Capital Markets Strategy
Essential inCights for the C-Suite

MUFG

Supply Side Dislocations

Navigating Disruption, Delays & the Downgrade to Global Growth

NOV 2021

Global Corporate & Investment Banking
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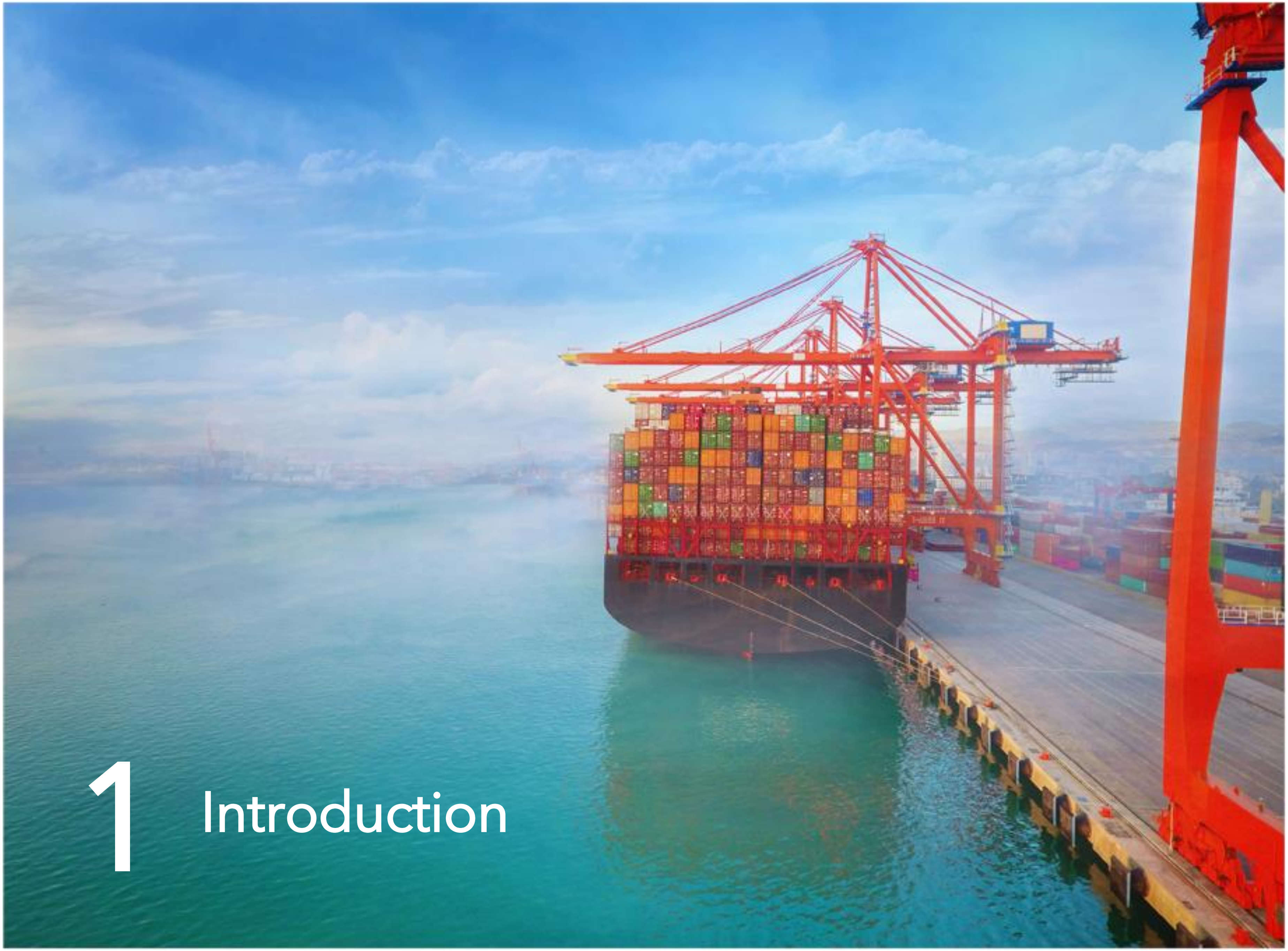
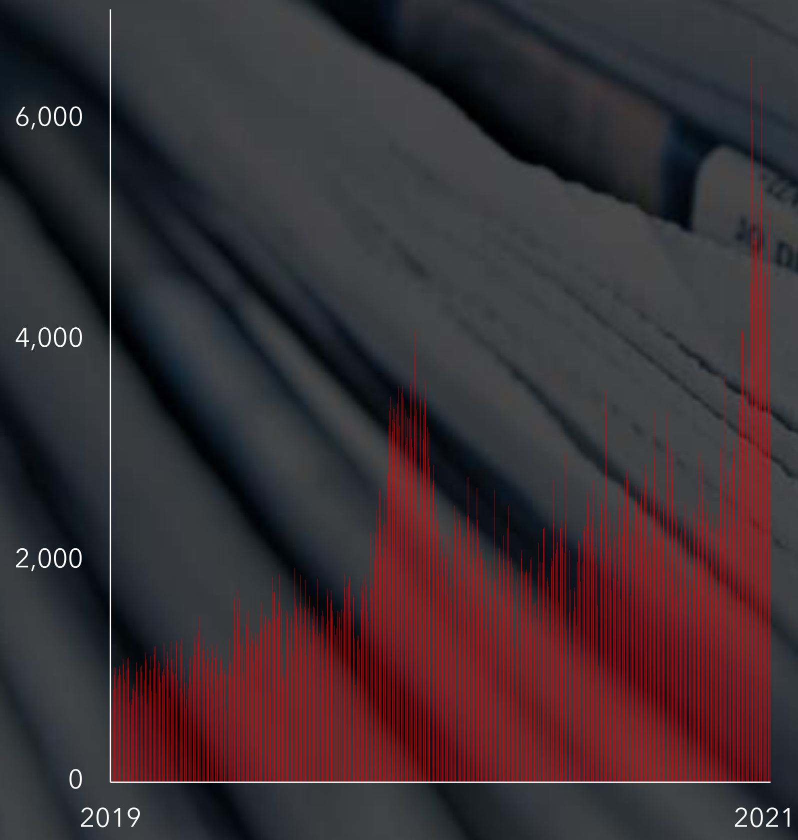


1 Introduction

Supply Chain Disruptions Top of Mind

Mentions of "supply chains" in investor and earnings calls reached a record high in 2021

News stories mentioning supply chain



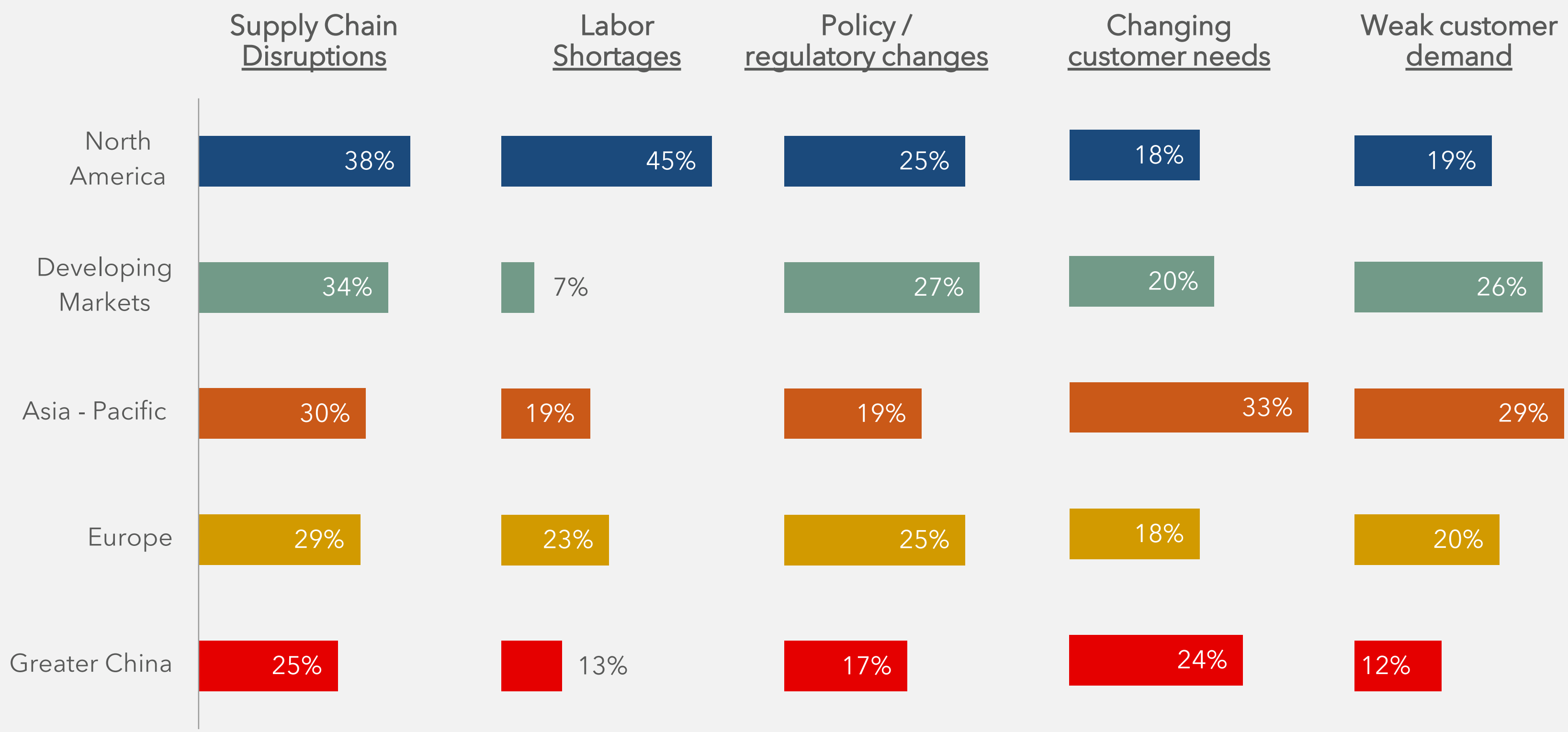
Mentions of "supply chain" on earnings / investor calls

Source: (1) Bloomberg . Data as of November 15, 2021. Count based on topics and includes every article that Bloomberg index algorithm counts as about supply chain, even if it mentions those words or not. Bloomberg "Supply Chain Mentions on Earnings Calls Hit a Record High" (October 13, 2021). (2) Bloomberg, "Inflation Builds with Biggest Gain in Consumer Prices Since 1990" (November 10, 2021).

Supply Chain Disruptions a Top Business Concern

According to a McKinsey Global Survey in October, the top risks to company growth globally are supply-chain disruptions and labor shortages

Potential risks to growth for respondents’ companies in the next 12 months, % of total respondents

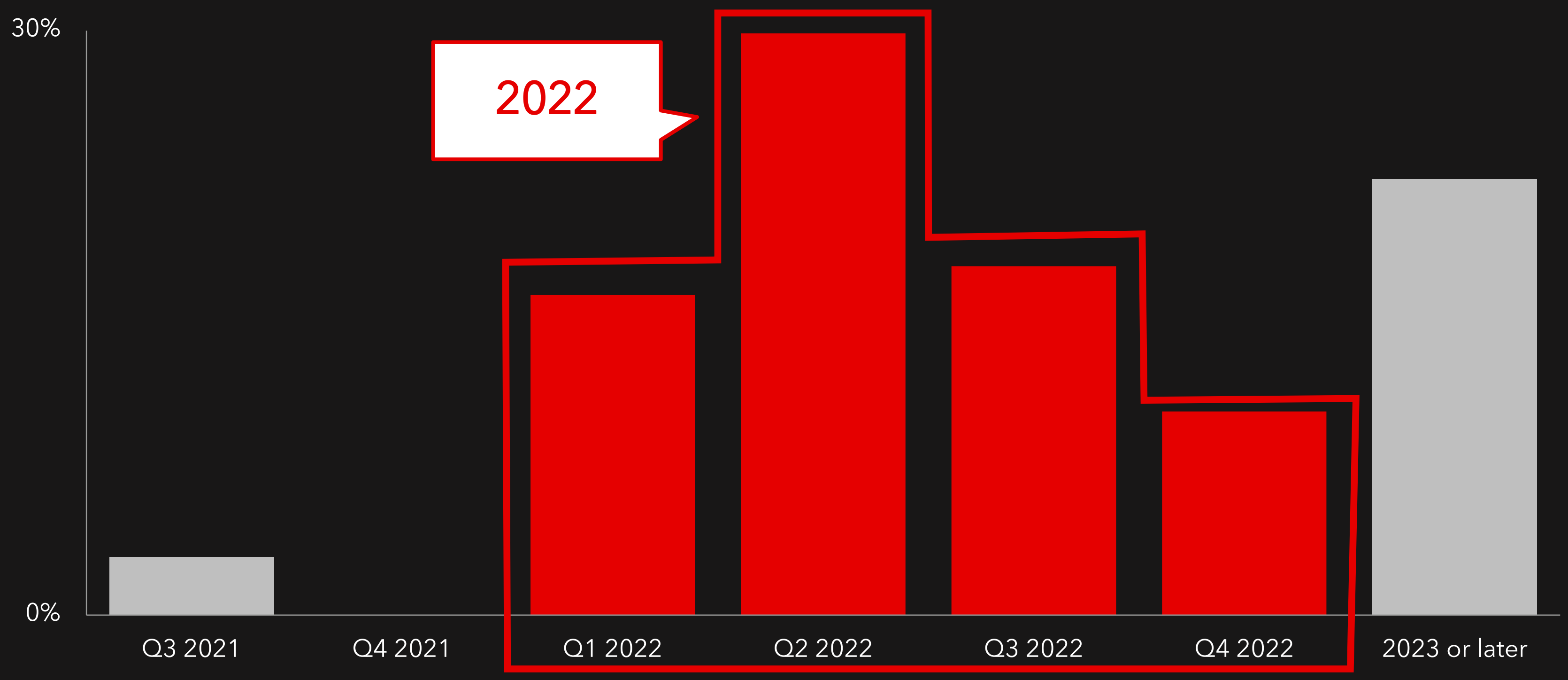


Source: (1) McKinsey "The Coronavirus Effect on Global Economic Sentiment" (October 29, 2021). Out of 16 risks that were presented as answer choices. North America, n=170; developing markets, n=166; Asia-Pacific, n=98; Europe, n=265; and Greater China, n=100. Developing markets includes India, Latin America, Middle East, North Africa, South Asia and sub-Saharan Africa. Greater China includes Hong Kong and Taiwan.

Significant Improvement Expected in 2H 2022

Global supply chain disruptions are likely to persist well into 1H 2022, as evidenced by a recent business survey from Oxford economics. However, a desynchronized deceleration in global growth, ramping production capacity, and more normalized consumer spending may ease disruptions in the back half o f the year.

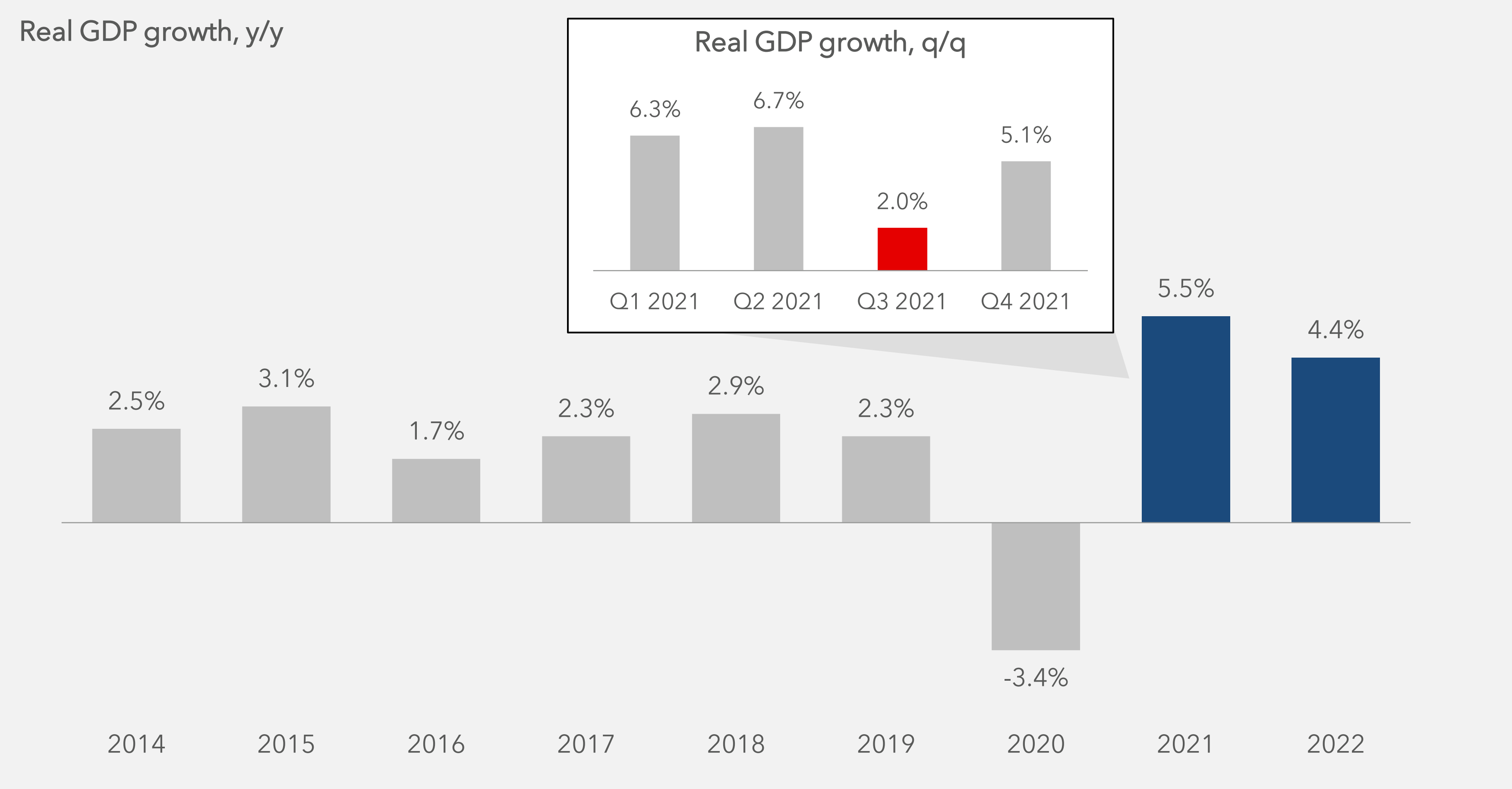
When do you expect supply-chain disruption to end for your business?
% of respondents affected by disruption



Source: Oxford Economics, September Oxford Economics Global Risk Survey, September 2021 flash survey. The survey was completed by 129 businesses from September 1 to 9.

Supply Side Drags US GDP Lower in Q3

Delta infections and supply chain dislocations drove US Q3 GDP sharply lower to 2% as rising inflation and declining demand adversely impacted growth. While growth is expected to recover in Q4, continued supply side disruptions remain a risk.

