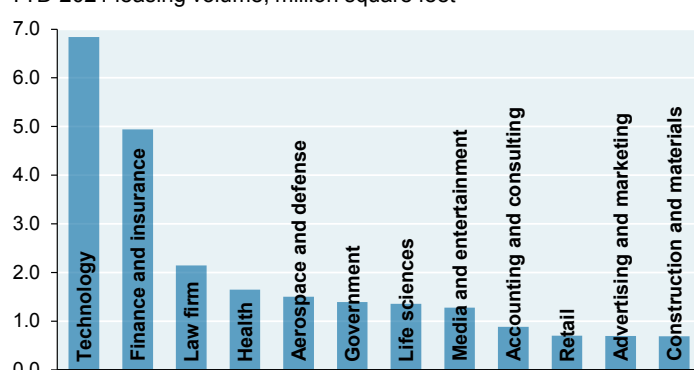


Source: JLL. Q3 2021.

While this might seem like a return to pre-COVID conditions, there are important changes to highlight. There are clear trends showing a rise in space demand by technology firms in newer buildings in growth node areas. As a result, our commercial real estate investment teams believe that owning generic central business district office is no longer as reliable a route to appreciation. Even as vacancies come down, a large swath of the office market may likely remain weak as long-term returns for those buildings are dragged down by higher capex designed to fight these secular trends. Accordingly, generic office should ideally make up a smaller share of portfolios, and real estate portfolio investors should focus on buying or building modern office in growth nodes.

Commercial office leasing volume by sector

YTD 2021 leasing volume, million square feet



Source: JLL, CoStar, JPMAM. Q3 2021.

Office building absorption by construction year

YTD 2021 net absorption, million square feet



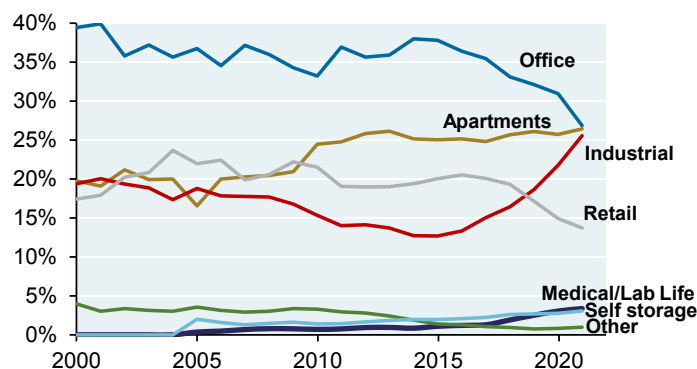
Source: JLL, CoStar, JPMAM. Q3 2021.



The declining share of office investing in institutional and REIT portfolios

Any discussion on office fundamentals would be incomplete without mentioning its gradual decline in many institutional portfolios. As shown below, office allocations have declined in the bellwether MSCI Core Diversified Open-End Property Fund Index which captures allocations across \$270 bn of real estate investment. The same lower exposure to office is true with regards to publicly traded REITs. Industrial, life sciences and specialty property types have been the major beneficiaries of this shift.

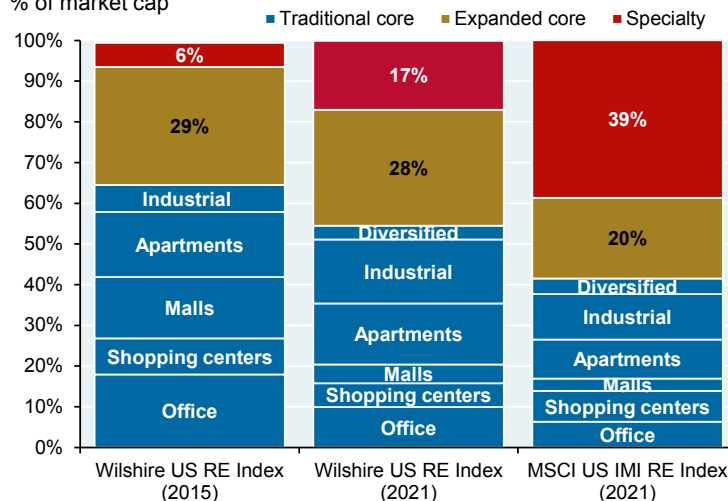
MSCI commercial real estate core index property type allocations



Source: MSCI, JPMAM. Q3 2021.

US REIT breakdown by sector

% of market cap



Source: Wilshire, Vanguard, JPMAM. Q3 2021.

Sector definitions:

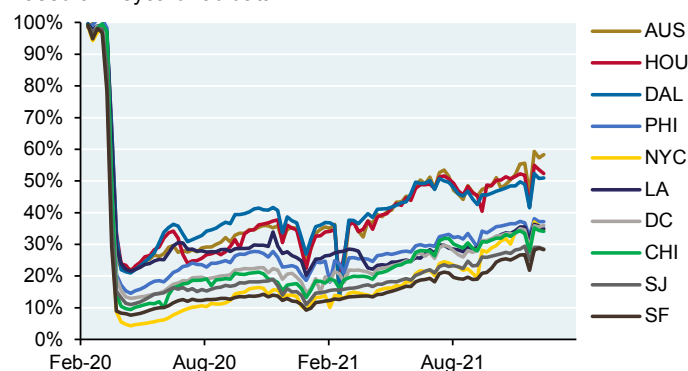
Expanded core: self-storage, hotels, senior housing, medical offices, student housing and manufactured homes

Specialty: data centers, single family rentals, land and cell towers

Measures of office utilization: Keycard/fob data and Google phone geolocation

Office utilization rates by metro area

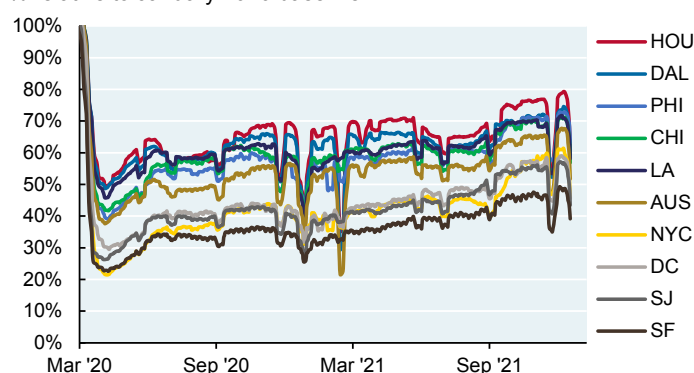
Based on keycard/fob data



Source: Kastle. December 15, 2021.

Google workplace mobility trends

% relative to January 2020 baseline



Source: Google. December 24, 2021. 7 day avgs.

**[5] Infrastructure investing: devil is in the details (electricity distribution, solar power and bulk storage)**

Infrastructure investing has become more broadly accepted over the last decade. In a 2019 survey¹⁰, 96% of institutional investor respondents said they were either maintaining or increasing the pace of infrastructure investment. Investors are now comfortable with value-added approaches and co-investment in addition to core funds, with a focus on renewable energy, transportation, energy/power, waste management and telecom.

One difference between infrastructure and other alternative sectors is the presence of government projects structured as Public Private Partnerships (“PPPs”). A decade ago PPPs were a main pillar of core infrastructure investing, but politics, challenges to existing projects and complexity have been a problem in some jurisdictions, and they have fallen out of favor among many investors and managers.

Instead of walking through some bland facts and figures on infrastructure assets, I thought it would be more interesting to dive into the details of the risk and return catalysts affecting some of our actual infrastructure investments. Our infrastructure team and I review three of them below: one in regulated electricity distribution, one in contracted solar power and one in bulk liquid storage. The Q&A helps illustrate the micro and macro factors at work in infrastructure investing.

Regulated electricity distribution

What kind of utilities do you often look for?