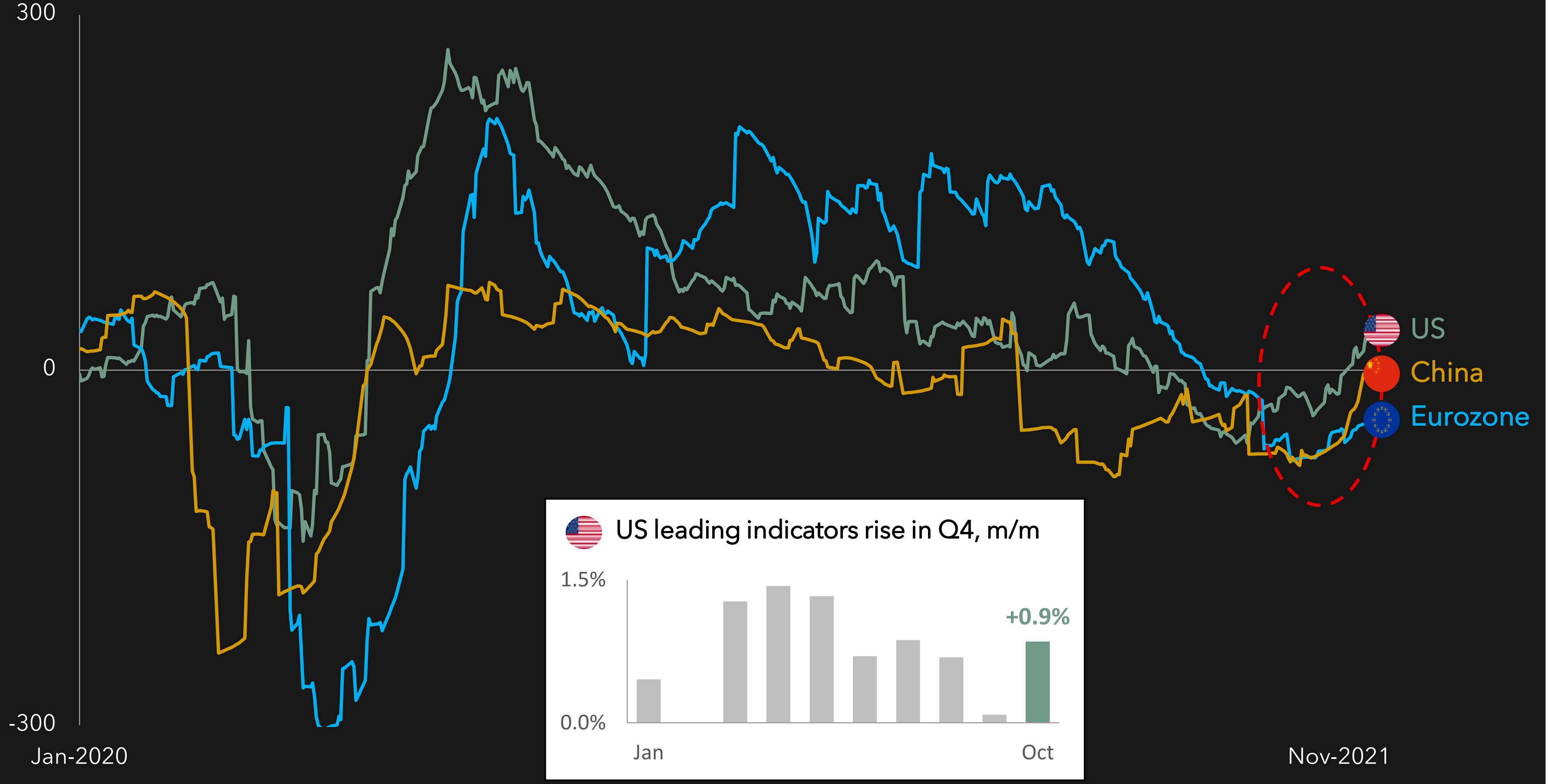


Source: (1) Oxford, "US Quick Take" Lackluster GDP Print in Q3" (October 28, 2021). Data updated as of November 19, 2021.

Moderate Recovery Expected in Q4

Since the start of October, economic data in the US, China and the Eurozone has surprised to the upside, a strong indicator that global growth is likely to recover in Q4 before moderating in 2022

Citi economic surprise index



Source: (1-2) Bloomberg. Data as of November 19, 2021.

2 Global Demand Shock

Vaccine

- 7 billion administered globally

Extraordinary policy easing

- $32 trillion of global monetary & fiscal stimulus in 18 months ($13 trillion in US)

Excess consumer savings

- >$5 trillion globally

Changing consumer behavior patterns

- Pent-up demand
- Goods over services
- Increased online purchases

Largest global demand shock since WWII

GDP growth rates at 2-3x long term averages

Supply side dislocations

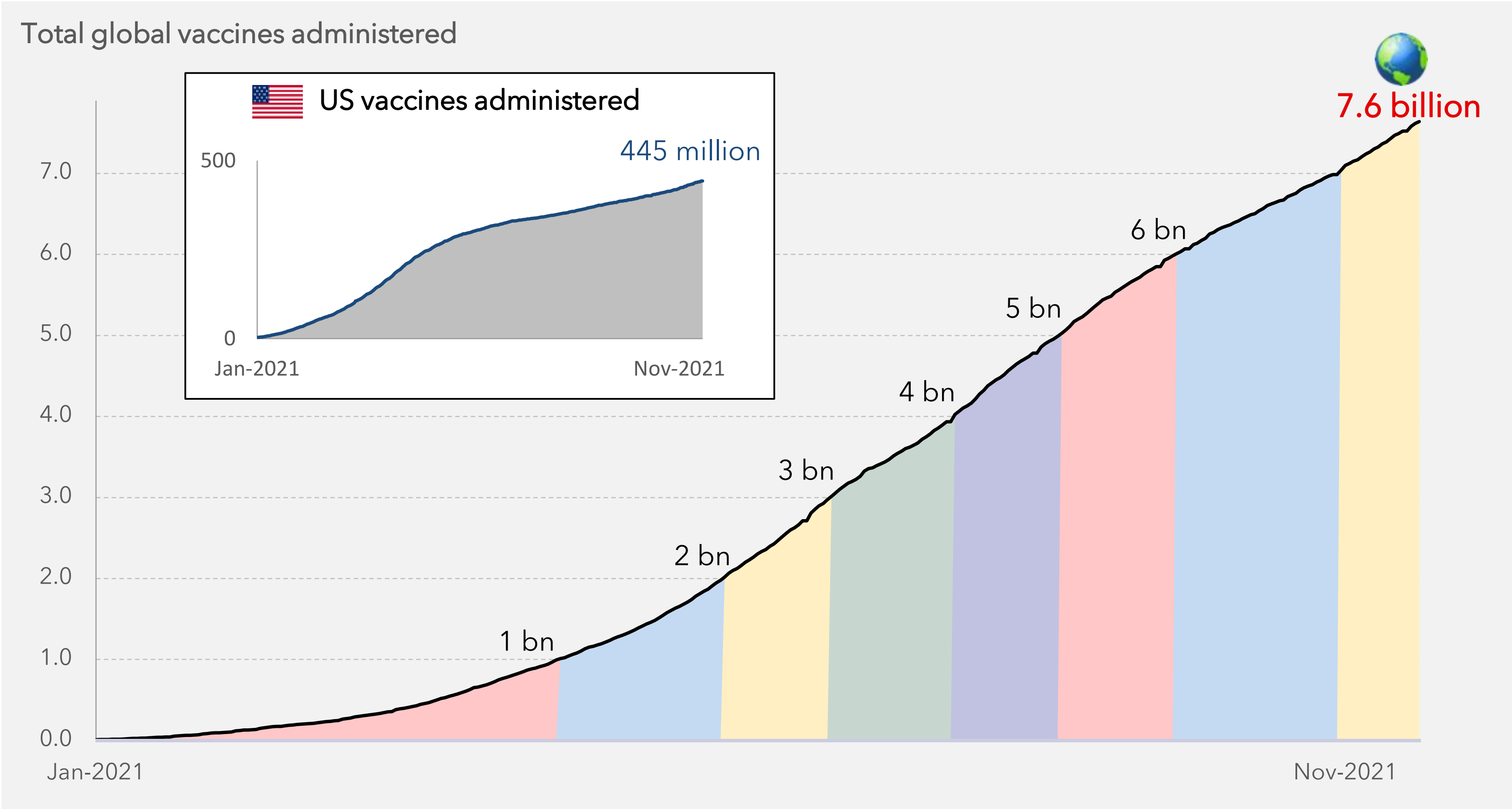
- Production shortfalls
- Transportation delays
- Labor market shortages
- Higher input costs & wages

Delta virus restrictions

- East Asia "zero Covid tolerance" policy
- Factory disruptions
- Port closure & capacity reductions

Rapid Global Vaccine Rollout

In less than one year, over 7.6 billion COVID vaccines have been administered globally across 184 countries, including 445 million doses in the United States



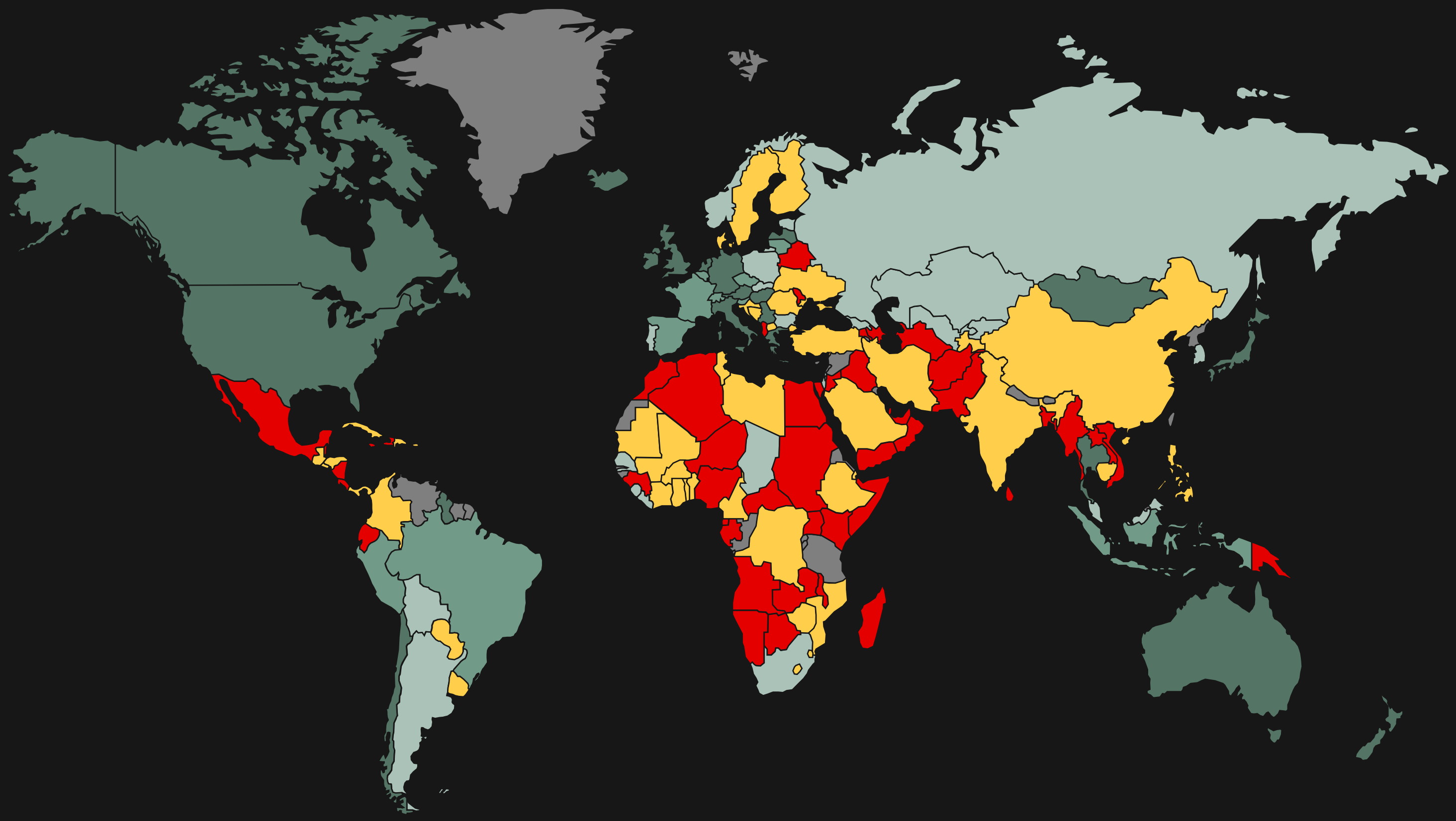
Source: (1-2) Bloomberg. Data as of November 19, 2021.

Over $30 Trillion of Global Monetary & Fiscal Stimulus

Global monetary and fiscal stimulus has risen by a remarkable $32 trillion over the last 18 months, $13 trillion in the US alone ($5.5 monetary, $7.4 fiscal)

Global fiscal stimulus in response to COVID-19 (% of GDP)

Less than 2.5%   2.5% - 5%   5% - 7.5%   7.5% - 10%   More than 10%

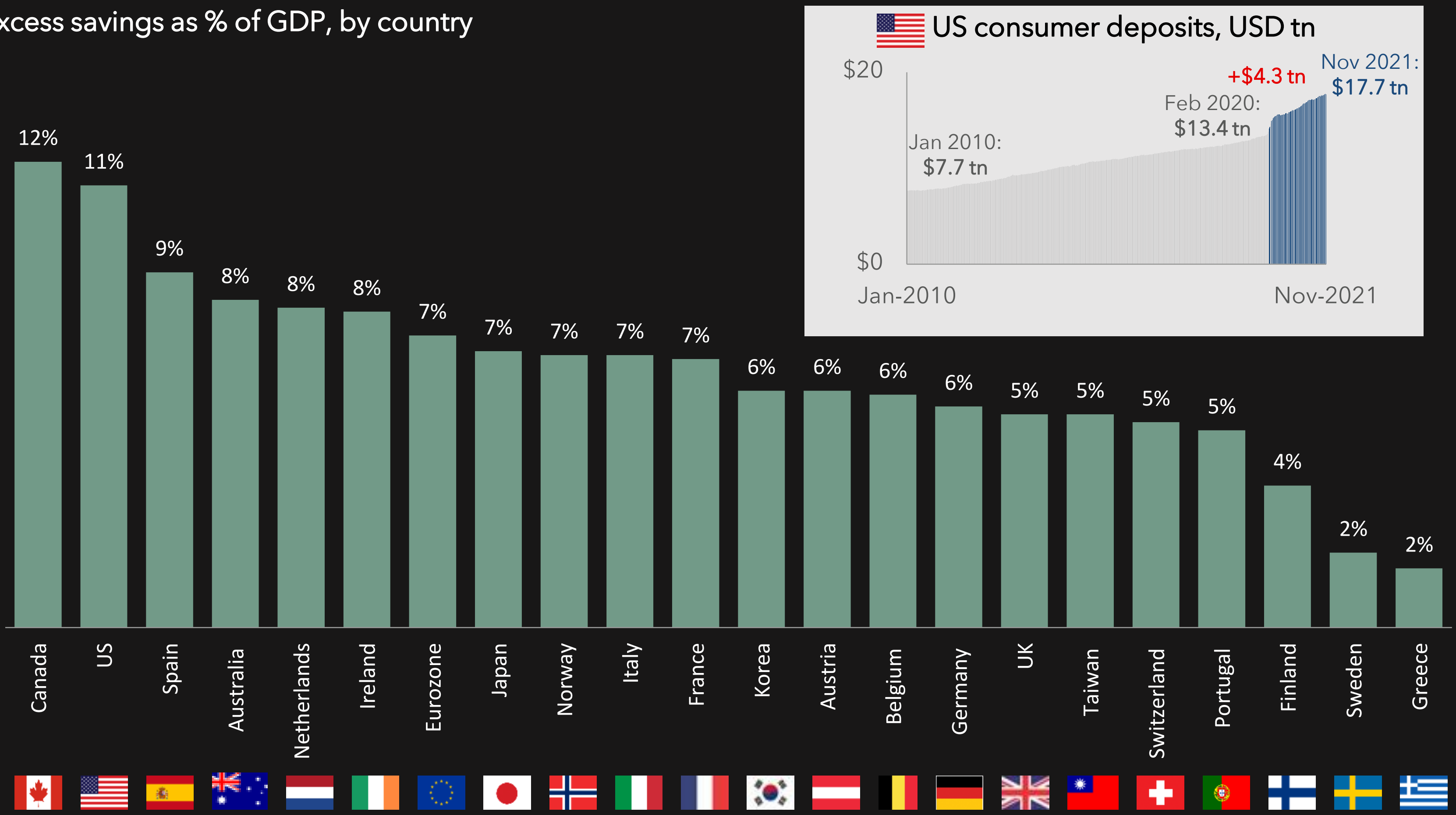


Source: IMF Database of Fiscal Policy Response to COVID-19, data as of October 2021. Fiscal stimulus includes spending and foregone revenue in response to COVID-19 pandemic as percent of 2020 GDP

Over $5 Trillion of Global "Excess Savings"

Over the course of the COVID-crisis, global consumers accumulated over $5 trillion in excess savings. In advanced economies alone, households accumulated roughly $3.7 trillion in excess savings, equivalent to 14% of advanced economy consumer spending and 8.4% of GDP.

Excess savings as % of GDP, by country

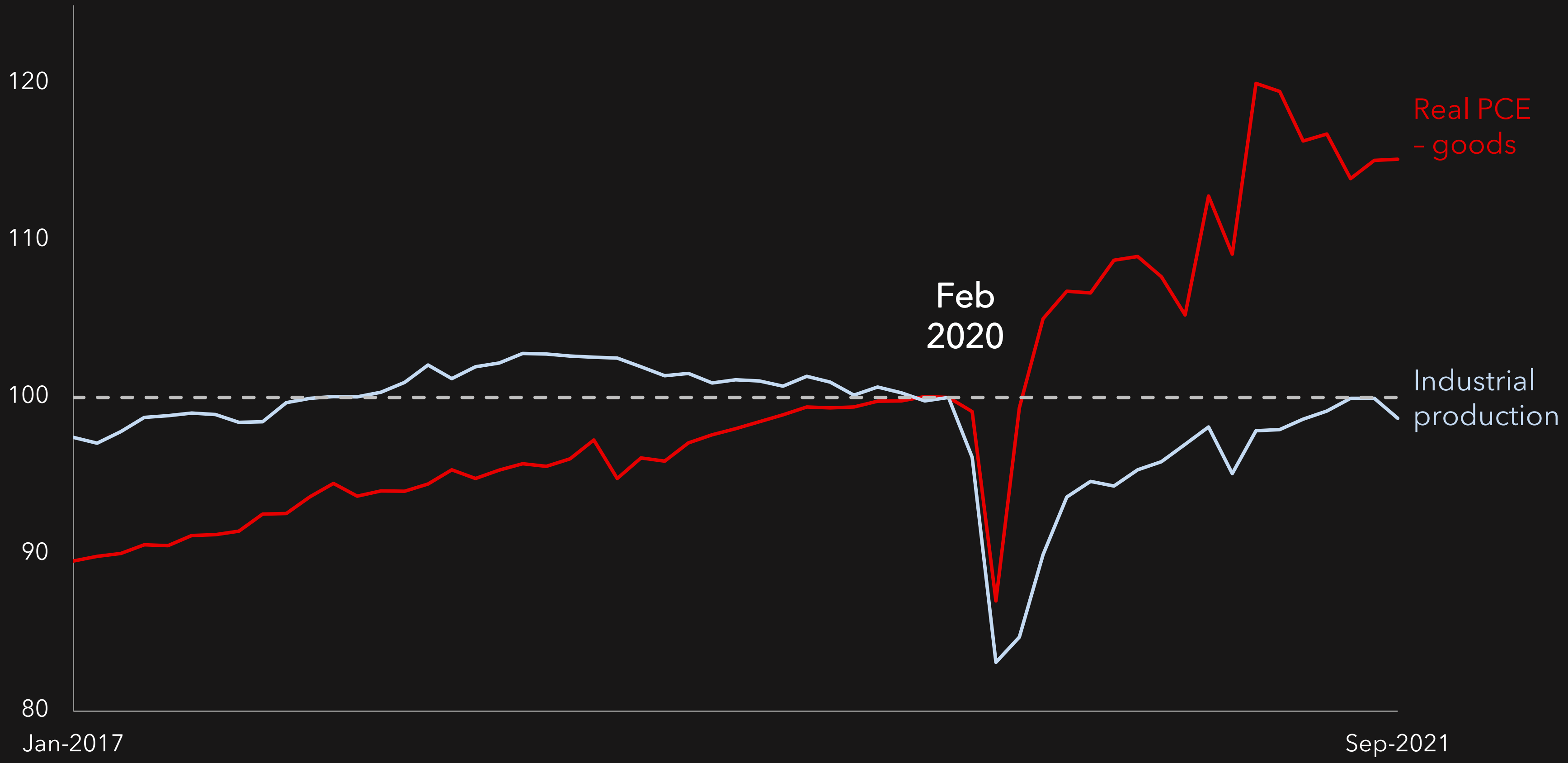


Source: (1) Oxford Economics. (2) FRED. Deposits for all commercial banks, weekly Wednesday level as of November 3, 2021.