Vertically integrated utilities can be attractive investments: they operate customer-facing distribution and interstate transmission lines and own generation capacity, which reduces power they need to purchase from third parties and allows them to sell power in wholesale markets. In addition to vertically integrated utilities, stand-alone transmission and distribution assets can be attractive as well. We pay attention to demographic and income characteristics of a region to ensure that utility bills represent a manageable percentage of earned income. Finally, we tend to avoid potentially distressed utilities with legacy operational and other problems since it can be difficult for new owners to distance themselves from mistakes of the past.

What kind of generation mix do you find in such integrated utilities?

There is obviously a wide variation across companies. One of our holdings generates around 40% of its electricity from natural gas, another 40% from nuclear power and the rest from purchased power and wholly owned renewables. The nuclear plant’s license ends in 2044; furthermore, decommissioning costs are recoverable as long as the utility prefunds them on an annual basis.

What are the primary drivers of utility profitability? When we look at publicly traded utilities, the 75th and 25th percentile ROE is 11.3% and 6.4%, while the 75th and 25th percentile free cash flow margin is 24% and 17%. In other words, profits are more divergent than revenues.

Profitability is based on allowed ROE set by regulators, which management may try to exceed by controlling costs (i.e., actual ROE). Profit variability in public utilities is often driven by business mix as many are not pure-play regulated monopolies. While an unregulated business model might seem interesting, it has often led to underperforming assets and distress. One example: merchant power generation which was hurt by stagnant energy demand, the rise of renewables and the decline in natural gas prices. The key problem with the merchant business model: generator revenues generally do not cover all-in costs of energy supply, capital and variable costs¹¹. Such costs can include existing and new regulations governing air emissions, coal ash disposal and cooling systems which renewable resources with zero variable cost do not contend with. Notable historical bankruptcies of merchant generators include Calpine, Dynegy, Mirant, NRG Energy and Texas Energy Future Holdings, and the competitive generation subsidiaries of AES, Edison International and PG&E Corp. These bankruptcies ended up destabilizing associated regulated utilities as well.

¹⁰ “Infrastructure institutional investor trends”, Probitas Partners, 2019

¹¹ “The breakdown of the merchant generation business model”, Wilkinson, Barker and Knauer/PRG, 2017



Investments in pure-play monopolies where a majority of earnings are derived from remuneration structures and regulator-approved capital investment reduce uncertainty and result in more stable ROEs. In addition, investing into control positions in relatively high-margin utilities under investment grade capital structures provides relatively forecastable free cash flow for distributable yield.

When utility investments don't work out, what are the primary reasons?

We can think of three. First, unexpected and sudden regulatory/political changes could pressure the company to lower customer bills or prioritize other metrics (i.e. environmental goals), making allowable equity returns unsustainable. We generally prefer state and local jurisdictions with a long history of predictable policies regarding returns on capital invested. One example of a sudden regulatory change: after the Three Mile Island episode in 1979, regulators substantially changed rules and design requirements for previously approved nuclear power plants that ended up doubling, tripling and in some instances quadrupling costs.

Second, essential service utilities are responsible for providing critical services without interruption, keeping services affordable, maintaining safe operations, and operating in environmental compliance. A failure to deliver can result in loss of faith with customers, employees, the community, regulators and politicians. PG&E is probably the best example of a company that has through its merchant power and operations failures lost the support of many stakeholders, which complicates their ability to achieve a long term viable ROE.

Third, leverage can cause big problems for utilities. Most utilities are investment grade and businesses are managed to these levels carefully. Leverage can lead to business failures, particularly when allowable equity returns are reduced by the regulator. Allowable returns could decline due to the company benefitting from a decline in its own cost of capital, or when retrospective reassessments of prior contracts show the company's net cash flow outperformed initial expectations.

Contracted solar power

I have a number of questions on how independent solar power producers actually function within the grid. Let's start here. How are curtailment situations handled in countries they operate in? In other words, if they can produce solar power at a given moment but it's not drawn due to an excess of potential load over demand, do they suffer the opportunity cost loss of curtailment or are they paid for foregone generation?

Curtailment has not been a major issue for our solar company, although there are specific instances in countries like Chile and Japan when they experience intermittent curtailment. The big picture: a large portion of its generation is sold under tariff structures and/or take-or-pay power purchase agreements (PPAs), many of which have protection against curtailment. Spain's regulated return revenue structure is one example of this.

Similarly, as new solar assets are added to the grid, does the company end up having any priority or are all participants treated the same irrespective of when their plants were built?

Each market is different; our solar company typically invests in assets that have a large majority of cash flows contracted either through private PPAs, or benefiting from feed-in tariffs and other government-backed programs. Most independent power producers do not have explicit grid priority from a transmission dispatch standpoint, but the company's more seasoned assets usually benefit from higher feed-in tariffs. Having a global reach is critical, since from time to time, the latest PPA agreement and subsidy arrangements may no longer provide attractive returns to new investment. The ability to scan opportunities in North America, South America, Europe and Japan helps the company focus on the best investment opportunities available at the time.



Have your solar managers experienced declines in capacity factors over time? There are industry debates about the speed with which capacity factors decline as equipment ages.

Overall, the decline in capacity factors is minimal in solar when compared to wind. Active asset management is key to maintaining a high level of operational productivity across the portfolio. The company centralizes monitoring of performance across its global installed base in conjunction with on-the-ground operating teams that respond to issues as they arise. Additionally, the company engages in repowering and/or revamping efforts to benefit from declines in module pricing and any technological advances that occur.

Does the company build solar facilities from scratch or does it only buy existing completed ones?

The company predominantly operates existing “brownfield” projects, and also pursues completion of late-stage development projects where they already have an existing presence.

I know this can get complicated, but in a general sense, how much of its power is sold at a prefixed price per kWh vs spot market pricing reflective of demand conditions at that time?

The company generally enters into long-term contracts with investment grade counterparties, with the majority of operating assets remunerated under fixed-price government-backed revenue schemes (feed in tariffs). These contracts generally have minimal power price exposure. In some markets, remuneration can result in small merchant price exposure, but the company aims to minimize this exposure across its portfolio. Its weighted average contract life is around 22 years.

Bulk liquid storage facilities

I know you have also invested in Gulf Coast multi-modal bulk storage facilities for liquid fuels which are accessible by rail, truck, barge and deep water vessels. Like some of the solar power PPAs, I get the sense the storage facility cash flows are not highly sensitive to actual throughput volumes. Is that right?

That’s right; around 70% of the company’s revenues are derived from take-or-pay storage contracts, with contract rates indexed to inflation.

Do the company’s storage tanks hold oil and other liquid fuels as well?

Part of the attraction here is the revenue mix by end product. The company actually does not store gasoline and also does not store a lot of oil derived products. Its facilities are mostly focused on storing industrial chemicals such as lubricants, caustic soda, acids used for chemical production, fertilizer and agriculture-related feedstocks, and some renewable fuels. As a result, we do not expect a material impact on the company from declining oil & gas demand resulting from electrification of transport or home heating.

Are the company’s facilities primarily used for liquid fuels moving around the US from one place to another, or for import/export to other countries?

The primary customer profile is a large strategic player whose storage assets are fully integrated into their supply chain. In some cases, the company stores material as a last stop before shipment to domestic and international customers, and in other cases, it stores critical inputs for domestic manufacturing processes. Its facilities are a critical step in the supply chain for its customers, and the company tends to have high rates of contract renewal and customer integration (~85% renewal rate).

How long do these storage tanks last?

Physical useful lives are ~40 years, and existing ones can be refurbished and repositioned with minimal capital spending relative to replacement value. For certain product switches (i.e., mineral oils to agricultural oils), they would need full replacement.