Robust Consumer Demand for "Goods"

The COVID related lockdowns dramatically shifted consumer spending to "goods" over "services". The boom in goods demand and intermittent COVID production shutdowns have created a significant supply / demand imbalance.

US Real PCE on goods & industrial output, Feb 2020 = 100

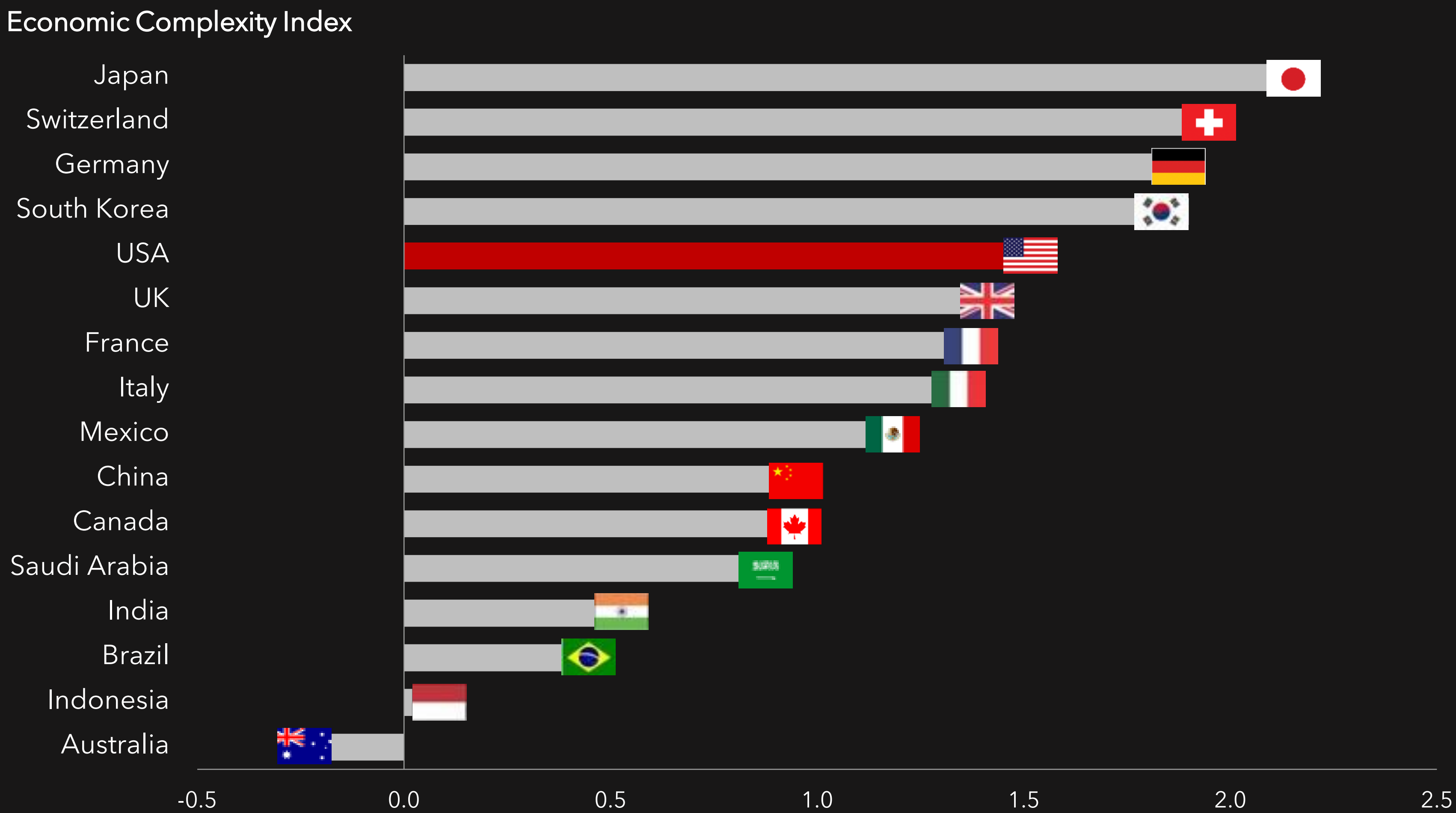


Source: (1) Bloomberg. Data as of November 19, 2021.

3 Supply Chain Dislocations

Countries Most Vulnerable

Countries with higher trade in intermediate goods and production complexity are relatively more exposed to global supply chain disruption. In addition, the United States has been more highly impacted than many other advanced economies due to the strength of its economic demand shock.

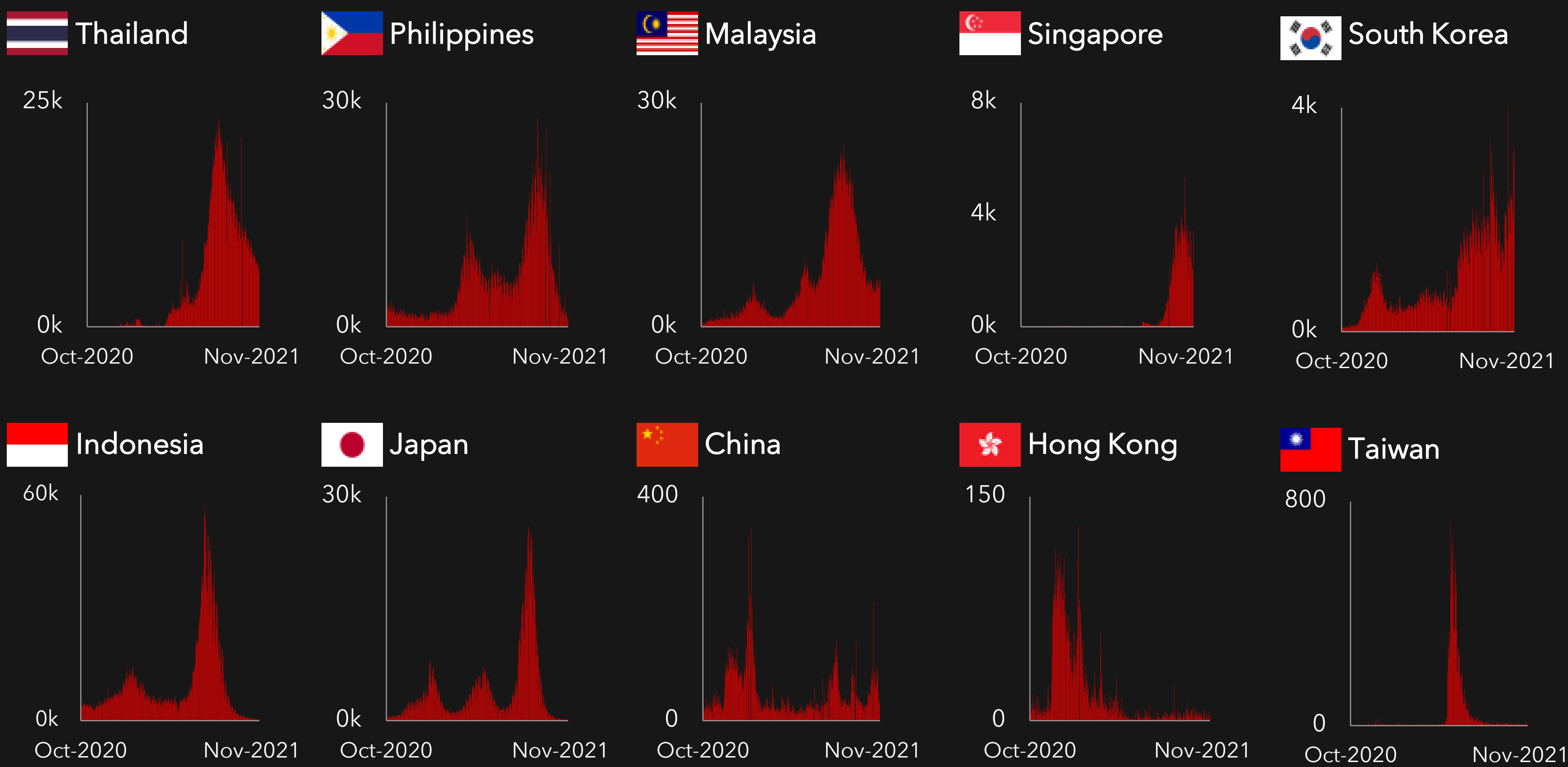


Source: Oxford Economics, "Global Scenarios: Delta Surge" (September 2021). The Observatory of Economic Complexity

East Asia COVID Waves Exacerbate Bottlenecks

With a "zero Covid tolerance" policy across much of the region, Delta related disruptions in East Asia, which accounts for 40% of global exports, have episodically rippled through the global supply chain (closures and reduced hours for factories and ports)

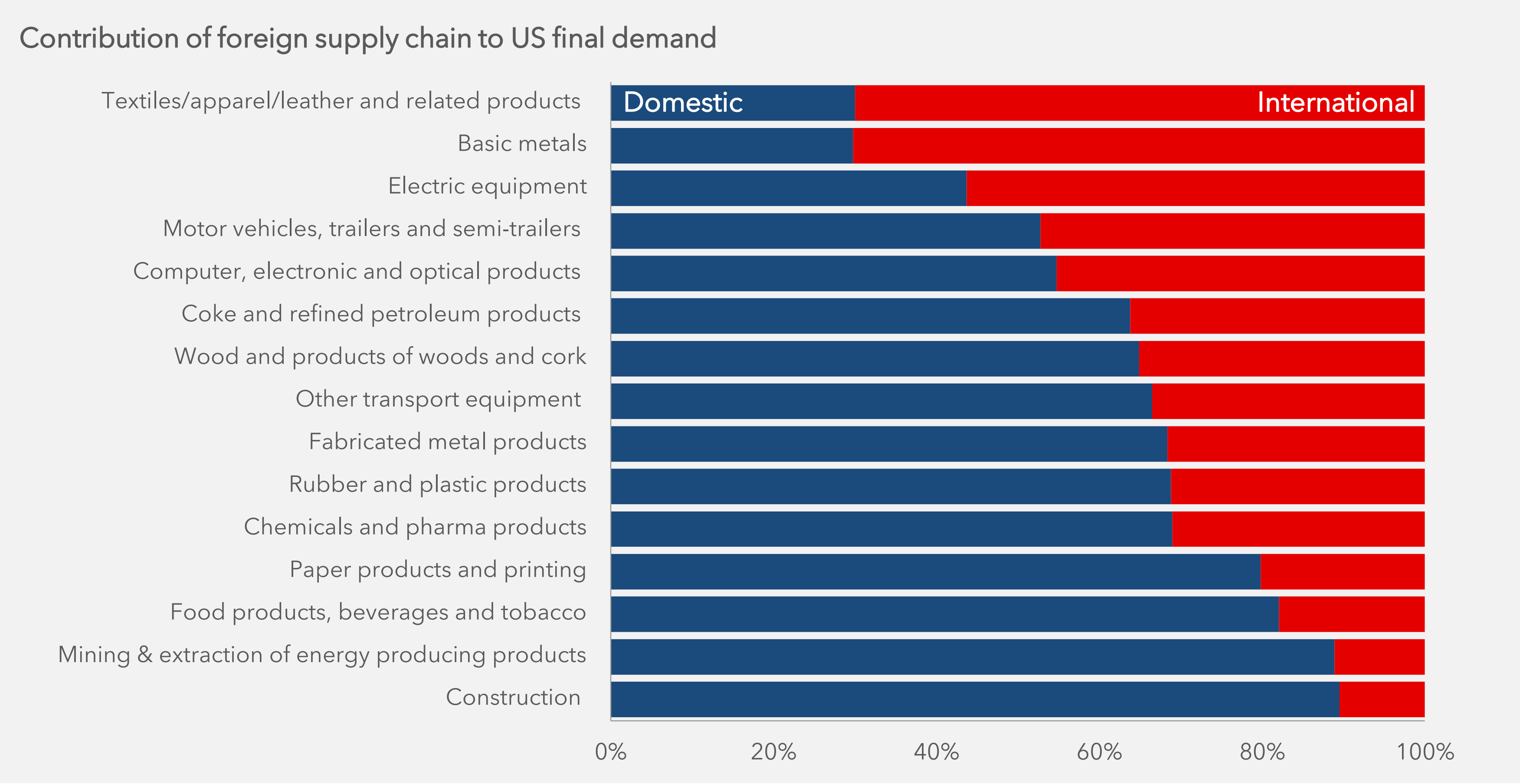
Daily new COVID cases



(1-10) Bloomberg. Data as of November 19, 2021.

Industries Most Vulnerable

Those industries most dependent on international supply chains – in particular, textiles, electronics and autos – have been the most highly impacted by the COVID-19 global demand and supply shocks, and related dislocations

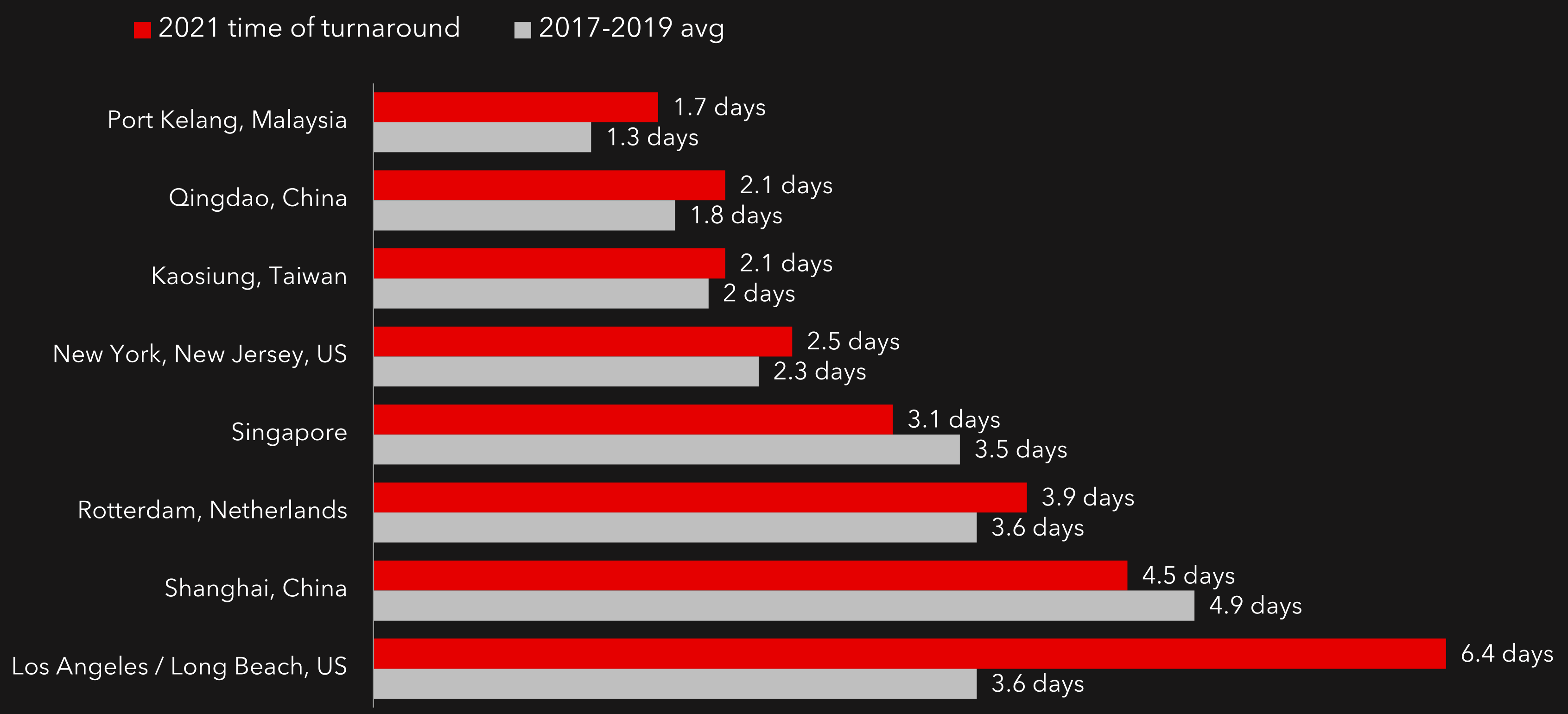


Source: (1) Apollo (Torsten Slok). OECD. Trade in value added , latest data available is 2015.

Longer Port Wait Times

The precipitous reduction in transportation capacity has slowed the pace of unloading container ships and pushed wait times in US ports to record lengths. In November, the wait times to enter the ports of Los Angeles and Long Beach more than doubled from two months prior to reach a record high.

Time of turnaround, by port

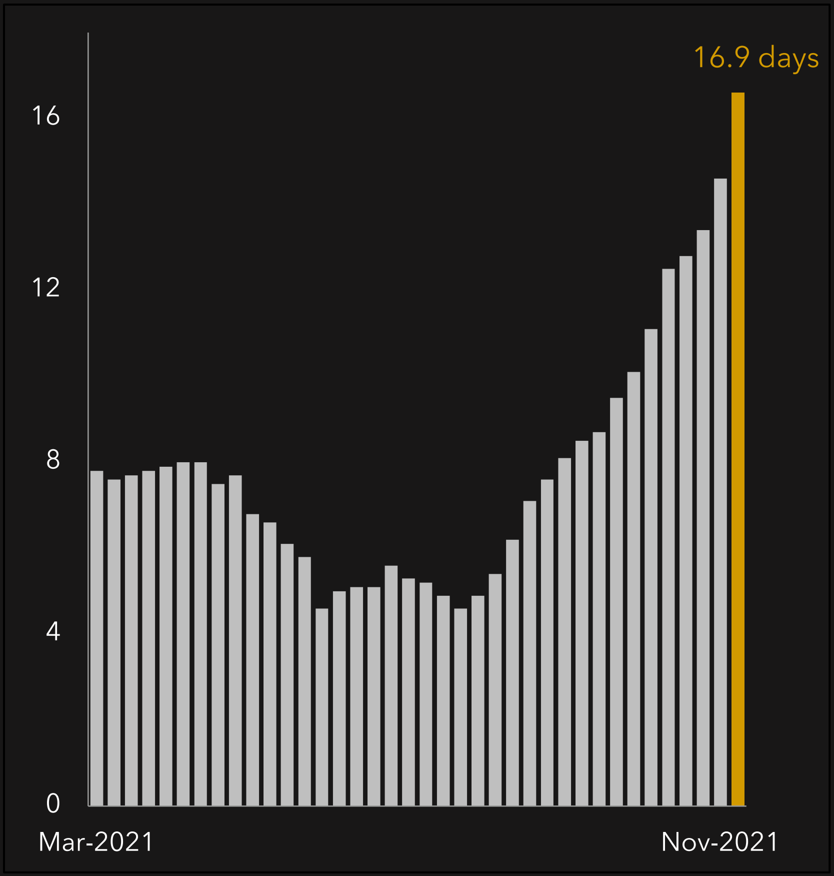


Source: (1) Bloomberg "Global Port Trackers Show Where the Worst Ship Logjams Lurk" (October 12, 2021). RBC Capital Markets.

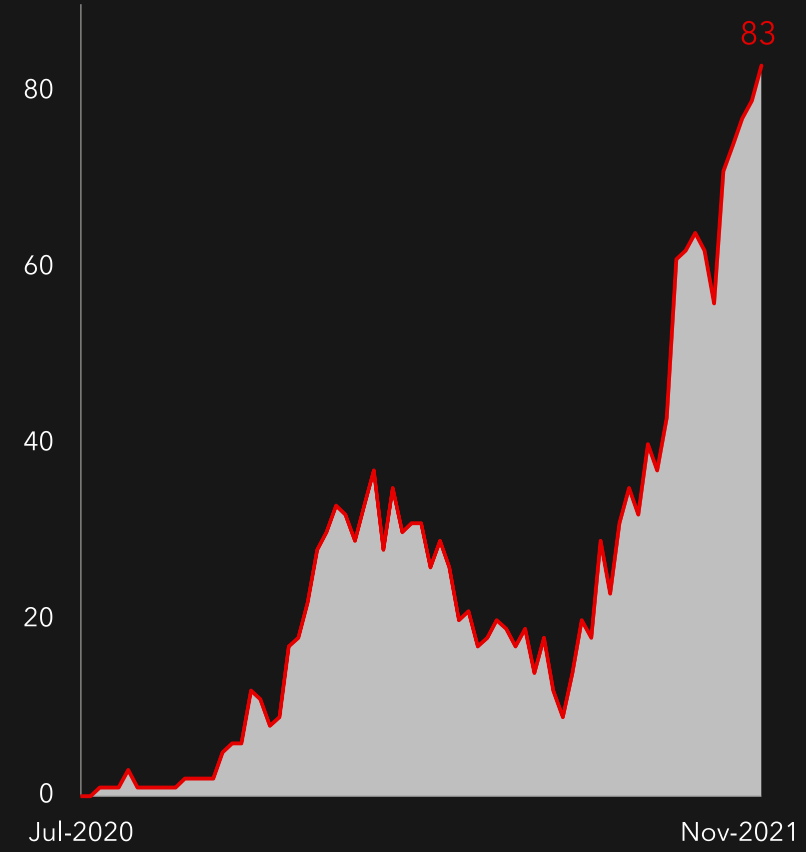
Record Number of Container Ships Waiting

As of mid-November, a record 83 ships were waiting in the San Pedro Bay to be unloaded in the ports of Long Beach and Los Angeles

Average container ship wait time at anchor to enter port of LA / Long Beach



Number of vessels waiting in San Pedro Bay

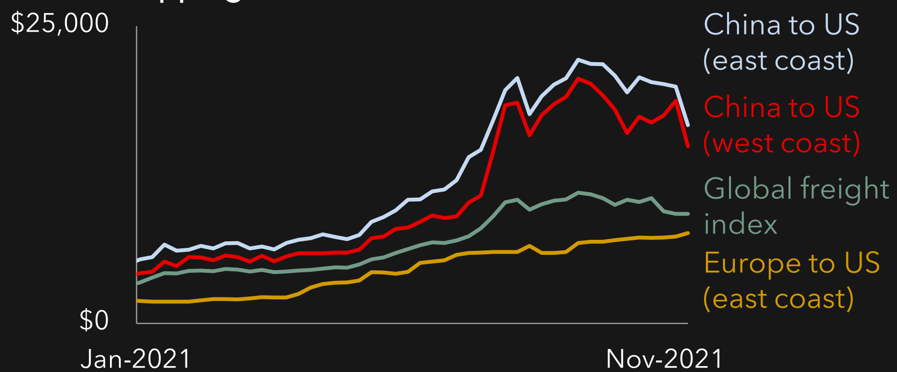


Source: (1-2) Bloomberg, "Ships Keep Coming, Pushing US Port Logjam and Waits to Records" (November 13, 2021). Marine Exchange of Southern California & Vessel Traffic Services LA / Long Beach. Wabtec Port Optimizer.

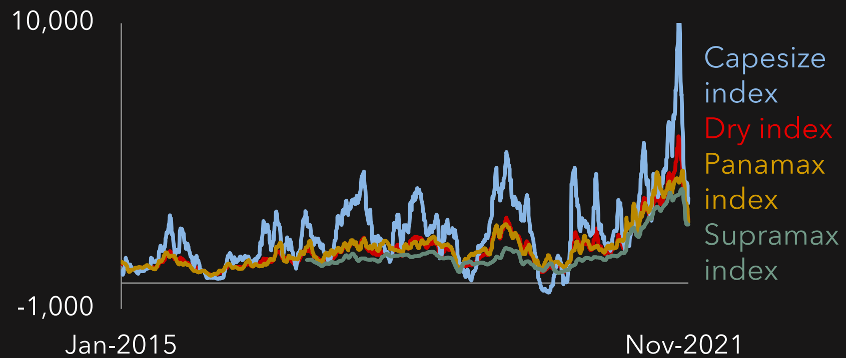
Transportation Costs Elevated

While likely past peak, transportation costs may take two years to return to normalized levels, based on analysis of past market cycles by Sea-Intelligence, a Copenhagen-based maritime data and advisory company

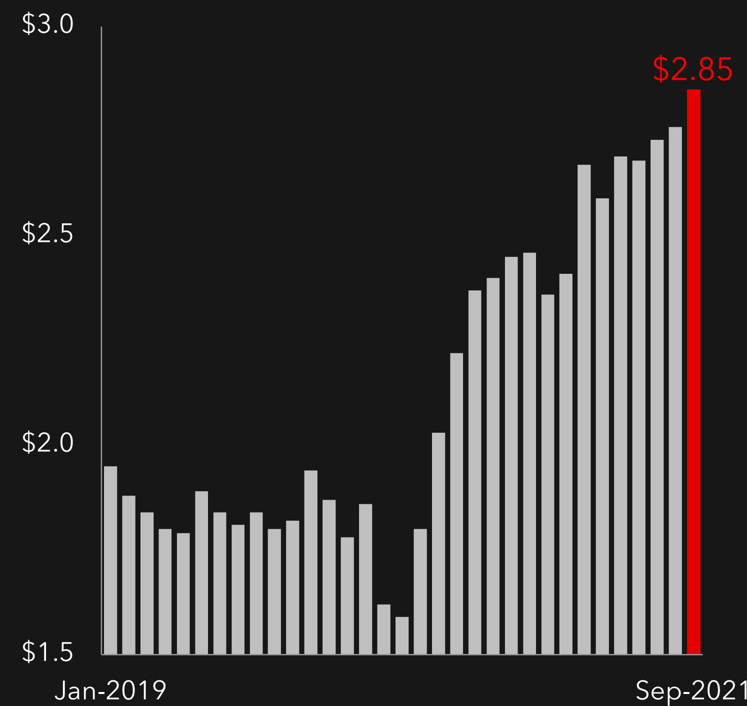
Cost of shipping a container, USD



Baltic exchange index, by ship size



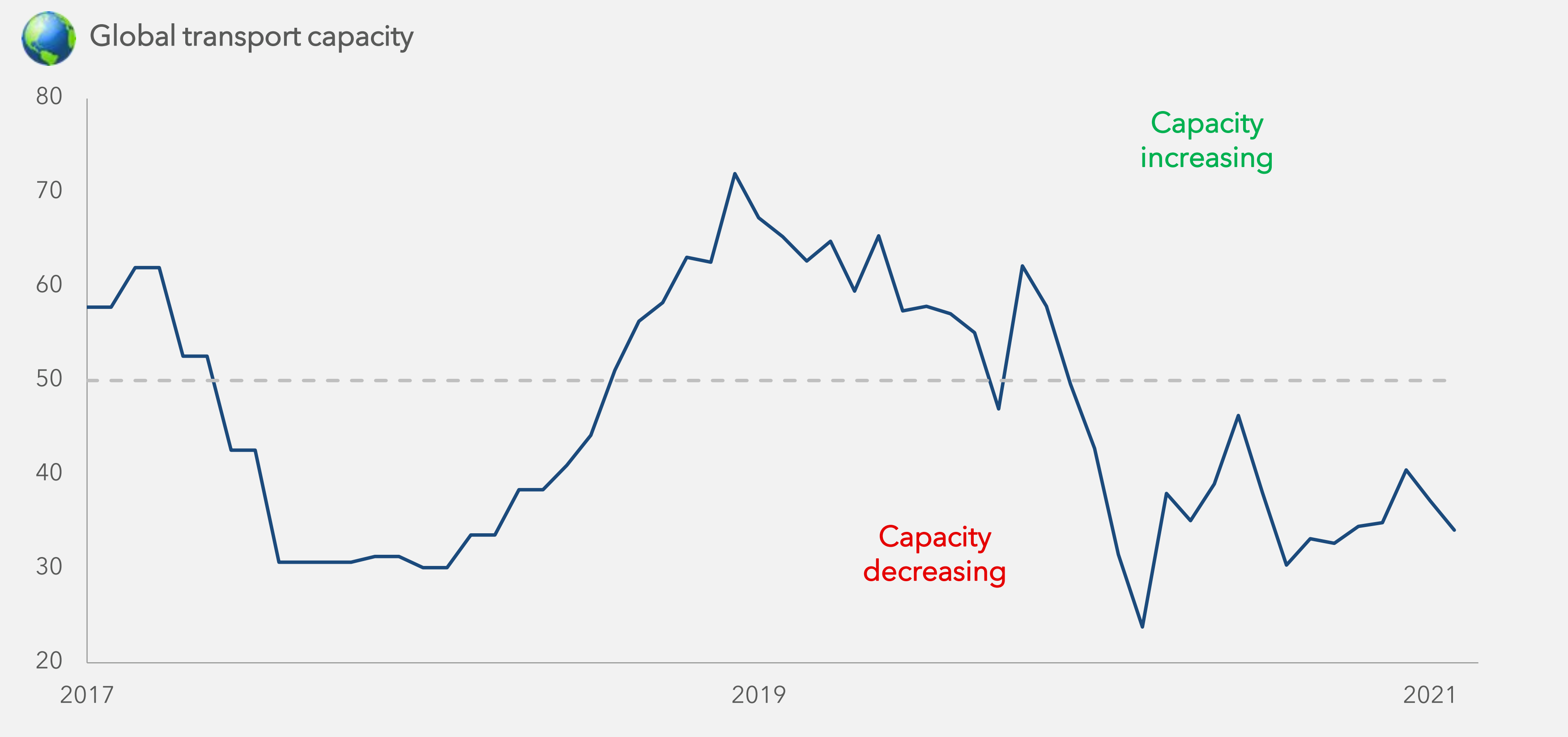
The average spot-market price for transport via truck hit $2.85, the highest recorded and 19% above the same level last year



Source: (1) Oxford Economics ""How the Pandemic is Reshaping the Trade Outlook" (August 18, 2021). Bloomberg. Data as of November 19, 2021. Freightos Baltic Index. Ocean Freight. (2) Bloomberg. Data as of November 19, 2021. Drewry World Container Index. (3) WSJ "Freight Operators' Profits are Surging in Strained Supply-Chain Markets" (November 3, 2021). DAT Solutions LLC. Monthly average per-mile price includes fuel surcharges.

Transport Capacity Declining

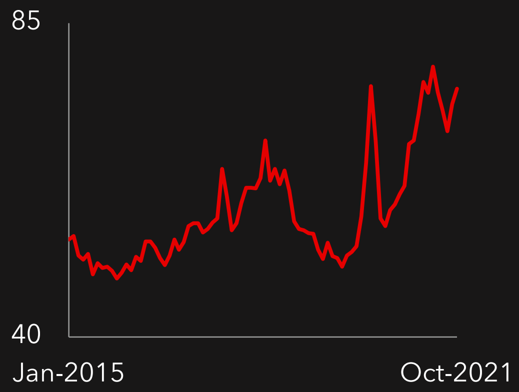
Transportation capacity has contracted for 17 consecutive months with scores below 40 in 13 of the past 15 readings. In the US, the outsized proportion of imports coming through ports in Southern California has caused a mismatch in trucking capacity moving west vs. east (outbound demand from California is 43% higher than inbound demand). Further, shortages in semiconductors make it difficult to build new trucks to alleviate the constraint.



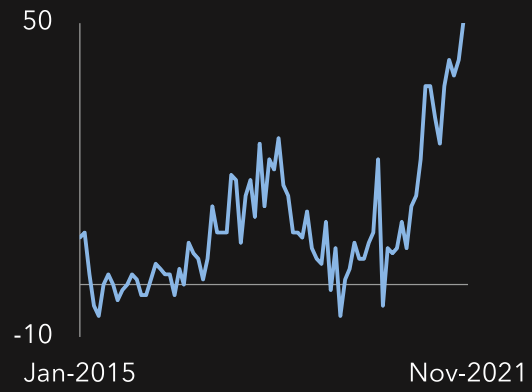
Source: (1) Logistical Managers' Index "October 2021 Logistics Manager's Index report."

Longer Delivery Times & Elevated Backlogs

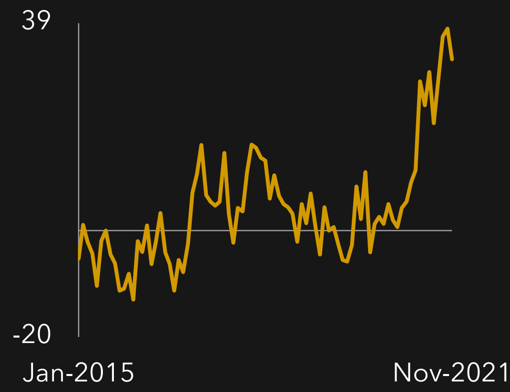
ISM delivery times



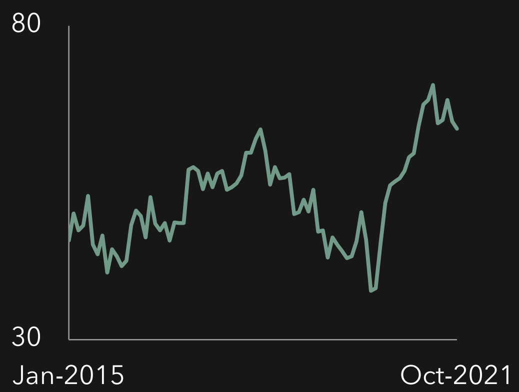
Kansas City Fed delivery times



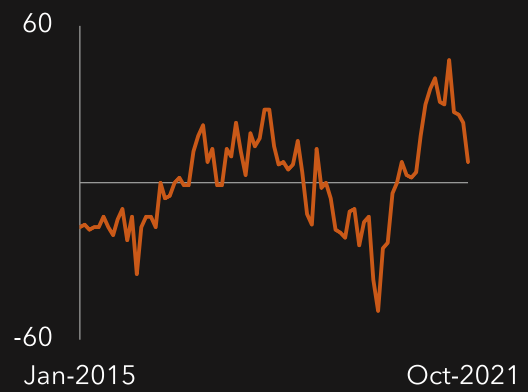
Empire State delivery times



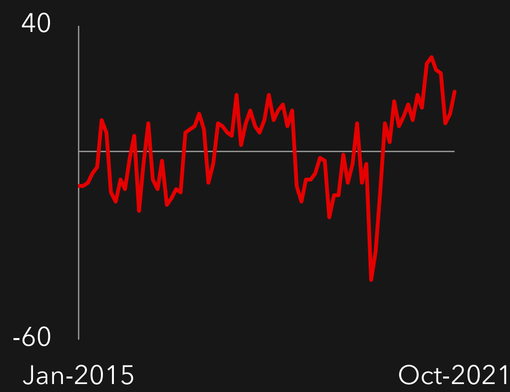
ISM order backlog



Kansas City Fed order backlog



Richmond Fed order backlog

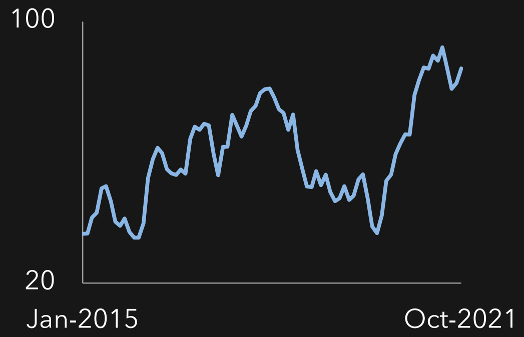


Source: (1-6) Bloomberg. Data as of November 19, 2021. ISM orders backlog is manufacturing report.