[6] Timber: steady yields with potential upside in a world searching for real sequestration

Timber investing has been around for a long time; some of the first analyses of expected returns were derived by German forester Martin Faustmann in 1850. The tables below compare US timber returns to other US real assets, and show nominal and risk adjusted returns. US timber returns have been lower since the 2008 housing crisis caused a collapse in demand: the US has a surplus of Southern Pine that may take another decade to exhaust¹², even with today's tight housing markets. I'm not a fan of risk-adjusted returns applied to illiquid appraisal-based assets for the obvious reasons, and include them for those who put more stock in them than I do. US timber investing has been a pretty steady, modest-return addition to portfolios over the last 20 years¹³.

The exhibits below show NCREIF index returns for real assets, which are not investable. These indexes track **unleveraged** property returns; in practice, most managed products investing in real assets hold some degree of leverage. One example: the NCREIF ODCE index tracks returns of commercial property funds which in aggregate use ~25% leverage, two thirds of which is at the property level.

Unleveraged real asset returns, 1991-2021

Asset class	Annualized return	Standard deviation	Sharpe ratio
Farmland	10.6%	5.8%	1.36
Industrial properties	9.9%	4.9%	1.49
Timberland	8.9%	6.8%	0.91
Apartment properties	8.7%	4.3%	1.43
Retail properties	7.5%	4.2%	1.16
Office properties	6.9%	5.3%	0.81

Source: Bloomberg, NCREIF, JPMAM. Q3 2021.

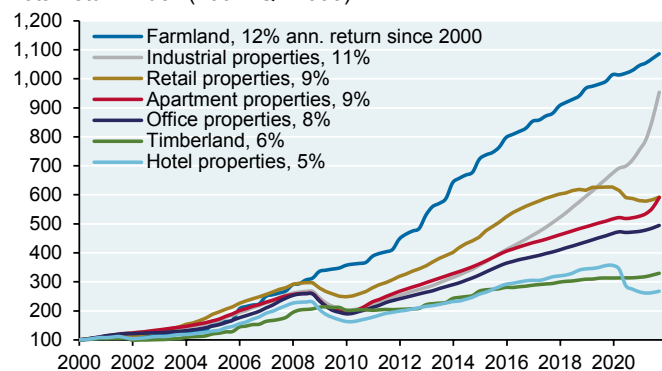
Unleveraged real asset returns, 2000-2021

Asset class	Annualized return	Standard deviation	Sharpe ratio
Farmland	11.6%	6.7%	1.55
Industrial properties	10.9%	5.1%	1.92
Retail properties	8.5%	4.6%	1.60
Apartment properties	8.5%	4.7%	1.55
Office properties	7.6%	4.9%	1.33
Timberland	5.6%	4.7%	0.95
Hotel properties	4.6%	7.0%	0.49

Source: Bloomberg, NCREIF, JPMAM. Q3 2021.

Unleveraged real asset returns since 2000

Total return index (100 = Q4 1999)



Source: Bloomberg, NCREIF, JPMAM. Q3 2021.

¹² **On Southern Pine.** Our timber managers believe that in the US Southeast, while sawlog prices could start rising in 2-4 years, it could take another 8-10 years for structural demand to fully restore the Southern Pine supply/demand balance and price trajectory that existed before 2008.

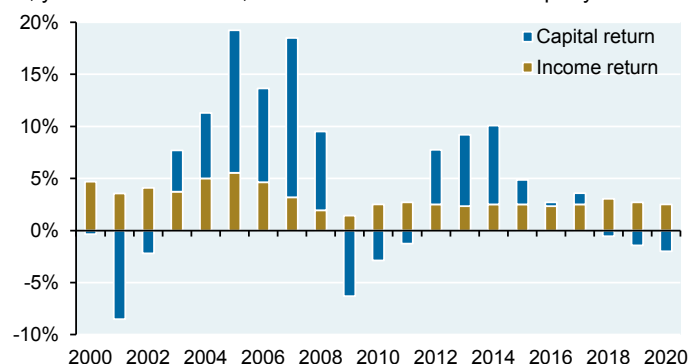
¹³ An October 2018 article in the WSJ highlighted the losses incurred by a large US institutional investor selling its timber portfolio. The details are important to understand: its timber portfolio was purchased at peak valuations in 2008 right before the housing collapse impacted timber prices; the project was highly leveraged and some of the best timber was harvested early to pay down debt; the timber portfolio was undiversified (just Texas and Mississippi); and according to our forestry contacts, was subject to a lease with below-market price, quantity and escalation clauses.



Timber total returns can be variable from year to year. As shown in the chart, income from harvesting is steady. Capital return refers to changes in valuation and can vary, a reflection of monetary policy, changes in long term interest rates, housing policy and the value of potential land use changes. Over the last three decades, timber returns have exhibited higher positive correlations with inflation than other real assets. On tax treatment: in the US, income from timberland harvesting is treated as capital gains rather than as ordinary income.

Timberland performance: income vs capital return

%, year-end total return, NCREIF U.S. Timberland Property Index



Source: Hancock Natural Resource Group. December 2020.

Returns vs inflation (1991 - Q3 2021, 5 yr ann)

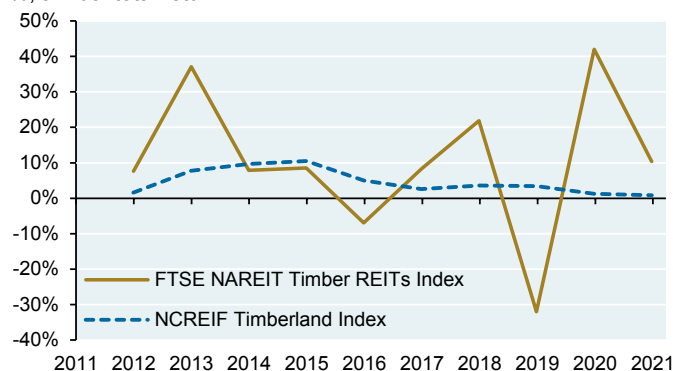
Asset class	Correlation	R squared
Timberland	54%	30%
Apartment properties	31%	9%
Office properties	27%	7%
Retail properties	19%	4%
Farmland	13%	2%
Industrial properties	3%	0%

Source: Bloomberg, NCREIF, JPMAM. Q3 2021.

What about timber REITs? Investors in publicly traded REITs typically expect annual distributions irrespective of the economic or timber cycle. As a result, timber REITs tend to harvest timber every year whether lumber prices are high or low. In private timber vehicles, managers have the option to time harvesting more closely to the variations in log prices. For many institutional investors, private vehicles may make more sense since while REIT structures avoid double taxation, they still incur some level of corporate tax.

NCREIF Timberland vs Timber REITs

%, annual total return



Source: Bloomberg, NCREIF, JPMAM. 2021.

Timber REITS have different return profiles than the NCREIF timberland index:

- Timber REITs use leverage, NCREIF is unleveraged
- Timber REITs can own saw mills to convert saw logs into lumber & manufactured wood products; Weyerhaeuser usually earns almost as much from wood products as it does from timber harvesting, in some years 3x more
- Timber REITs like Rayonier own forests outside the US where returns can be higher; its New Zealand forest holdings and some non-forest interests represent 50% of net income; NCREIF Timber index is US forests only
- Timber REITs reflect recessions immediately, while NCREIF valuations rely on intermittent appraisals

Some timber investment risks¹⁴:

- Insects and diseases are unlikely to attack managed forests; mortality likelihood less than 0.2% per year
- Historically, fire losses have been < 1% per year on all US forestland, including public lands in California and other areas in the Western US. One example: in Oregon, the US Forest Service owns 60% of all forestland which has sustained 86% of all burned acreage over the last decade. However, very high winds created anomalous conditions in 2020 and resulted in high loss rates on private lands as well: of the 1 million acres that burned in Oregon, 40% were on industrial or private lands. Possible benefits of greater logging and clearing on private lands to reduce fire risks are inconclusive. After a fire, soil rehabilitation, clearing and planting seedlings can cost as much as \$1,500 per acre on more mature forests
- Hurricanes and storms affect less than 0.2%-0.5% of US timberland per year

¹⁴ "Global timberland investment returns and prospects: 2020", Fred Cabbage, North Carolina State University



Timber: non-US investments

The return data shown above reflects US timber investments only. Many timber portfolios have substantial international holdings as well, where returns can be higher. There's a lot of heterogeneity to global timber, and risks outside the US can be higher as well. A 2020 paper in *"Forest Policy and Economics"* included the table below on timber returns in 2020 by country and species. This analysis excludes land costs and reflects the IRR earned assuming pre-existing land ownership. The IRR differences primarily reflect variations in timber planting costs, forest management costs, timber prices for stumpage and timber growth rates. Including land costs can reduce the IRRs shown by 3%-8%; the main point of the table is to highlight the higher returns often obtainable outside the US.