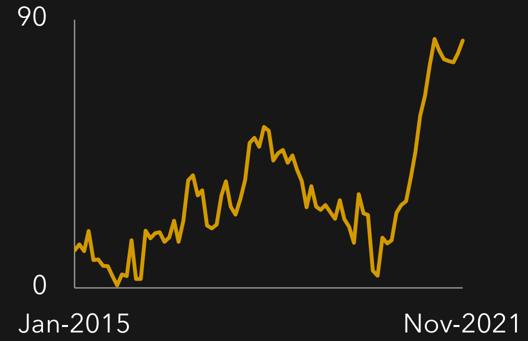
Prices Paid Rising

The persistent labor shortages, shipping delays, production bottlenecks and higher commodity prices have created pricing pressures that appear to have peaked in aggregate, but which remain elevated at multi-decade highs

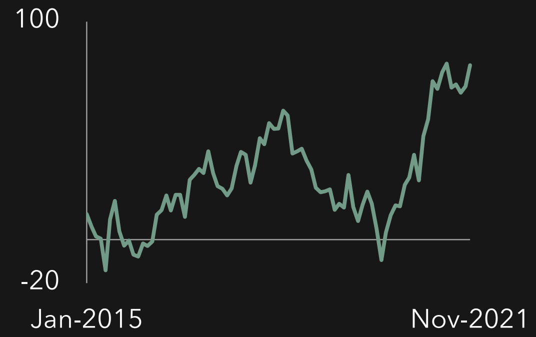
ISM manufacturing prices paid



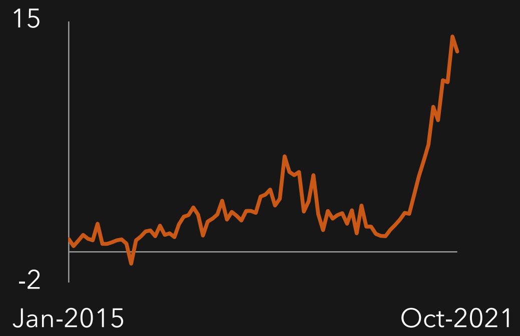
Empire State prices paid



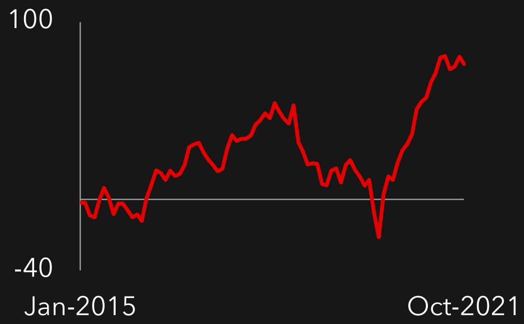
Philadelphia Fed prices paid



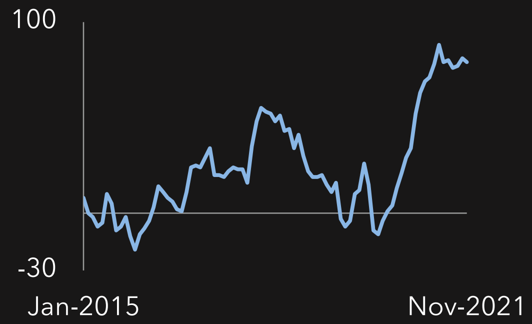
Richmond Fed prices paid



Dallas Fed prices paid for raw materials



Kansas City Fed prices paid for raw materials

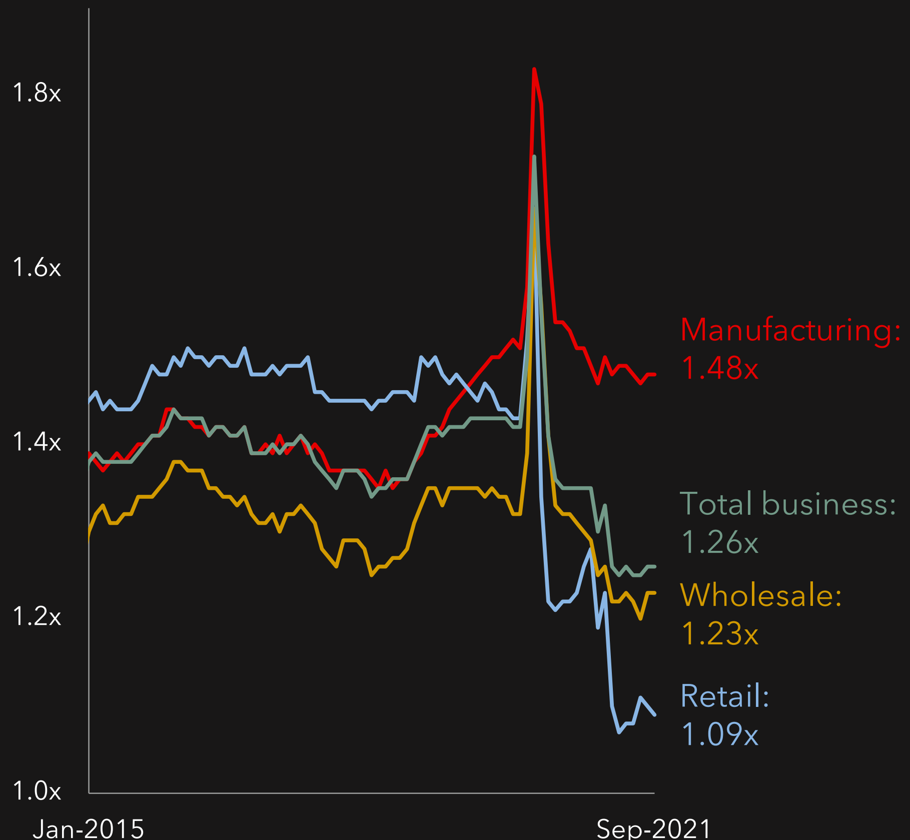


Source: (1-6) Bloomberg. Data as of November 19, 2021.

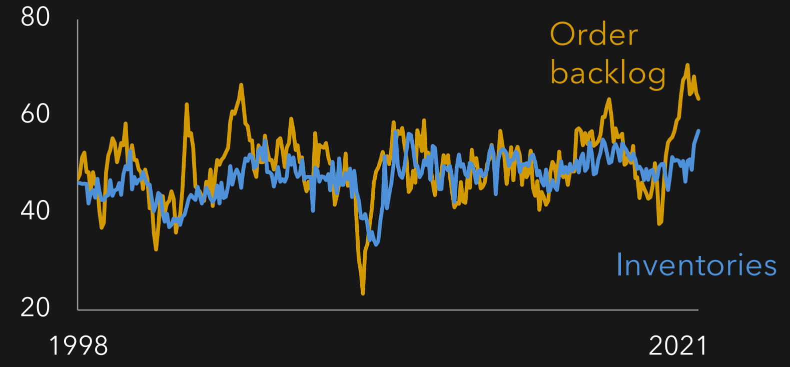
Business Inventory Lagging Demand

Retail inventories have lagged well behind broader business inventories and hit their lowest level in records going back to 1992. Despite business inventories increasing 0.7% in September, the business inventory-to-sales ratio remained unchanged at 1.26x as business sales rose 0.9% in the month.

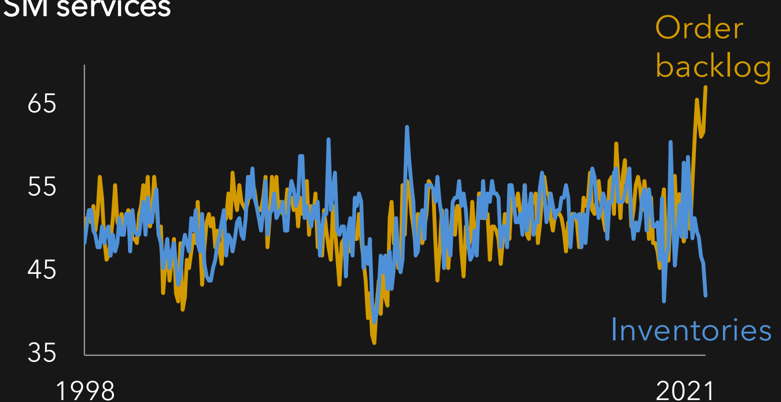
Inventory to sales ratio, by sector



ISM manufacturing



ISM services

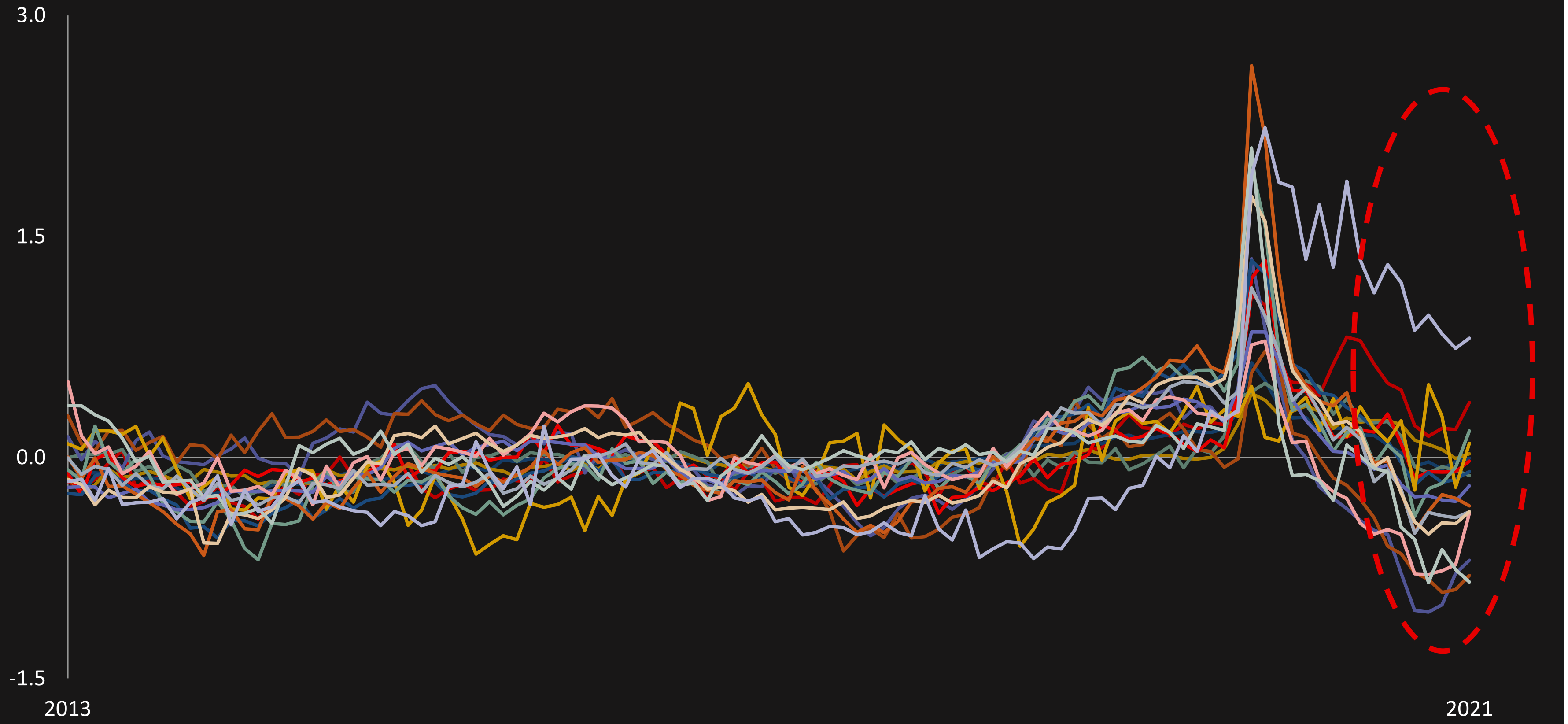


Source: (1-3) Oxford Economics,. Bloomberg. FRED. Data as of November 19, 2021.

Signs of Relief in Some Industries

Z-scores appear to have troughed for most industries, indicating that inventories are being rebuilt. However, the number of scores below zero show inventories are still low relative to historical norms.

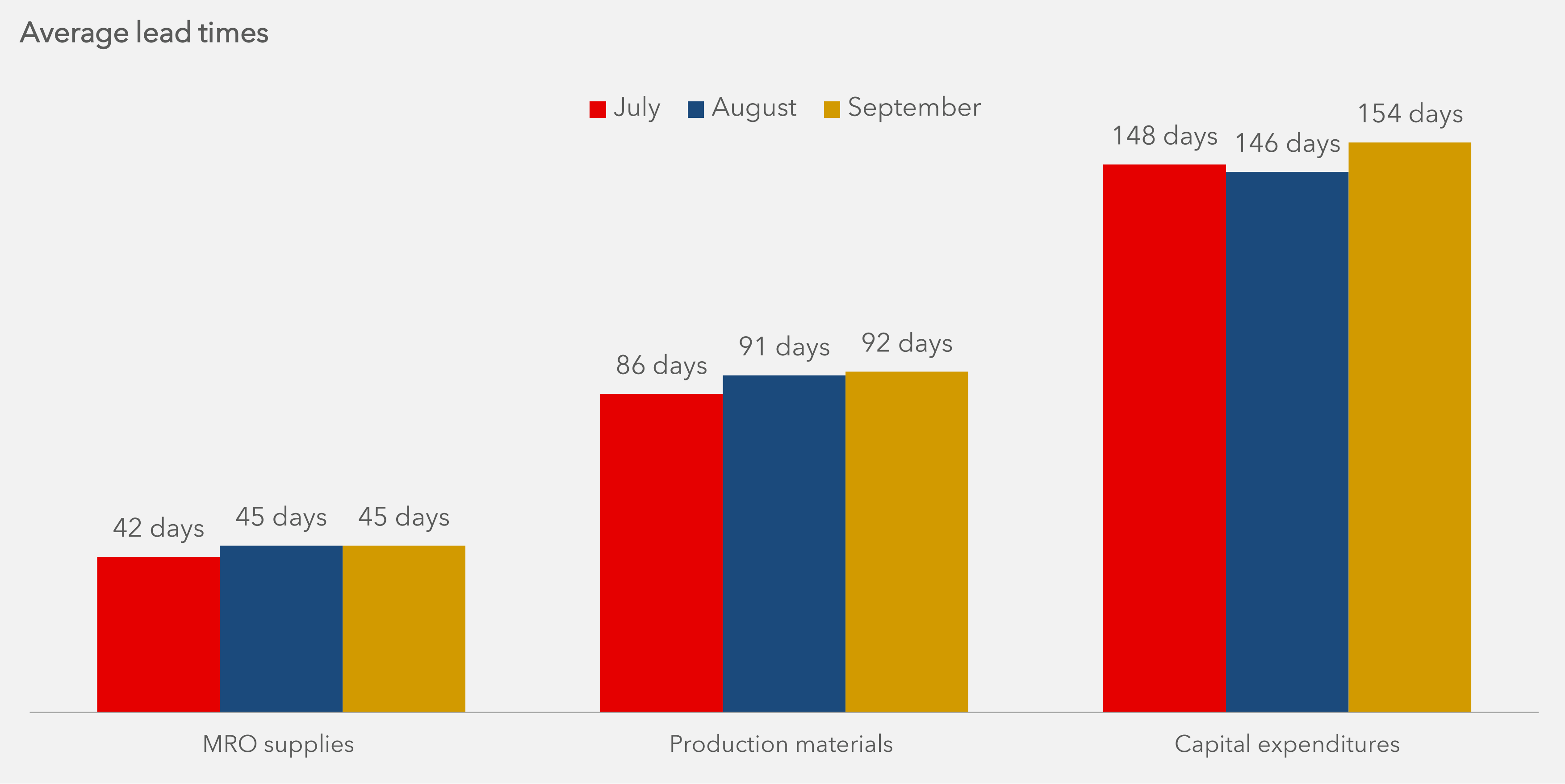
Sectoral inventory relative to demand, z-score



Source: (1) Oxford Economics, "Supply Chain Problems Peaking, but Risks Remain" (November 18, 2021). Calculated using inventory, orders, activity expectations and shipments data across EU, US, Korea & Japan.

Record Long US Factory Lead Time

In September, the lead time for maintenance and repair supplies reached 45 days (record high), for production materials it reached 92 days (record high) and for capital expenditures it reached 154 days (highest since 1989)

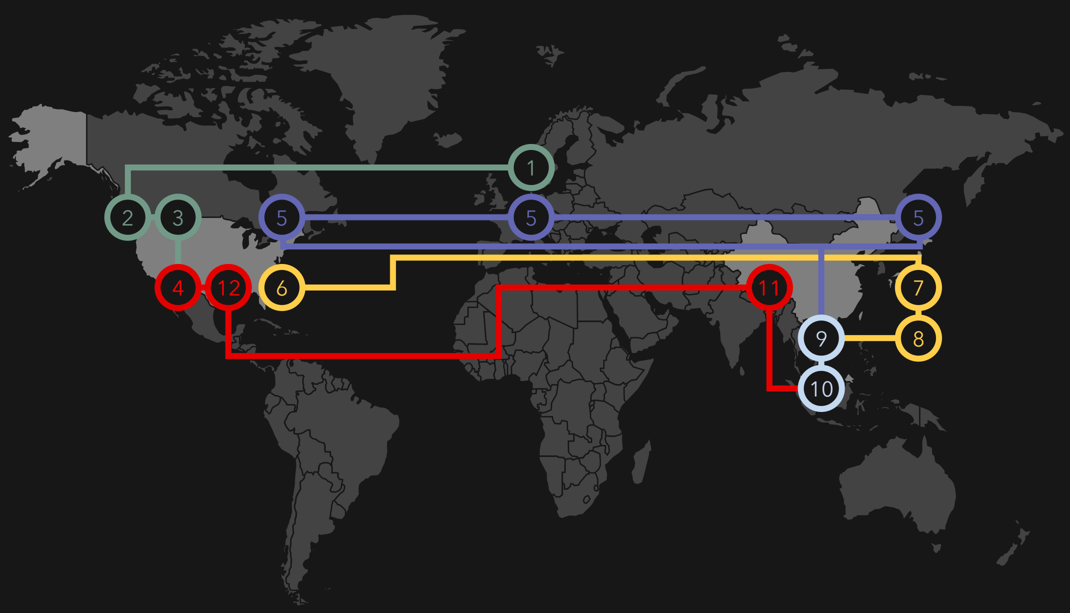


Source: (1) Bloomberg Government "Lead Times for US Factories Lengthen to a Record: Supply Lines" (October 5, 2021). ISM.

4 Microchip Backlog

Complex Global Semiconductor Value Chain

Semiconductor production requires the specialized capabilities of several different geographic regions. In 2019, the US, South Korea, Japan, mainland China, Taiwan and Europe each contributed 8% or more to the total value added by the semiconductor industry.



Design
Equipment
Manufacturing
Commercialization
Materials

Illustrative example of semiconductor design, manufacturing, and use process

1. European firm licenses IP
2. US firm provides software for chip design
3. US firm designs chip
4. US company selects chip for new device
5. US, Japan and Europe produce highly advanced manufacturing equipment for specific chip
6. Silicon dioxide mined in US to create metallurgical grade silicon
7. Silicon processed in Japan to create ingot
8. South Korea slices ingot into several wafers
9. Taiwan imprints wafers with integrated circuits to create “patterned” wafers which are stacked and interconnected
10. Individual chips are separated and packaged in Malaysia
11. Chip shipped to device assembly partner in China
12. Completed device sold to US consumer

Source: BCG, Semiconductor Industry Association “Strengthening the Global Semiconductor Supply Chain in an Uncertain Era” April 2021.

Semiconductor Supply Chain Vulnerabilities

Semiconductor demand exceeded global supply even before the onset of the pandemic. COVID exacerbated the existing supply-demand imbalance in three major ways: i) demand dislocation as consumer purchases shifted to home appliances and "work from home" equipment, requiring factories to alter output; ii) supply side dislocations from factory shutdowns; and iii) unexpected shipping bottlenecks as ports closed. While the global nature of the semiconductor value chain has allowed for rapid and cost efficient technological advancement, the regional specification creates numerous supply chain vulnerabilities.