Timber investment rates of return excluding land costs

Country	Species	IRR
Argentina	<i>Pinus taeda</i> - Misiones	7%
Argentina	<i>Eucalyptus grandis</i> - Corrientes 1	21%
Brazil	<i>Pinus taeda</i> sawtimber	12%
Brazil	<i>Eucalyptus urophylla</i> pulpwood, S.P.	9%
Chile	<i>Pinus radiata</i> sawtimber - good site	14%
Chile	<i>Pinus radiata</i> pulpwood - poor site	12%
Chile	<i>Eucalyptus globulus</i> pulpwood	15%
Chile	<i>Eucalyptus nitens</i> pulpwood	12%
China	<i>Eucalyptus</i>	29%
China	<i>Pinus massoniana</i>	8%
Colombia	<i>Eucalyptus grandis</i>	2%
Colombia	<i>Pinus patula</i> sawtimber	11%
Colombia	<i>Pinus patula</i> pulpwood	0%
Colombia	<i>Pinus tecunumanii</i>	14%
Ecuador	<i>Tectona grandis</i>	11%
Ecuador	<i>Eucalyptus globulus</i> (4 cutting cycles)	12%
Ecuador	<i>P. radiata</i> / <i>P. patula</i> - 80%/20%	7%
Finland	<i>Picea abies</i>	4%
Finland	<i>Pinus sylvestris</i>	4%
Laos	<i>Eucalyptus</i> spp. Industry	21%
Laos	<i>Eucalyptus</i> spp. Outgrower	32%
Laos	<i>Tectona grandis</i>	21%
Laos	<i>Tectona grandis</i>	16%
Mexico	<i>Pinus gregii</i>	12%
Mexico	<i>Eucalyptus grandis</i>	21%

Country	Species	IRR
New Zealand	<i>Pinus radiata</i> , no pruning	11%
Paraguay	<i>Eucalyptus</i> sp. clones	22%
Poland	<i>Quercus</i> Sp. State Forest	3%
Poland	<i>Quercus</i> Sp. Private	4%
Poland	<i>Pinus sylvestris</i> State Forest	1%
Poland	<i>Pinus sylvestris</i> Private	3%
Spain	<i>Populus</i>	10%
Spain	<i>Eucalyptus globulus</i>	11%
Spain	<i>Eucalyptus nitens</i>	10%
Spain	<i>Pinus radiata</i>	6%
Uruguay	<i>Eucalyptus smithii</i>	15%
Uruguay	<i>Eucalyptus dunnii</i>	12%
Uruguay	<i>Eucalyptus grandis</i> pulp	14%
Uruguay	<i>Eucalyptus grandis</i> sawtimber - faster	12%
Uruguay	<i>Eucalyptus grandis</i> sawtimber - slower	4%
USA	<i>Pinus taeda</i> / Medium Yield & Intns NC	5%
USA	<i>Pinus taeda</i> / High Yield & Intensity NC	7%
USA	Mixed Hardwoods, Even Age, Planted, Clearcut	3%
USA	<i>Psuedotsuga menziesii</i> Site I	7%
USA	<i>Psuedotsuga menziesii</i> Site III	6%
Vietnam	<i>Acacia</i> Smallholder	26%
Vietnam	<i>Eucalyptus urophylla</i> High growth	22%

Source: "Global Timber Investments Benchmarking Triennial Report, 2020", Cubbage et al. (NC State University)

A few comments on the table:

- Timber growth rates vary considerably, but in general Northern Hemisphere native temperate forests grow more slowly than exotic plantations in subtropical and equatorial Southern Hemisphere forests. Temperate exotic plantation growth rates and prices in Oceania, Chile, and South Africa fall between Northern Hemisphere and subtropical regions
- South American forests are generally comprised of pine from North America and eucalypt from Australia. These species are now in the second or third generation of genetic improvement and intensively managed on relatively good sites where they can grow almost all year long. As of 2017, average growth rates in Brazil were the highest in the world, at up to 40 cubic meters per hectare per year for pine and 50 cubic meters per year for eucalypt. These high growth rates and good forest management practices often require medium to above average forest establishment costs as well
- Timber investing in Asia can be difficult: land is scarce, rural infrastructure is poor, government institutions are weak, biological and political risks are higher and achieving good forest management can be challenging



What about cross laminated timber demand (“CLT”)? Builders are examining the potential to use CLT mass timber as an alternative to steel and concrete. If this became commonplace, it could provide additional demand for Southern Pine and Douglas Fir and for Canadian softwoods as well. In 2019, the International Code Council approved proposals to allow tall wood buildings as part of the 2021 International Building Code. The code includes provisions for up to 18 stories of heavy timber construction for businesses and residences. Here are some pros and cons; to be clear, mass timber is still a negligible component of current demand.

CLT Pros: performs well in fire vs steel and concrete according to the US Forest Service, the International Code Council and the Fire Protection Research Foundation; reduces carbon emissions compared to traditional building methods; allows buildings to be constructed faster with lower labor costs and less waste; performs well in earthquakes; and can support better forest management on public lands.

CLT Cons: durability and structural concerns given the cracking and collapse of CLT subflooring panels used in a college of forestry building in Oregon. Subsequent investigation found that the root cause was a factory error related to binding agents used to glue individual boards together, and not a pervasive risk related to use of CLT itself. Water can also lead to warping, rotting and mold if not properly addressed.

Timber optionality, corporate carbon emissions commitments and carbon sequestration by trees. More than two thirds of companies and 80% of S&P 500 market cap have announced commitments to reduce or eliminate their carbon footprints, some committing to reverse emissions from prior years. If they’re planning to accomplish this via direct air capture or carbon mineralization, they’re facing a rude awakening: as explained in our 2021 energy piece, direct air capture energy requirements appear to be 6x-10x higher than traditional geologic carbon sequestration, a process which itself now only sequesters 0.1% of global emissions due to its high costs and complexity. If that’s the case, many companies may find themselves eventually needing to invest in timber in order to deliver on their sequestration commitments.