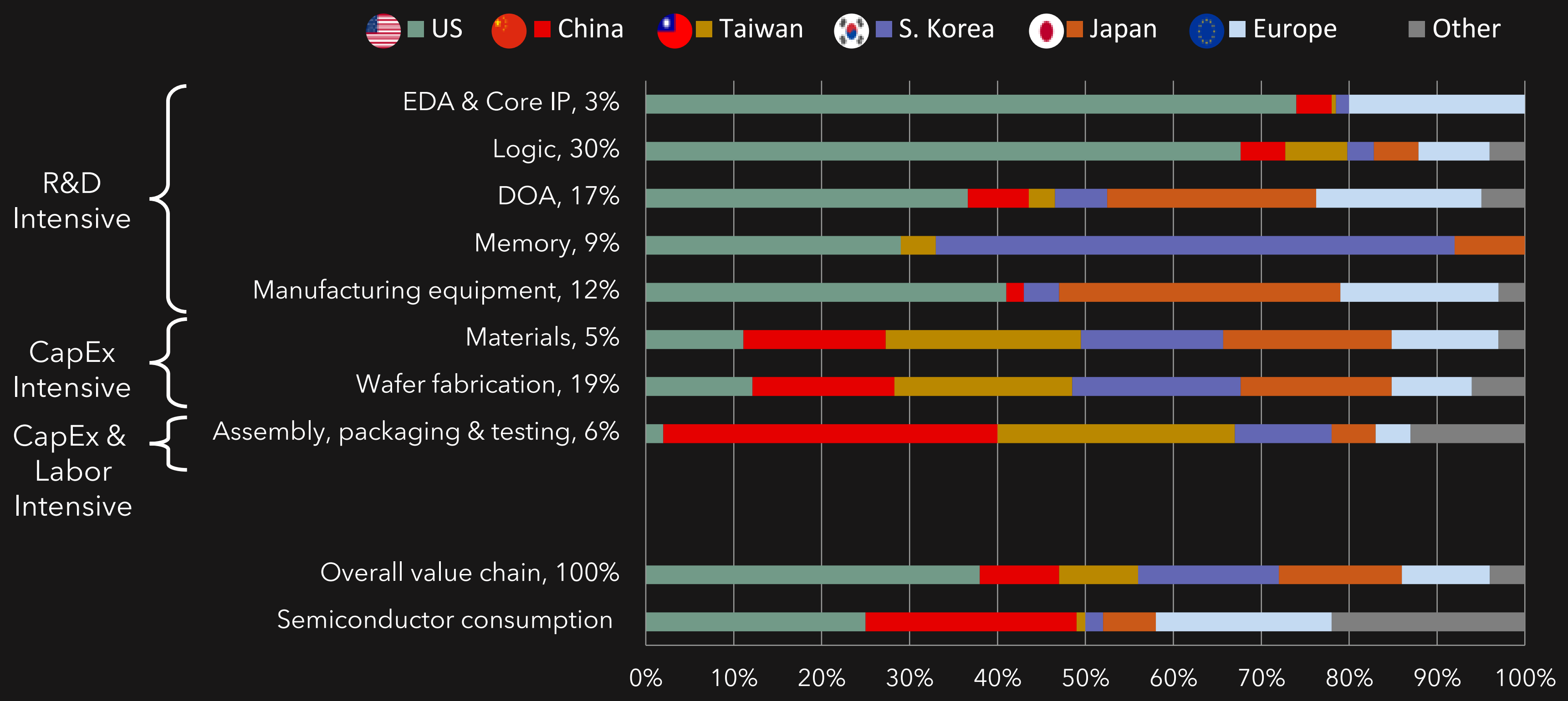
75%	share of global semiconductor capacity located in East Asia
100%	share of most advanced semiconductor manufacturing (nodes below 10 nanometers) located in Taiwan & South Korea
70%	share of manufacturing market controlled by just two companies (Taiwan's TSMC & South Korea's Samsung Electronics)
12%	share of semiconductors made in American factories, down from 37% in 1990
$1 trillion	estimated incremental upfront investment that would have been required to have a fully self-sufficient local supply chain in each region

Source: BCG, Semiconductor Industry Association "Strengthening the Global Semiconductor Supply Chain in an Uncertain Era" April 2021.

Regional Specialization

Each region specializes in a different part of the semiconductor production supply chain. In general, the US leads in R&D intensive activities while regions in Asia focus more on raw materials and manufacturing (which are more capital intensive).

Semiconductor industry value added by activity and region, 2019 (%)

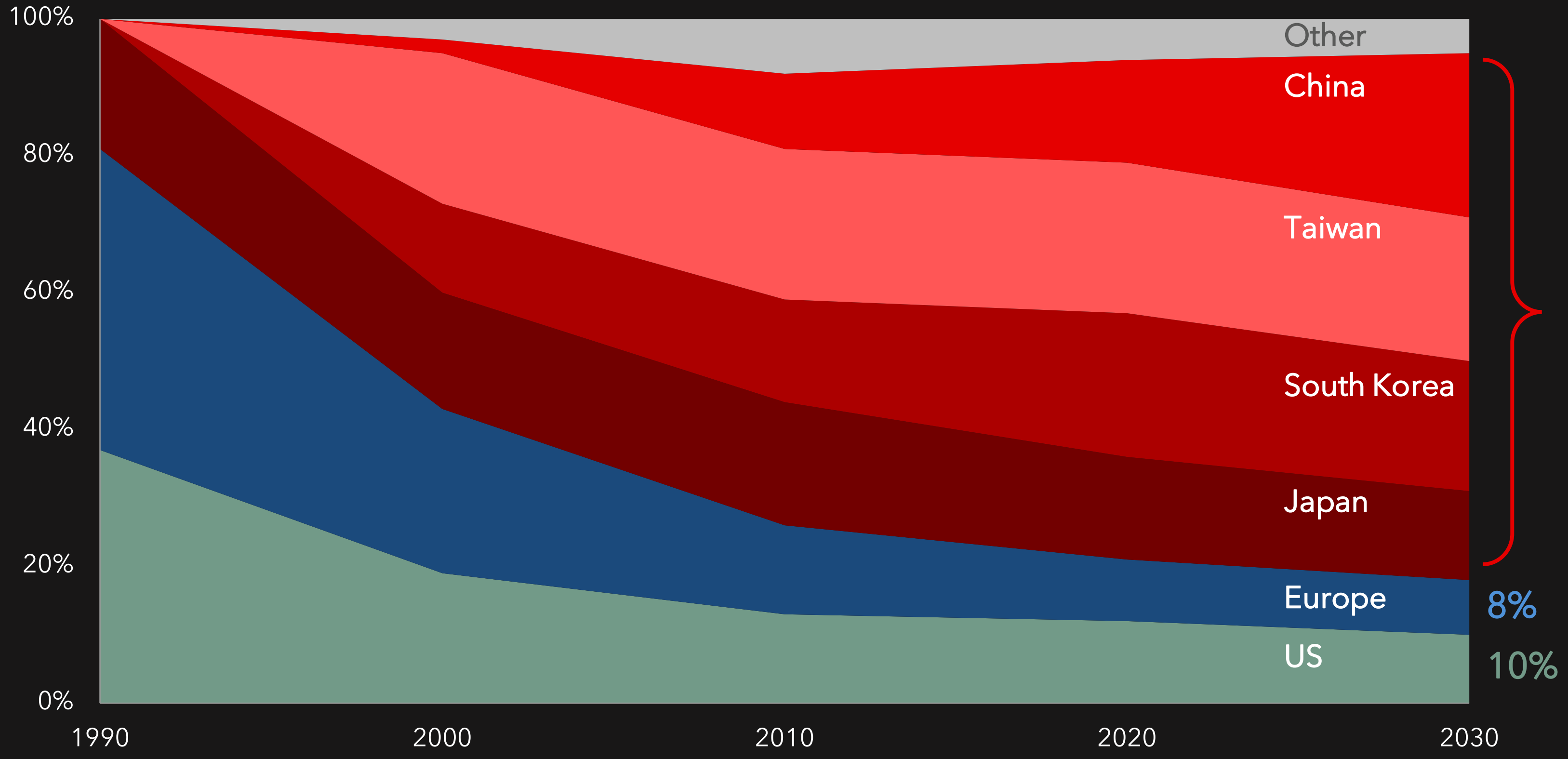


Source: (1) BCG, Semiconductors Industry Association "Strengthening the Global Semiconductor Supply Chain in an Uncertain Era". April 2021. China is mainland china only. BCG analysis with data from SIA WSTS, Gartner, IDC.

US and Europe Losing Manufacturing Share

Over the past 30 years, the US & Europe's share of chip manufacturing has declined from 81% to 21%. Furthermore, over the next decade, global manufacturing capacity is expected to increase by roughly 50%, 40% of which will be in China and only 6% expected to come from the US. According to a study by BCG, between $20 and $50 billion in US federal grants and tax incentives would be needed to reverse the declining market share trend of the last 30 years.

Global semiconductor manufacturing by location

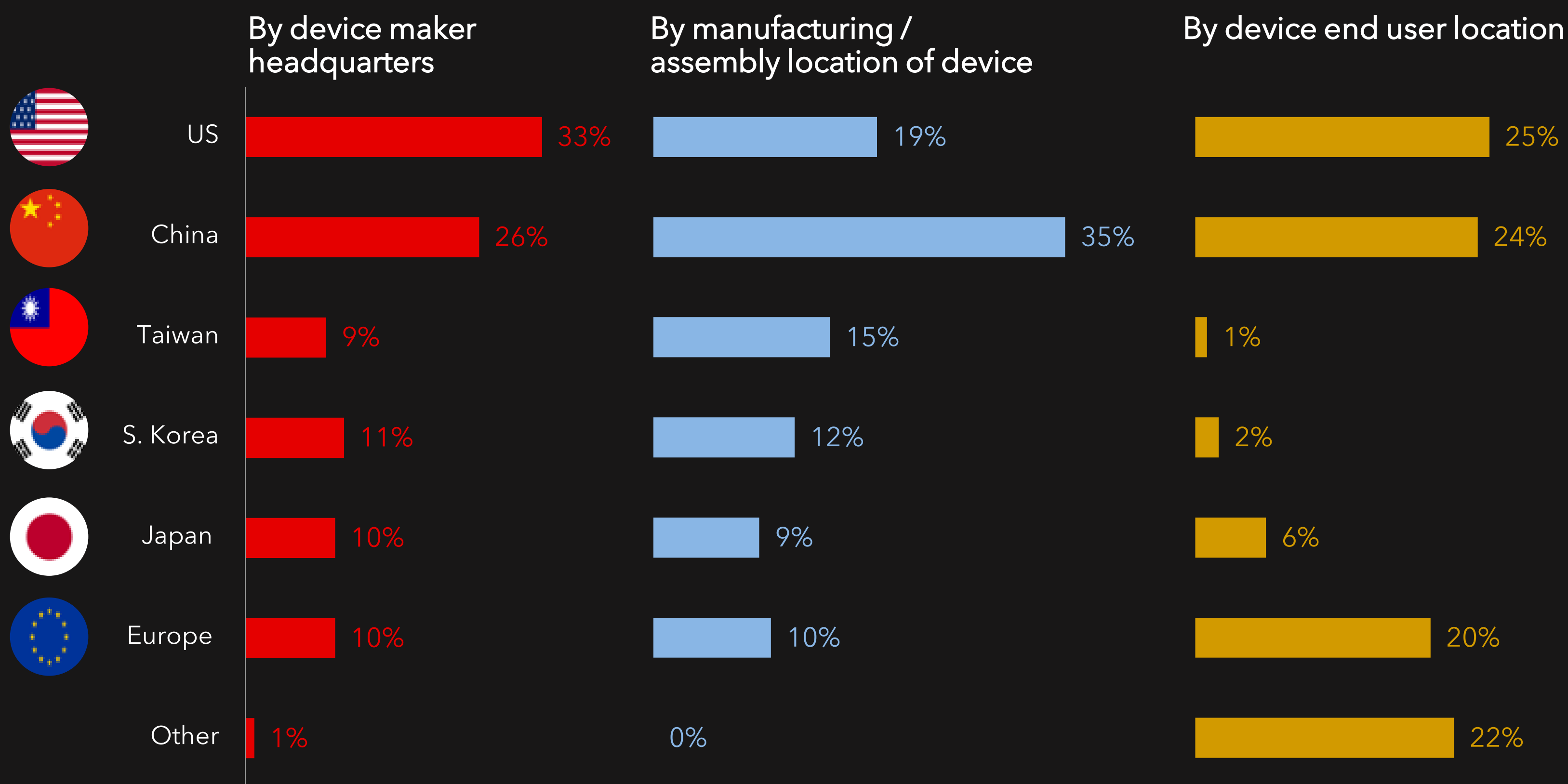


Source: (1) Statista. Boston Consulting Group, "Government Incentives and US Competitiveness In Semiconductor Manufacturing" (September 2020). Semiconductor Industry Association.

Global Semiconductor Sales by Region

Regional semiconductor demand can be measured in three different ways: i) by the headquarter location of the electronic device maker (design devices and purchase chips); ii) by the manufacturing or assembly location; or, iii) by the location of the end user of the finished electronic device

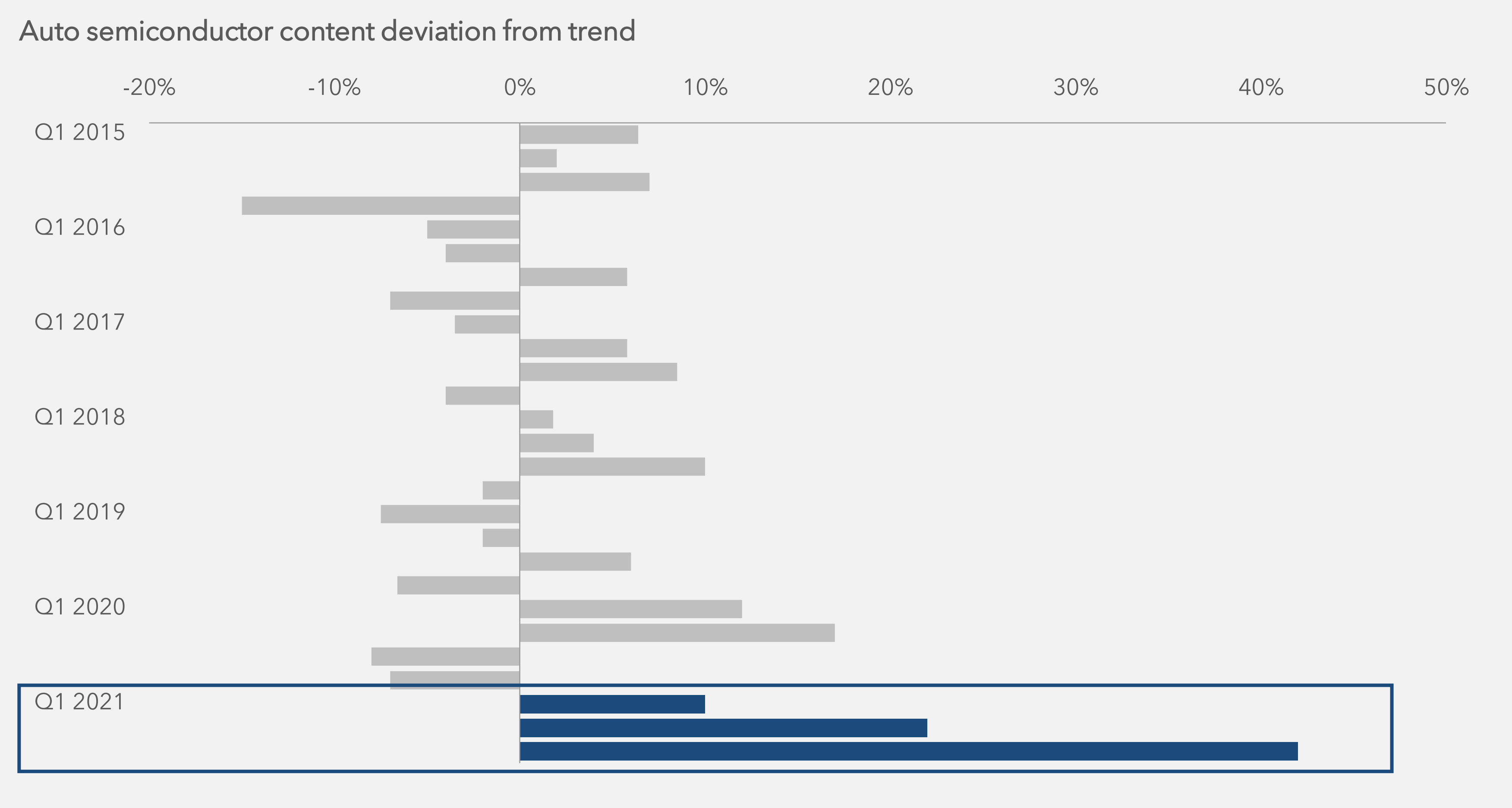
Global semiconductor sales by geographic area, 2019



Source: (1) BCG, Semiconductors Industry Association "Strengthening the Global Semiconductor Supply Chain in an Uncertain Era". April 2021. China is mainland china only. BCG analysis with data from SIA WSTS, Gartner, IDC.

Semiconductor Demand Well Above Trend

In an effort to avoid future supply chain bottlenecks, automakers globally have started "over-ordering" chips necessary for production. In Q3 2021, chip orders by automotive customers were 42% above the number of cars actually being produced.



Source: (1) FT. "EU Should Put the Brakes on its Chips Strategy" (November 4, 2021). Bernstein.

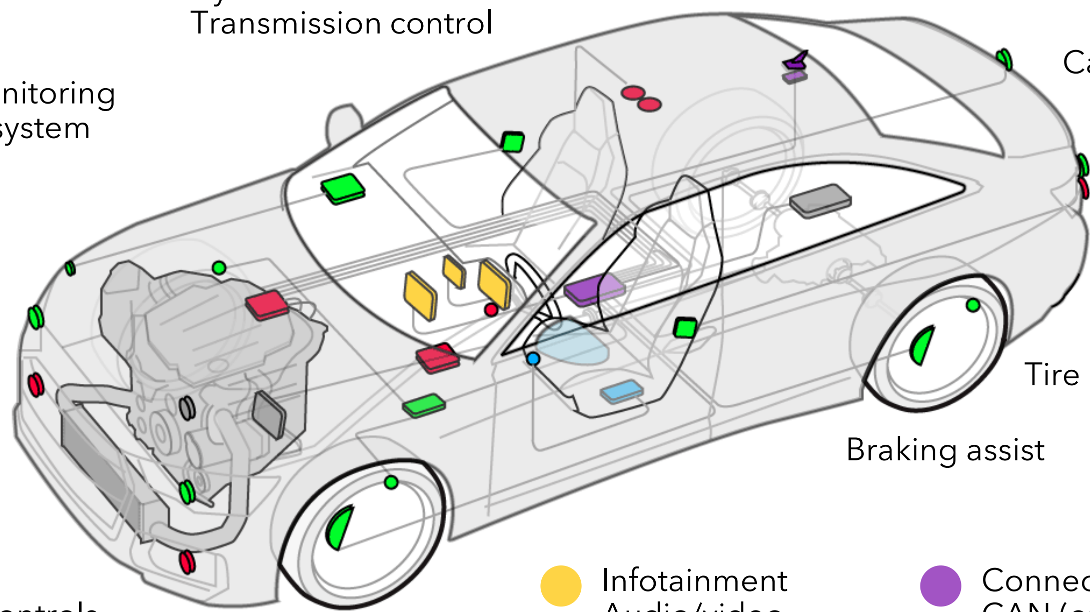
Semiconductors Essential to Auto Manufacturing

As vehicles become more technologically advanced, semiconductors have become a more critical piece of the manufacturing process. A modern vehicle uses roughly 1,400 chips, on average, to control everything from the airbags to AV displays and navigation.