Might it make sense at some point to own timberland in order to monetize carbon sequestered by the trees rather than to harvest them? This is a very forward-looking idea, particularly since nationwide markets for selling tree-sourced carbon sequestration do not exist yet in the US. The Western Climate Initiative market only includes California, Quebec and Nova Scotia, and the Regional Greenhouse Gas Initiative is limited to 11 Northeastern states; both combined only represented 12% of the global carbon market by value in 2020. But it is notable that in a variety of studies, the breakeven price per ton of carbon for timber owners (i.e., the indifference point between either selling carbon credits or harvesting the trees) was consistently less than \$50 per ton. **In other words, should carbon markets emerge with prices per ton that are similar to levels now seen in Europe, timber owners might eventually have another route to monetizing their investment.**

Estimates of breakeven carbon price needed to offset revenues lost from foregone forest harvesting

Study location/authors	Year	Description	Breakeven price (per ton of CO ₂)
British Columbia, Canada (Man et al.)	2014	At 30% of baseline harvest level, study analyzed three forest regions in British Columbia over a range of top heights at age 50 and timber net revenues.	\$3.9-\$40.8
Gabon, Africa (Ndjondo et al.)	2014	Assumes a median timber contribution margin (selling price less construction price) is \$25 per m ³ for all commercial species.	\$11-16
Nepal (Pandit et al.)	2017	Examines the feasibility of financial incentives for forest carbon sequestration in community forests within Nepalese watershed regions.	\$2.4-\$41.8
Washington, USA (Fischer et al.)	2017	Using regional average land-holding costs and assuming a no-harvest scenario, study uses probabilistic simulation to estimate carbon credit break point price.	\$14
Legal Amazon region, Brazil (Silva et al.)	2018	Assumes average forest carbon density of 132 tons per hectare to estimate the price of reducing deforestation in terms of agricultural income foregone.	\$16

Source: University of Nebraska, University of British Columbia, University of Washington, University of Western Australia, Research Institute for Tropical Ecology (Gabon), JPMAM. 2018.

**POLICY ISSUES: CHINA'S REGULATORY PURGE, BREXIT and ESG INVESTMENT FACTORS****[7] China portfolio inflows continue despite 2021 regulatory purge and slowing growth**

Chinese growth stalled last fall as new standards for real estate and other sectors curtailed growth, and as rising energy prices¹⁵ and power rationing shifted its industrial production rebound into reverse. **Signals for 2022 are mixed, but we believe the positives will outweigh the negatives as it relates to onshore Chinese stocks.** We're still cautious for obvious reasons on offshore Chinese internet stocks.

Positives: stimulus has been modest so far, just a 50 bps cut in bank reserve requirements but was accompanied by pro-growth statements and allowance for greater credit allocation to local gov'ts, small/medium enterprises, mortgages and developers. While Chinese corporate profits growth has weakened due to losses at hog farms, independent power producers and companies impacted by new regulation, JP Morgan Equity Research expects 19% earnings growth in 2022 along with 4.7% real GDP growth and just 2% inflation.

Negatives: in November, antitrust regulators were given tougher enforcement powers and broader reach. Internet regulation has been deemed essential for long-term governance which may result in lower revenue growth, higher compliance costs and more volatility from regulatory events. This follows growing regulatory costs and operating restrictions on overseas listings and tracking of consumer data. China hasn't provided much help to defaulting property developers, and some of their projects may end up transferred to state owned firms. Finally, zero COVID policies continue to constrain growth, and anti-pollution policies may constrain industrial production as China prepares for the 2022 Winter Olympics.

China economy: positive signs

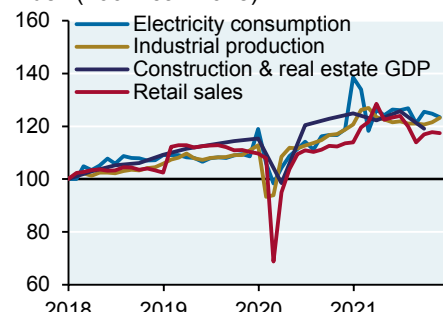
Index (100 = Jan 2018)



Source: General Administration of Customs, MSCI, JPMAM. November 2021.

China economy: stable signs

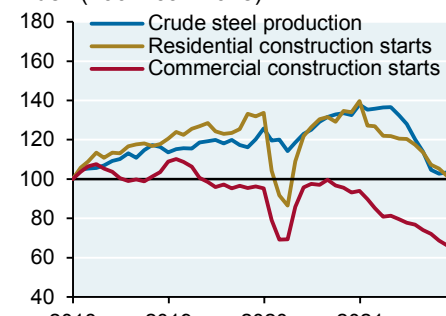
Index (100 = Jan 2018)



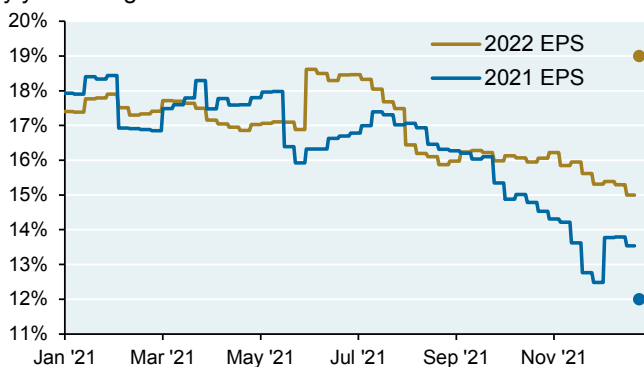
Source: China NBS, China Electricity Council, JPMAM. November 2021.

China economy: negative signs

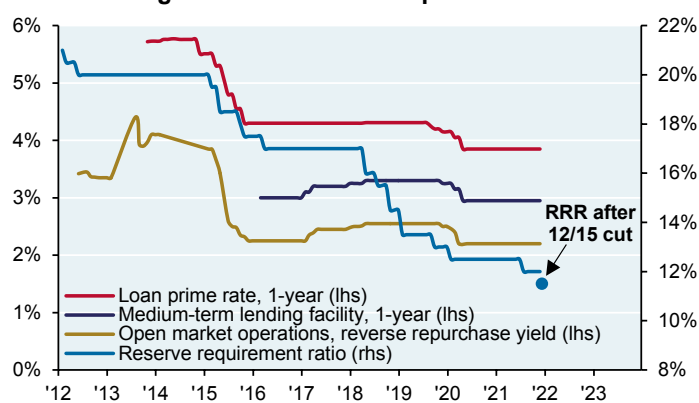
Index (100 = Jan 2018)



Source: China NBS, JPMAM. November 2021.

MSCI China consensus earnings expectations by year
y/y % change

Source: Datastream, JPMAM. December 28, 2021. Dots = JPM forecasts.

China lending rates and reserve requirements

Source: People's Bank of China. November 2021.

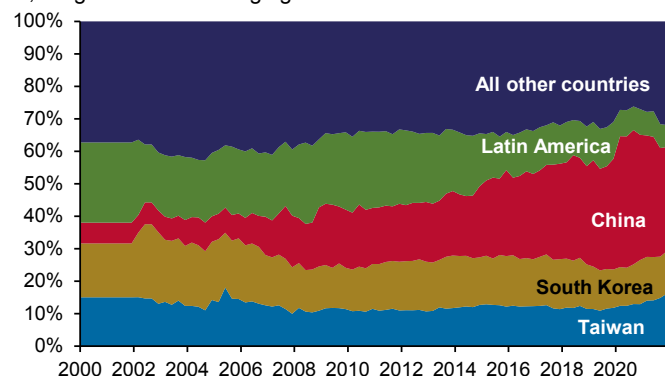
¹⁵ **China's power problems** are the byproduct of a surge in its power demand as the global economy rebounded; lower China hydropower output which increased demand for coal powered generation; a slowdown in China coal production due to climate goals, safety concerns and a coal price cap, leading to power plants running down coal inventories below normal levels; and price controls in China's power sector which prevent utilities from recovering rising input costs (China has since relaxed coal production restrictions and implemented price controls on coal itself).



On China and portfolio inflows. Emerging Market equity index products used to provide more geographically diverse exposures. For reasons both good¹⁶ and bad, this has changed: China, South Korea and Taiwan alone now comprise two thirds of the entire MSCI EM equity index. Most money managers tend to stick pretty close to these index levels; a pre-COVID look at the largest EM money managers showed median country weights that were only 1%-3% away from benchmark for these three countries. Also interesting: manager overweights tended to be out-of-benchmark positions rather than overweights elsewhere in the EM universe.

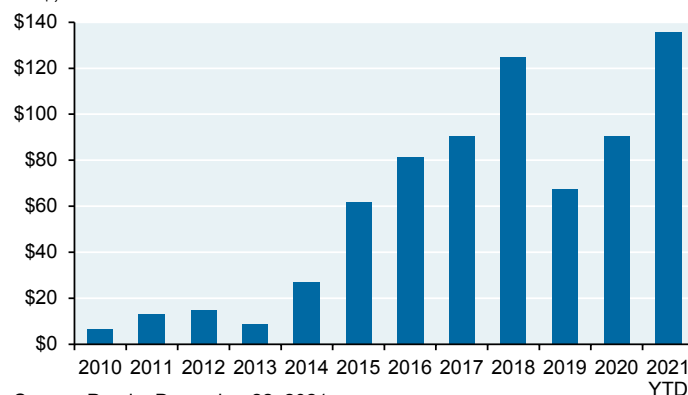
China's weight in the MSCI EM index could rise from 35% to 45% as more of its onshore market cap is included. **For this reason and given the ongoing rise of an enormous middle class in China, we will still believe the long run opportunity in China is compelling, despite the 2021 regulatory purge.** When looking at venture capital inflows in 2021 (YTD through late December), private investors apparently believe that the Chinese government will not permanently cripple long term growth prospects of many large and successful private enterprises. As shown below, private equity and venture investments in Emerging Asia (much of which is China) have substantially outperformed public equity markets. Private investors tend to focus on healthcare, staples, insurance and other sectors that are under-represented in China's public equity markets.

Emerging markets country weights
%, weight in MSCI Emerging Markets Index



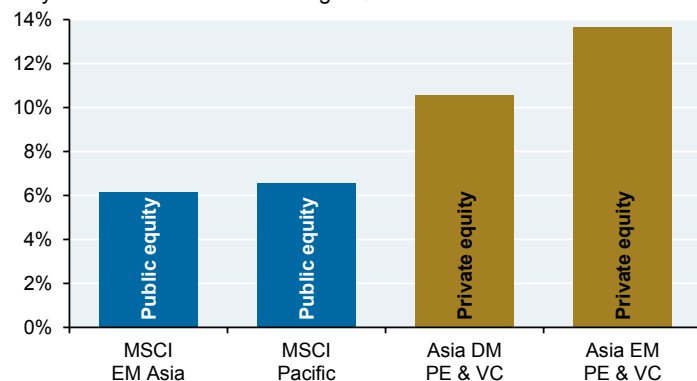
Source: Bloomberg. December 28, 2021.

China VC investments by US dollar denominated funds
US\$, billions



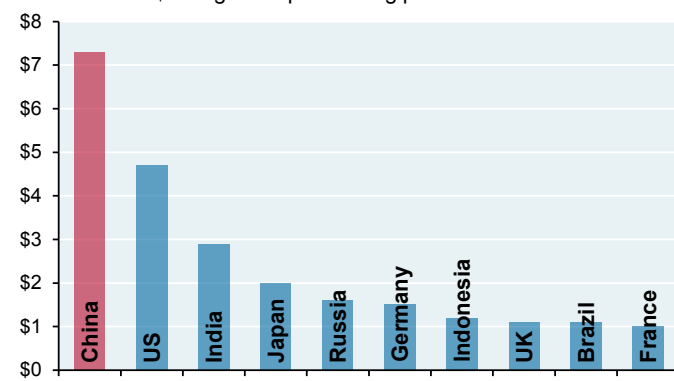
Source: Preqin. December 22, 2021.

Private equity performance versus public equity in Asia
10-year annualized return through Q2 2020



Source: Cambridge Associates LLC, Bloomberg, JPMAM. Q2 2020.

Middle class consumption in 2020
Trillions of US\$ using 2011 purchasing power



Source: Brookings Institution. October 2020.

Sources include *"Regulatory risks remain"*, Thomas Gatley, Gavekal Research, December 2, 2021 and *"China Equity Earnings Tracker"*, JP Morgan Equity Research, December 3, 2021

¹⁶ From the year 2000 to 2020, MSCI EM Asia and MSCI EM Latin America generated cumulative returns of 377% and 300%, respectively; that's outperformance by EM Asia of 1% per year on an annualized basis. Over the last ten years, the differences are even starker: -28% for MSCI EM Latin America and 95% for MSCI EM Asia. Both of these numbers pale in comparison to the S&P 500's ten year performance of 267%.

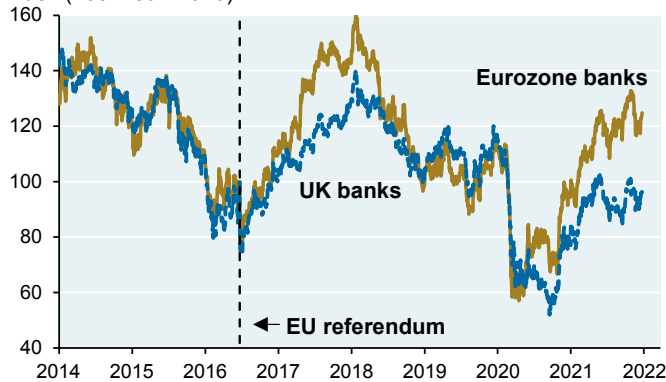


[8] Brexit and the high price of national sovereignty

Some of the most pessimistic Brexit assessments ever written were published by British economists. I always wondered how being British might have affected their outlook; many are employees of financial institutions and owners of London real estate, so they had two oxes that were about to be gored. As shown in the first chart, UK banks have lagged European peers since Brexit. The ECB is still pushing EU banks to relocate staff and facilities back to the continent, so the process is not complete. London home prices did decline after Brexit, but have since risen in tandem with home prices globally.

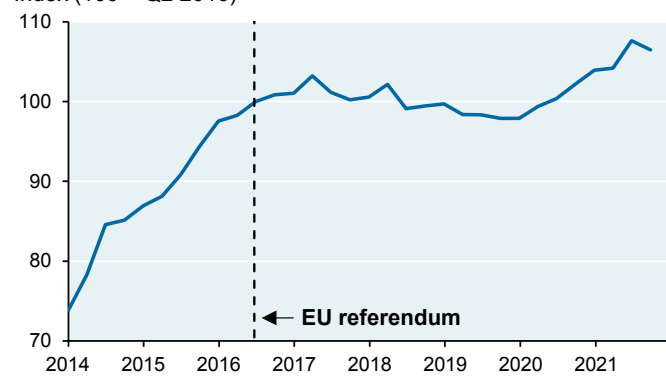
UK banks vs Eurozone banks

Index (100 = Jun 2016)



London home prices

Index (100 = Q2 2016)

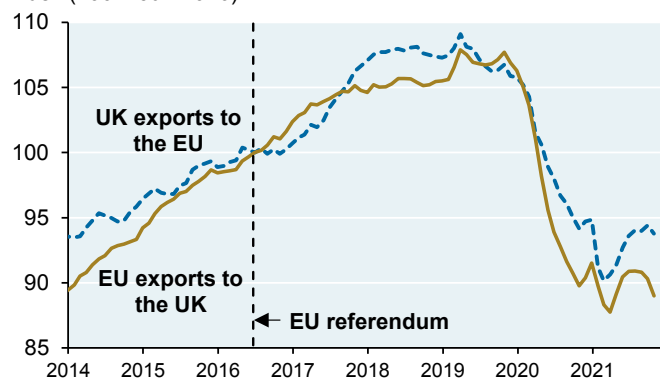


Let's step back and consider the consensus view that Brexit was going to end badly for the UK overall. The hard part is that we are not very far into the Brexit era. While the referendum took place in 2016, the UK did not legally leave the EU until Jan 2020 and did not formally leave the single market until the end of the transition period in Dec 2020. Also, the impacts on and responses by UK consumers and businesses will be spread over time. Lastly, the COVID pandemic impacts a lot of the data, making it harder to interpret. Despite these challenges, we are going to try and make an early assessment anyway.