Safety
Airbag controls
Collision-avoidance
Parking-assist
Power locks
Braking-assist
Tire-pressure-monitoring
Traction-control system

Powertrain
Engine control
Fuel-injection system
Hybrid-electric control
Transmission control

Electrical
Starter
Lighting system
Vehicle-diagnostics



Comfort
Window/mirror controls
Seat controls
Climate control

Infotainment
Audio/video
Driver display
Navigation

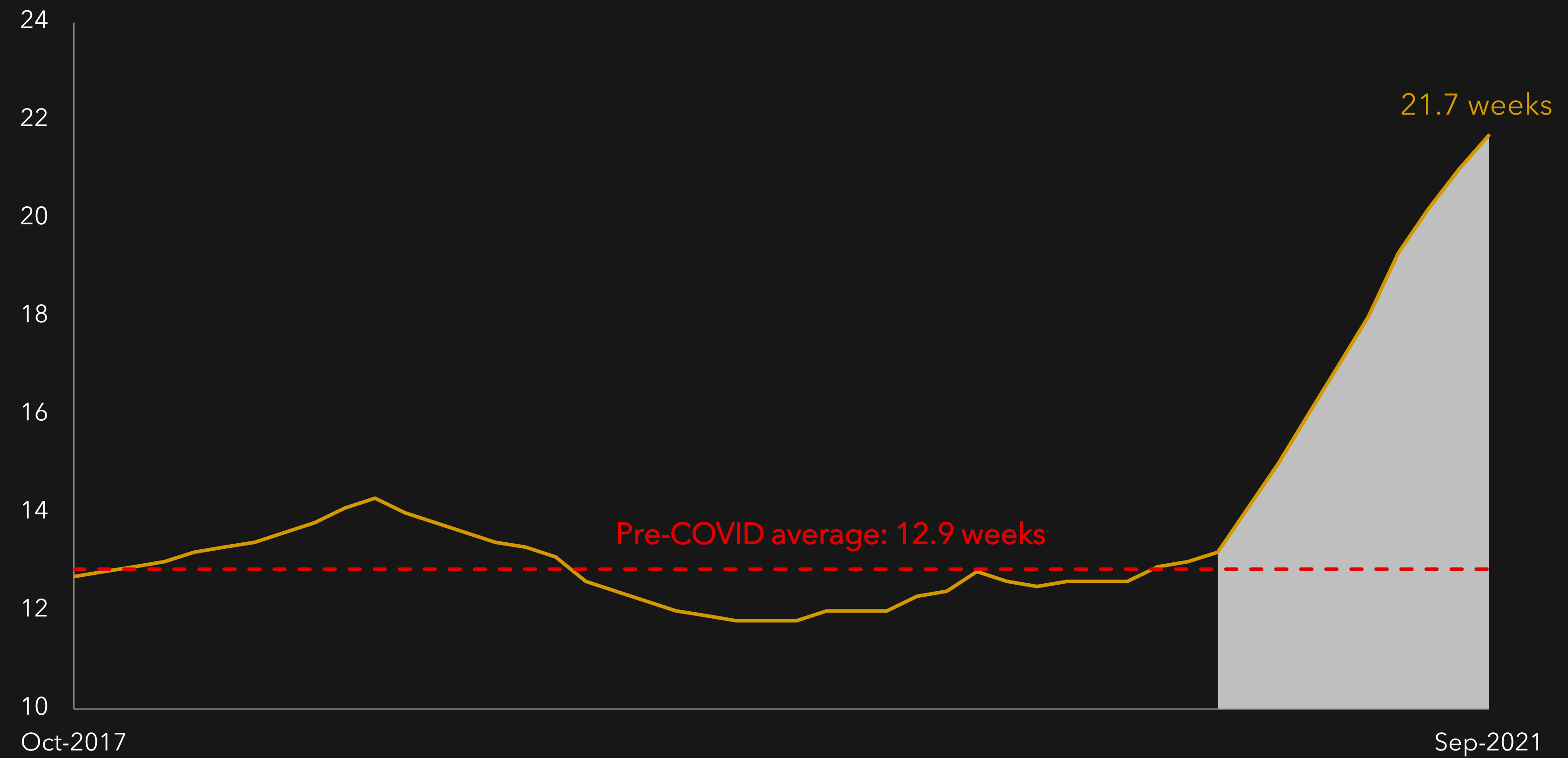
Connectivity
CAN (controller area network)
Broadband, WiFi, Bluetooth
Over-the-air software updates

Source: Bloomberg "Silicon Valley Answer to the EV Question Calls for Less Silicon" (King, Coppola, September 29, 2021).

Growing Chip Backlog

In September, the wait time between ordering a new semiconductor and delivery hit a record high 21.7 weeks, nearly double the pre-COVID average wait time. While the Biden administration and US Congress are pursuing ways to alleviate bottlenecks, the regionally specialized global value chain and surging global demand means disruption is likely to persist.

Gap between ordering a chip and delivery, weeks



Source: (1) Bloomberg Government "Container Rates Drift Lower After a Record Climb: Supply Lines" (October 11, 2021). ISM Services.

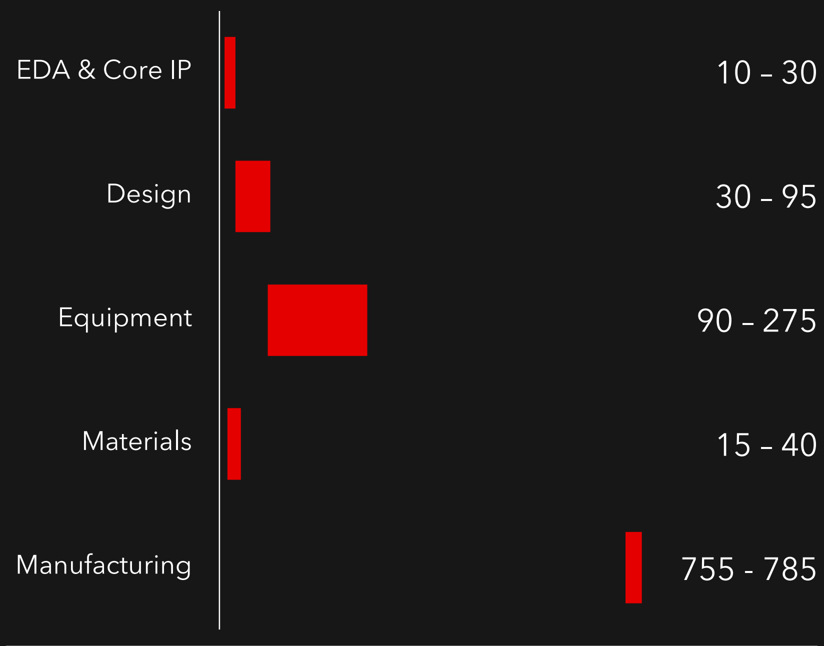
The Staggering Cost of Semiconductor Self-Sufficiency

While semiconductors are strategically important for both economic growth and national security, developing “self-sufficiency” in every major region would require roughly $1 trillion of upfront investment and up to $125 billion of incremental annual cost

Incremental cost to cover 2019 demand with fully “self-sufficient” localized semiconductor supply chains

<u>Upfront</u> investment

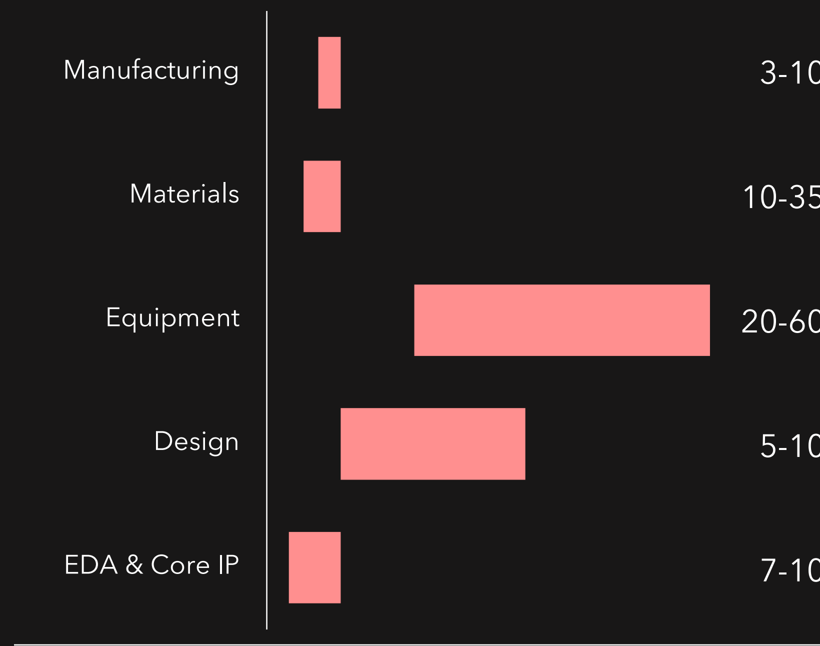
Est cost range ($ bn)



Total: $900 bn - $1.2 tn

<u>Incremental</u> annual cost

Est cost range ($ bn)



Total: $45 - $125 billion

Source: (1-2) BCG, Semiconductors Industry Association “ Strengthening the Global Semiconductor Supply Chain in an Uncertain Era”. April 2021. Manufacturing includes both wafer fabrication and assembly, packaging and testing. Range defined by number of local companies assumed to be required to meet the local needs in each activity of the value chain.

5 Labor Market Shortages

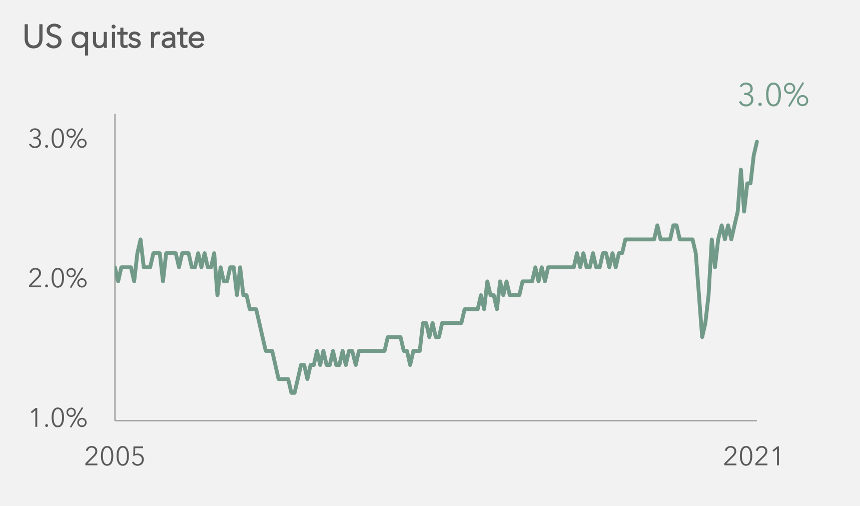
The Great Resignation

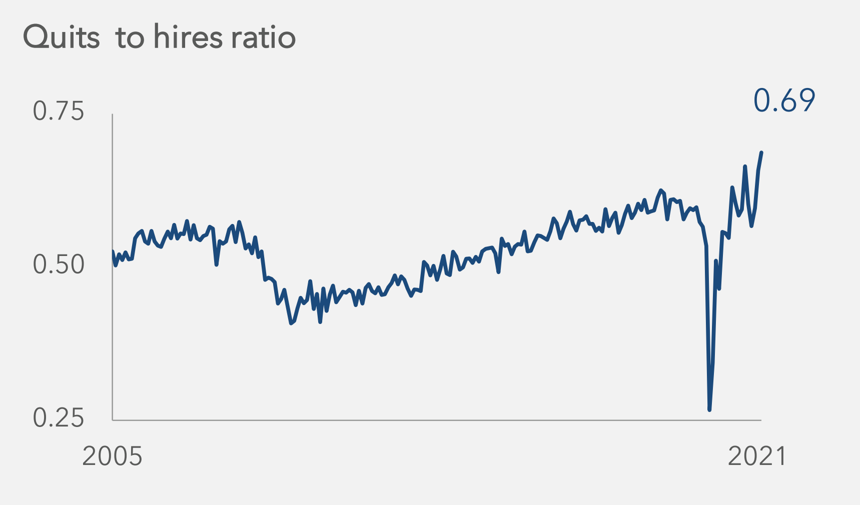
More than 24 million US workers have quit their jobs since April 2021. In September alone, 4.4 million US employees quit, a record high level since data started being recorded in 2000.

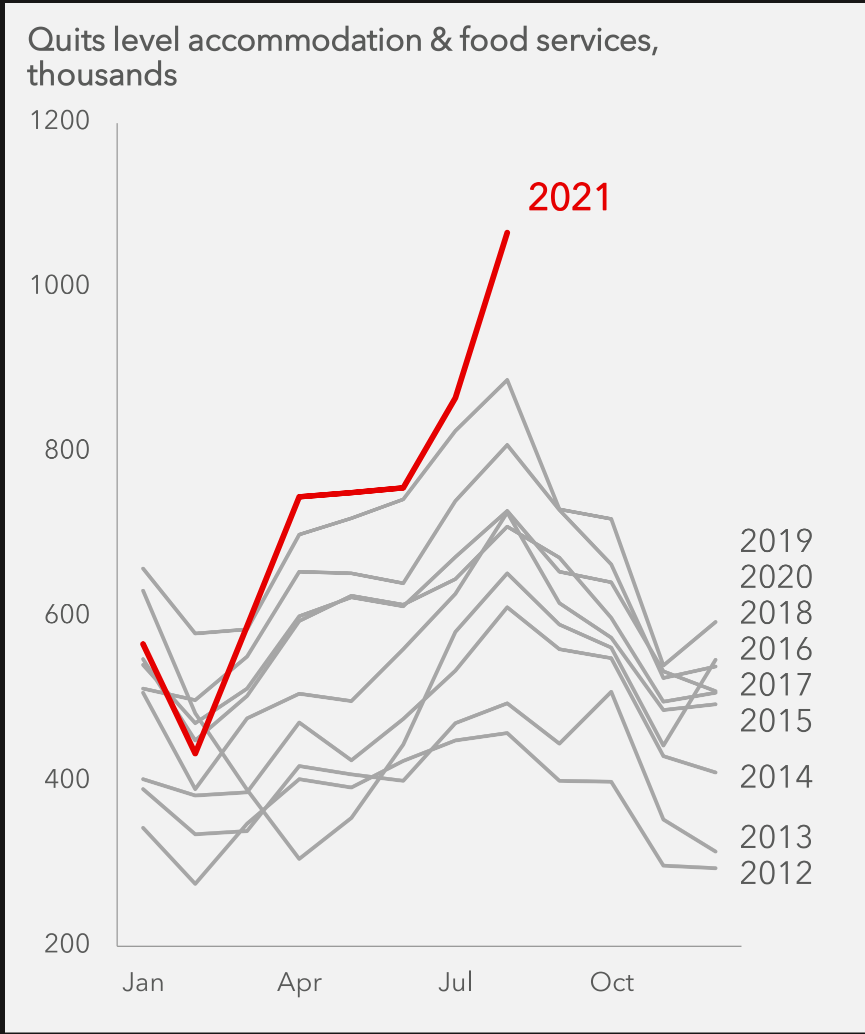
US job quits, millions

Source: (1) Bloomberg. Data as of November 19,2021.

The Great Resignation







Source: (1-3) Bloomberg. Data as of November 19,2021. Quits level is NSA.

Resignations Likely to Remain Elevated

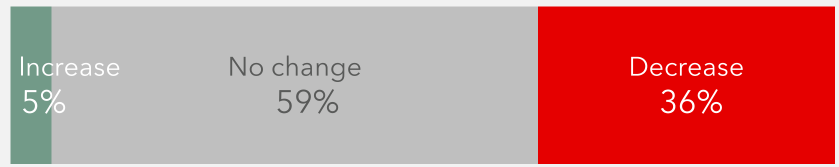
According to a study by McKinsey, a majority of companies are experiencing higher voluntary turnover in 2021 than in prior years, and over 60% expect the trend to continue or worsen going forward. In a departure from prior labor cycles, more employees have or are willing to resign without another offer in hand, a strong indicator that the "Great Resignation" trend is likely to accelerate.

Are you experiencing greater voluntary turnover (quit, resignation) in your workforce this year than in years prior?

Share of employers, %

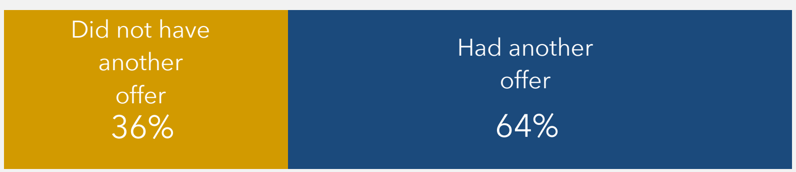
Follow-up question for respondents who answered yes:
How do you expect the rate of turnover to change over the next 6 months?

Share of employers, %



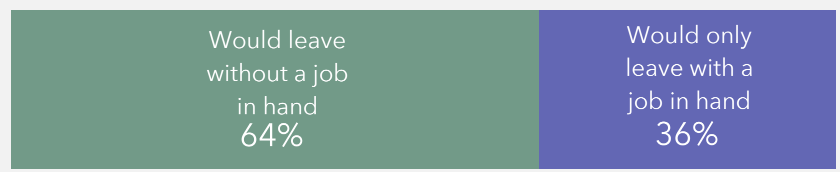
Employees who have recently quit

Share of employers, %



Employees who are at least "somewhat likely" to quit in the next 3 – 6 months

Share of employers, %



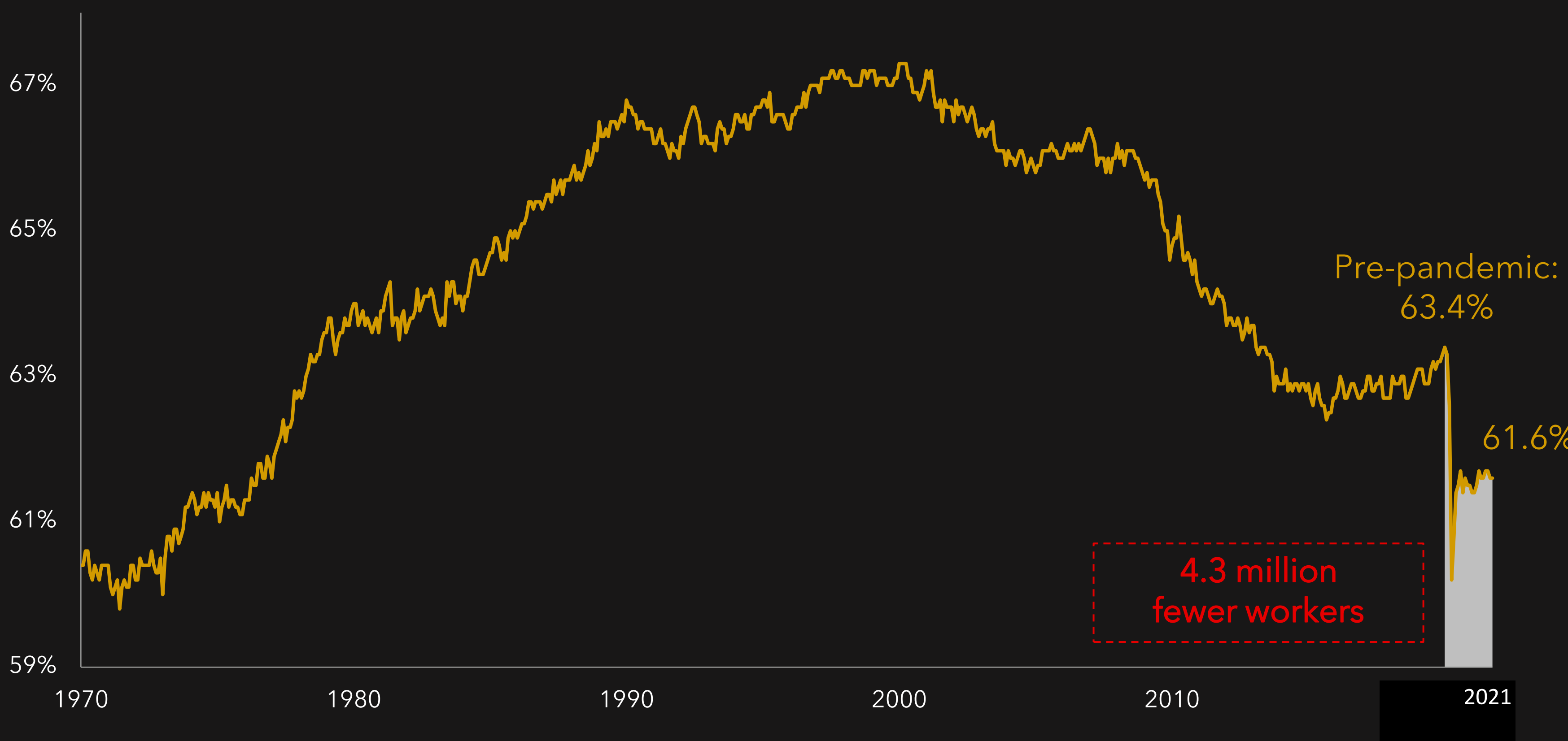
McKinsey & Company

Source: (1-2) McKinsey "Great Attrition or Great Attraction? The Choice is Yours" (September 8, 2021). Employee survey included 5,774 people of working age; the employer survey included 250 managers specializing in talent. Managers were evenly split between large and midsize organizations across Australia, Canada, Singapore, the UK and the US and across multiple industries.