Trade with the EU rose in the aftermath of Brexit since new trading provisions took time to be implemented. It wasn't until early 2019 that UK trade with the EU began to decline; and as soon as COVID hit, it collapsed even faster due to domestic demand declines in both the UK and Europe. Trade with the rest of the world collapsed as well and so far, the only thing that picked up in 2021 was UK importation of non-EU goods (UK exports to the rest of the world did not offset EU trade declines as Brexit proponents hoped). Even so, the 15% decline in the Pound since the eve of the referendum has helped stabilize the overall UK balance of trade. The UK current account deficit of 3.3% (Q3 2021) is around the average of the last 20 years, following a period of much larger deficits (see p. 38). Bottom line on trade: not great but too influenced by COVID to know for sure.

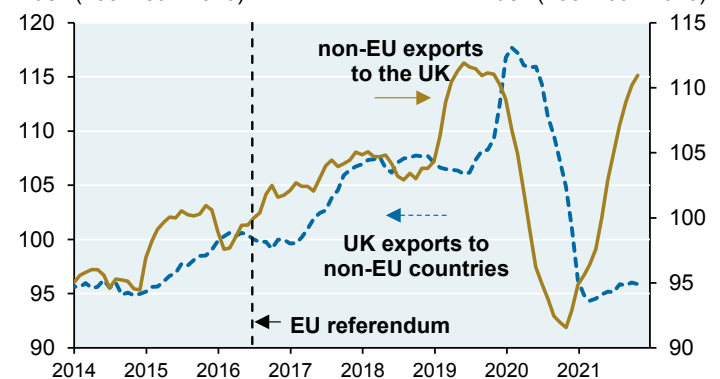
UK trade volumes with the European Union

Index (100 = Jun 2016)



UK trade volumes with non-EU countries

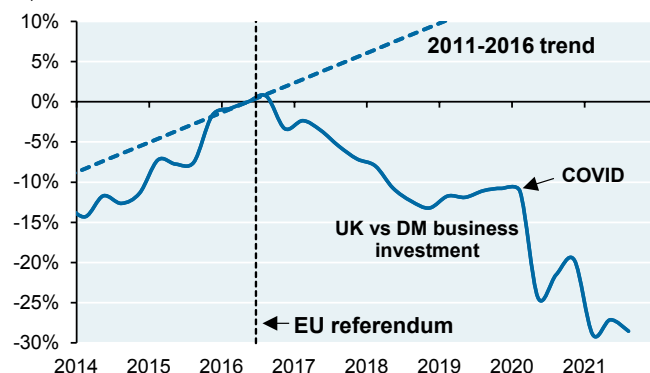
Index (100 = Jun 2016)





On business investment, the results are in: Brexit is pretty bad for the UK. The first chart shows how UK capital spending was rising vs the rest of the developed world from 2011 to 2016. Post-referendum, UK capital spending trends declined sharply vs the developed world even before COVID, after which it got even worse. The second chart shows the data by country; there is clearly a Brexit impact here, and it's a negative one. If you believe that business capital spending is one of the most important indicators of economic health, productivity gains, labor demand and growth, the current gap (if sustained) would be a very clear negative consequence from Brexit.

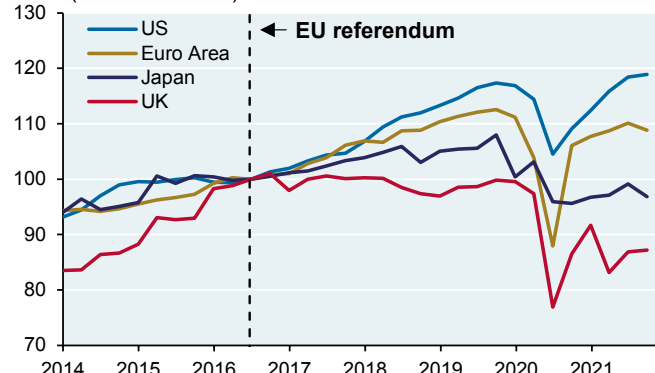
UK business investment relative to developed markets
%, indexed to 2Q 2016



Source: JPM Economic Research. Q3 2021.

Real business investment

Index (100 = Jun 2016)



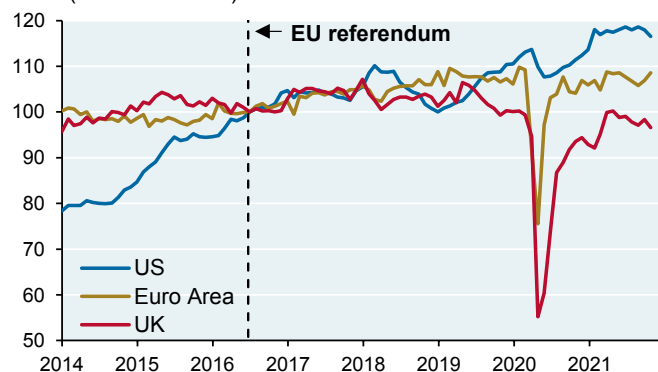
Source: BEA, Cabinet of Japan, regional statistical offices, JPMAM. Q3 2021.

The data on construction is similar; after Brexit there's a widening output gap vs the Euro area and the US, one that gets even worse after COVID. **Brexit is not just an issue for industry; it also ushered in a period of lagging UK real disposable income, particularly when compared to the US as illustrated below, right.** One example: the 2016 depreciation of the Pound is estimated by the London School of Economics to have increased consumer prices by 2.9% or the equivalent of a £870 increase in the cost of living per year for the average household.

These are multidimensional cross country relationships, and there are a lot of other factors influencing them other than Brexit. But...the timing of widening gaps appears inextricably linked with the Brexit referendum. It's also possible that structural deficiencies which Brexit creates for the UK have hampered its ability rebound from COVID as fast as other regions. That's not proven yet but will be something to watch.

Construction sector output

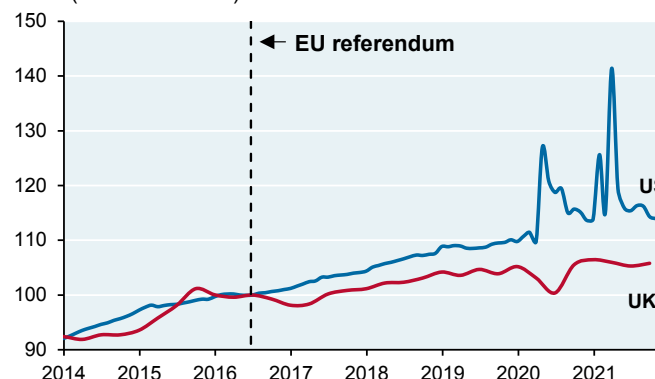
Index (100 = Jun 2016)



Source: Census, BLS, Eurostat, UK ONS, JPMAM. October 2021.

US vs UK real disposable household income

Index (100 = Jun 2016)



Source: BEA, UK Office for National Statistics, JPMAM. November 2021.



What might Brexit supporters point to as evidence that the journey is worth it?

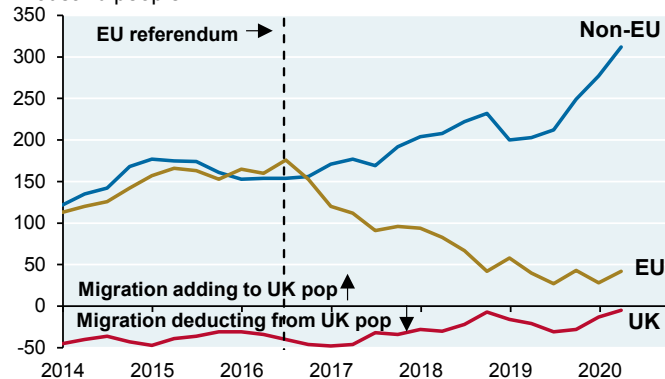
After the Brexit vote, many analysts pointed to a deeply entrenched desire in part of the UK population to regain control over its borders, something it could not do as part of the EU. A desire to strengthen border control is kind of ironic: according to historian Stuart Laycock, Britain at some point in its history invaded 90% of the world's countries. Laycock uses a broad definition, of course: if Britain achieved a military presence in the territory through force, threat of force, negotiation or payment, he included it. Furthermore, incursions by British pirates, privateers or armed explorers were included if they operated with approval of the British gov't.

Anyway, what happened on immigration since Brexit? With increased border control now in place, the UK relaxed constraints on immigration. Migration from the EU to the UK did drop sharply after Brexit. However, in a departure from Theresa May's approach, Boris Johnson implemented policies to relax the cap on Tier 2 visas for non-EU relatively skilled or highly paid migrants, with mechanisms to raise the cap when needed for occupations with labor shortages. As a result, non-EU migration into the UK has been soaring. Bottom line: **the new policies created a more geographically diverse and selective system, designed to benefit the UK economy**¹⁷. [Note: this is the kind of merit-based immigration system that exists in countries like Canada and Australia, and which Trump mentioned he was interested in but did nothing about.] UK opinion polls suggest voters have now become less concerned about immigration and are more positive about its economic impacts.

The strange thing about Brexit: the UK had obtained an advantageous position vis a vis Europe, having single market access, financial sector benefits and access to skilled labor without being stuck with the Euro albatross. Brexit now discards that advantageous position. One of my British economist friends describes Brexit as the "other great catastrophic policy mistake of the past 100 years", the first being the decision by Churchill to reinstate the gold standard at pre-war parity levels in 1925. He sees both as a consequence of nationalist pride and a misguided vision of the UK's place in the world. **We'll see; the ship has sailed and both the costs and benefits of Brexit to the UK are now clearer. While Brexit is not the disaster that many feared, at least not yet, the costs are piling up already and the post-Brexit era has just begun.**

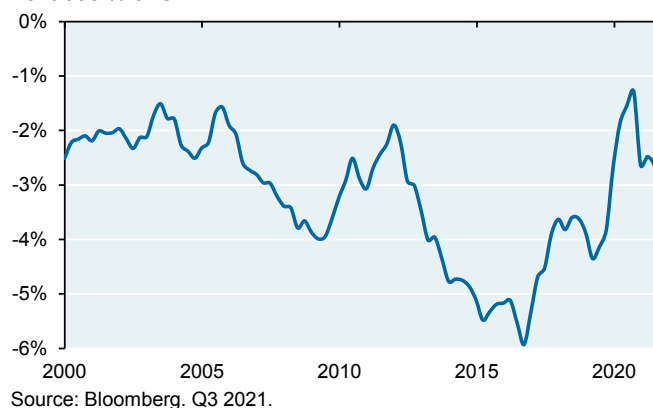
UK net migration by citizenship

Thousand people



UK current account balance

Deficit as % of GDP



¹⁷ "Immigration and the UK economy after Brexit", Jonathan Portes, Professor of Economics at Kings College and Senior Fellow at the Economic and Social Research Council, June 25, 2021



[9] ESG portfolio benefits look clearer but precede the 2021 recovery of traditional energy sectors

I prefer to wait for a large number of studies before making determinations about any factor affecting security selection in portfolios. On ESG, we now have a bit more evidence. A 2021 report from NYU aggregated 245 studies published from 2015-2020 to compare ESG portfolio performance with conventional ones¹⁸. The authors divided the studies into “corporate” studies which analyzed operational metrics (e.g. ROE, ROA, stock price) and “investor” studies which analyzed risk-adjusted performance metrics (e.g. alpha, Sharpe ratio).

The results: 58% of the corporate studies found a positive relationship between ESG factors and financial performance and only 8% found a negative relationship. Among investor studies, 33% found ESG had a positive impact, whereas 14% found a negative impact as compared to conventional portfolios. The rest of the studies found a neutral impact or mixed results. Big picture: **an ESG focus appears to help more than hurt.**

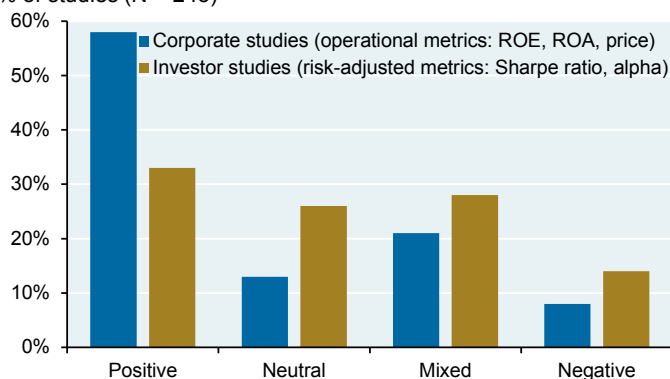
The NYU study also aggregated 15 corporate and investor meta-analysis studies and found similar results. The 13 corporate meta-analysis studies (covering 1,272 unique studies) found a consistent positive correlation between ESG and corporate financial performance. The 2 investor meta-analysis studies (covering 107 unique studies) found that ESG investing returns were indistinguishable from conventional investing returns.

Caveat #1: oil & gas. While ESG outcomes reflect a lot more than the difference between renewable and traditional energy stocks, this gap did play a role in the outcomes of many studies cited above. As shown below this gap has now reversed, with traditional energy stocks outperforming a basket of renewable energy indexes by nearly the largest amount in a decade. Global plans to accelerate decarbonization may reinstate the prior trend, but that remains to be seen.

Other caveats: the last several years have created a perfect storm tailwind for ESG investing. In addition to the underperformance of oil & gas sector, there has been a surge of inflows into ESG strategies. These flows could explain *why* ESG stocks are outperforming, rather than reflecting intrinsically higher profitability or greater resilience to climate related risks; such parabolic inflows into ESG strategies may not last forever. Also: low real interest rates have boosted investor tolerance for unprofitable growth companies (see first chart on page 14), some of which are ESG-focused. In effect, the Trade War and COVID short-circuited the narratives for many cyclical and value stocks, shifting attention to growth at any price. If the world economy ever gets a chance to move beyond these two risks, valuations for long horizon growth stocks could fall sharply.

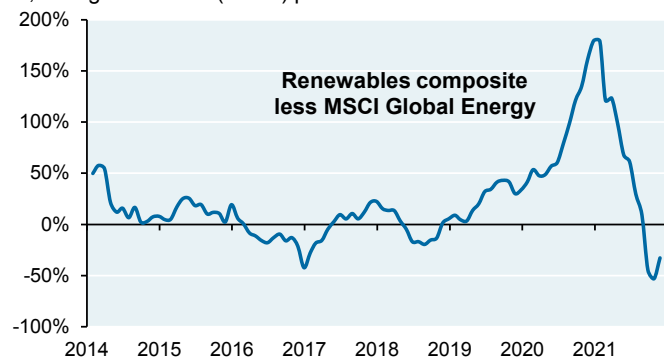
ESG impact on financial performance

% of studies (N = 245)



Excess return of renewables vs fossil fuels

%, rolling annual out (under) performance



Source: Bloomberg, JPMAM. November 2021. Renewables composite is the average of 5 energy indices: CELS, ECO, EORE, SPGTCD, SUNIDX.

¹⁸ "ESG and financial performance: uncovering the relationship by aggregating evidence from 1,000 plus studies published between 2015 - 2020", Whelan (NYU Stern) et al, February 10, 2021.

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