4 Million Worker Shortfall

At the start of the pandemic, the US labor force participation rate had its largest decline since WWII. While the rate has recovered since April 2020, it remains near the 1970s lows and nearly two points below its February 2020 level. The participation rate decline represents 4.3 million fewer workers employed today relative to pre-pandemic levels.

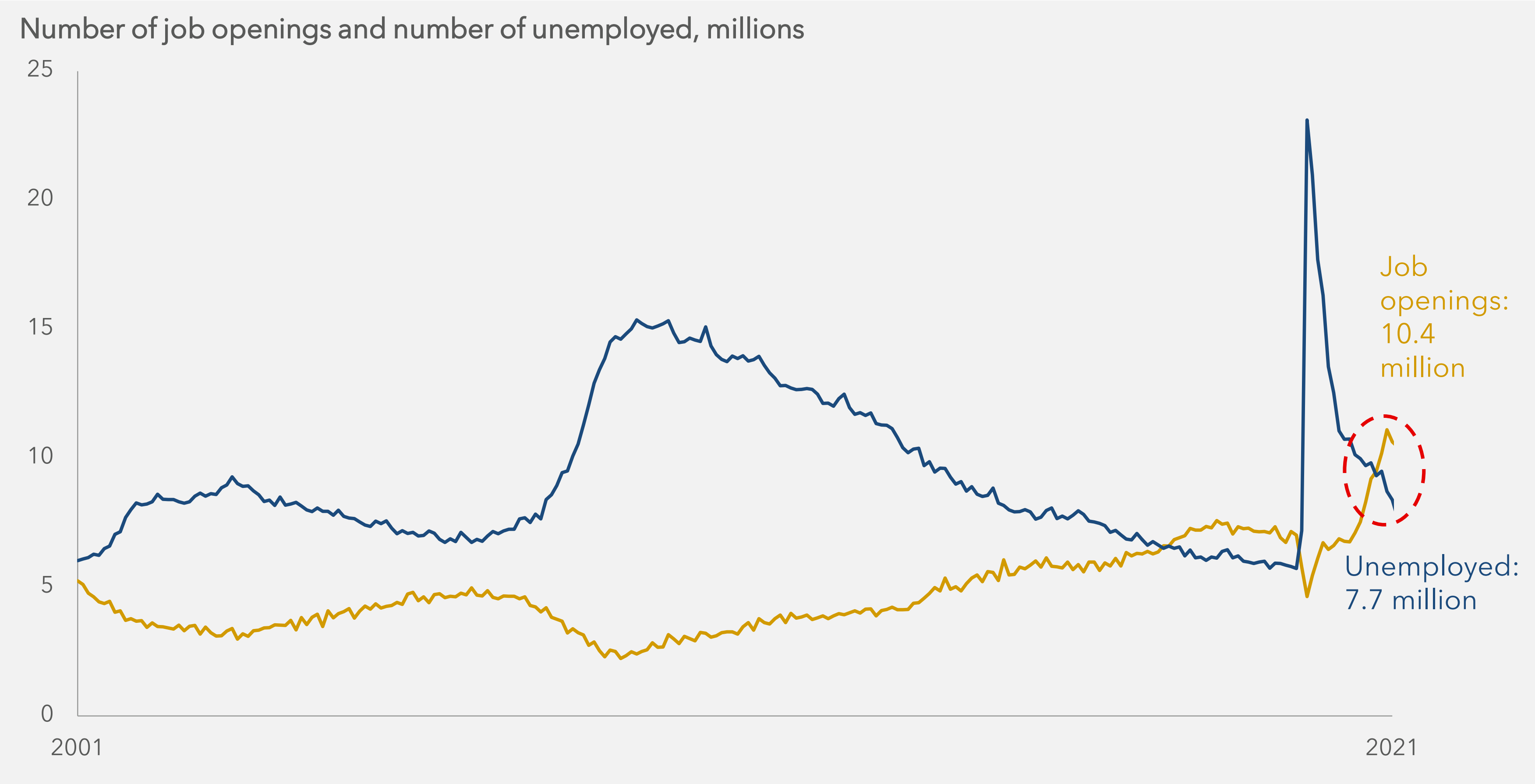
Labor force participation rate



Source: (1) Bloomberg. Data as of November 19, 2021.

Over 10 Million Job Openings

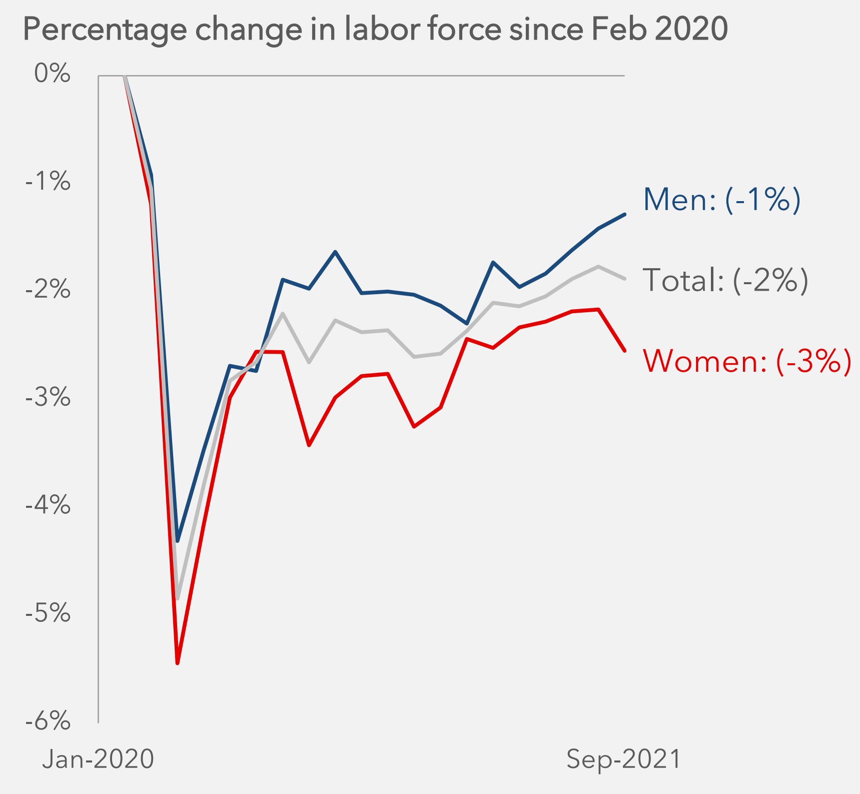
Data from the US department of labor shows employers are trying to fill more than 10 million job openings at the same time that layoffs are relatively low, resignations are rising rapidly and unemployment is steadily declining from pandemic levels. In October, jobless claims, a good proxy for layoffs, fell below 300k for the first time since the pandemic started.

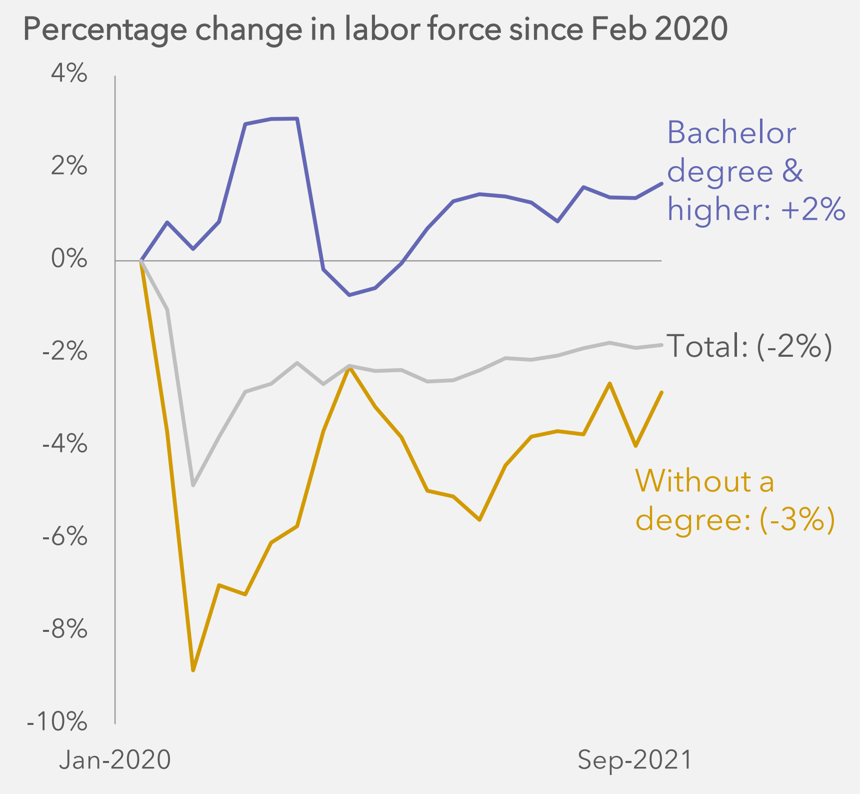


Source: (1) Bloomberg. Data as of November 19, 2021.

Structural Changes to the Workforce

Female labor force participation in the US had been slowly declining since its peak in 1999. However, in the wake of the COVID recession, with working women taking on more hours of unpaid child care compared to working men, women have left the workforce at a much more rapid pace. At the same time, there is a growing divide between the participation rates of workers with a bachelor's degree (or higher) vs. those without. As companies invest further in automation and business processing equipment, the number of lower skilled labor jobs available may be permanently reduced.





Source: (1-2) WSJ. "4.3 Million Workers Are Missing. Where Did They Go? (October 14, 2021). Labor Department. Seasonally adjusted data includes people 16 and older. Without a degree is high school graduate and no college. Bloomberg. Data as of November 19, 2021.

Key Drivers of Labor Market Shortages

Expansive unemployment benefits (expired Sep 6)

COVID related fears

COVID related visa / travel restrictions

Child & elderly care challenges

Elevated consumer savings rate
($3.7 trillion "excess savings" in US in 18 months)

High workforce exit rates (baby boomers, women)

"Mismatches" between job needs and skillsets

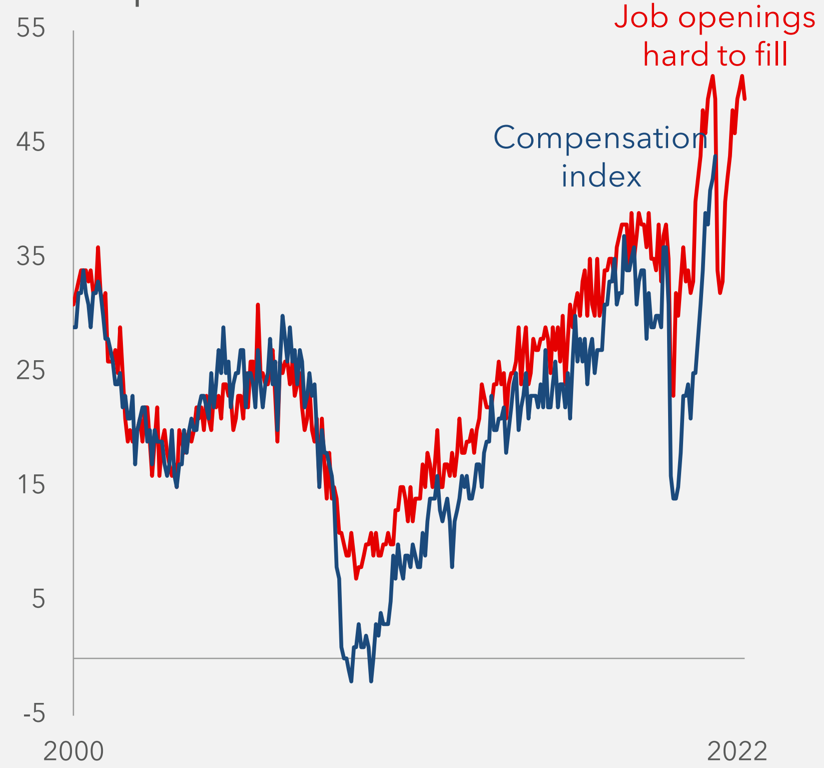
Impact of supply chain disruptions

Decade-long disruption from technology disintermediation

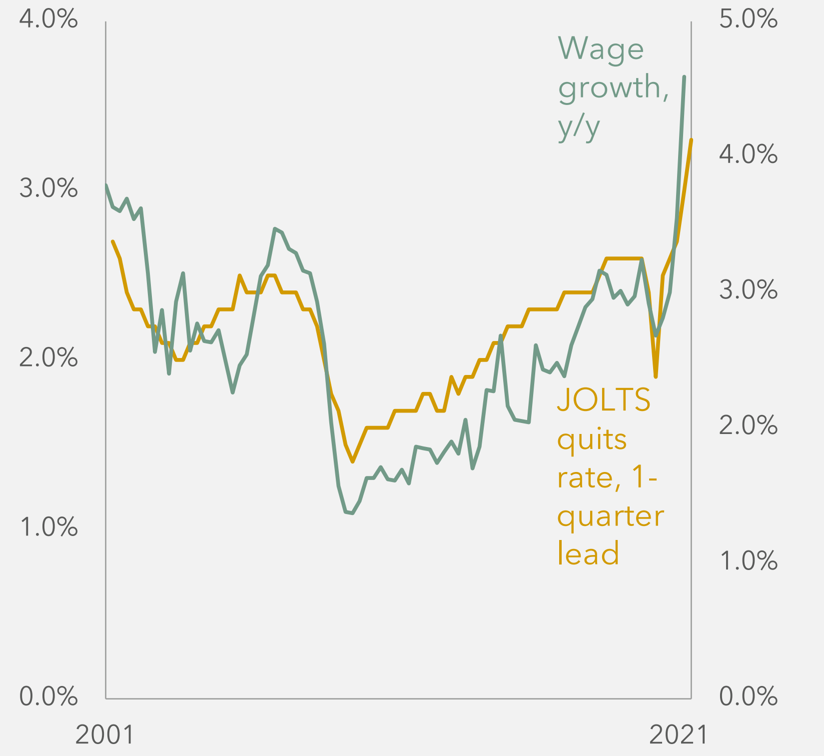
Wage Pressures Rising

With plentiful job openings and quit rates at record levels, wages have experienced upward pressure as employers attempt to fill positions. Near term, pressure is likely to remain elevated with Oxford Economics forecasting private hourly earnings to rise to 5% y/y in Q4 before easing toward 4% y/y in the first half of 2022.

NFIB job openings hard to fill (advanced 12 months) and compensation index



Quits rate and Employment Cost Index

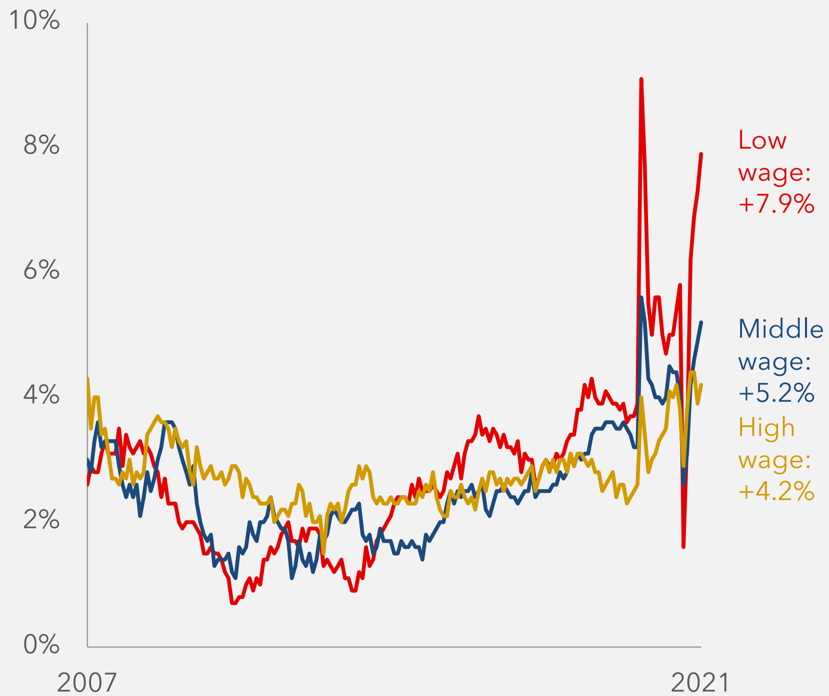


Source: (1) Bloomberg. Data as of November 19, 2021. (2) Oxford Economics, "No Wage-Price Spiral, But There are Three Ps to Monitor". JOLTS is private quits rate, 1-quarter lead. Wage growth Is Employment Cost Index, wages and salaries, private workers y/y.

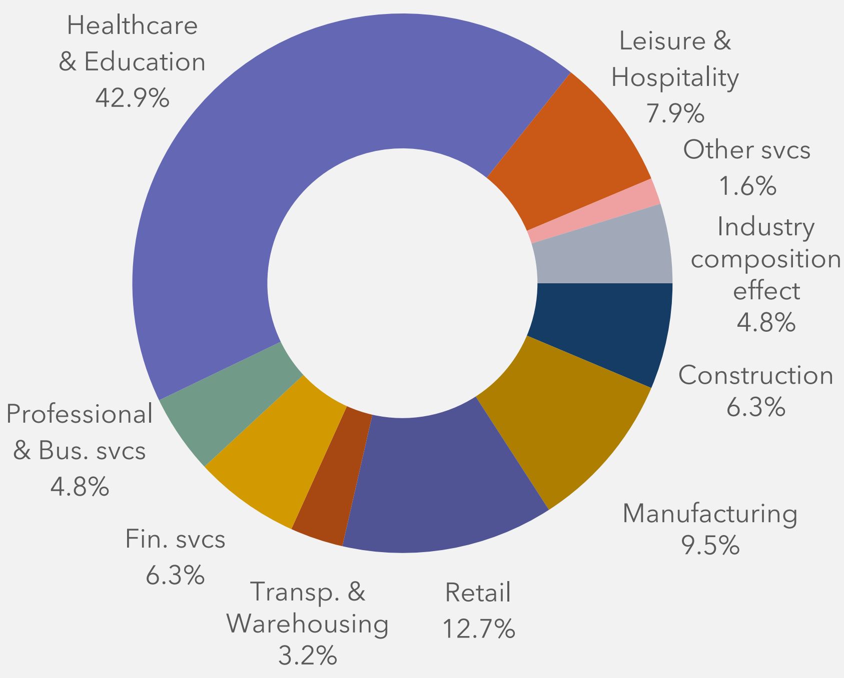
Wage Growth Pressures by Industry

A few industries have disproportionately contributed to recent wage growth. Over the past three months, education and healthcare, leisure and hospitality, and professional and business services industries have accounted for about 60% of the month-on-month wage growth. So far, the rise in wages is still below that of inflation and productivity growth.

US average hourly earnings, y/y



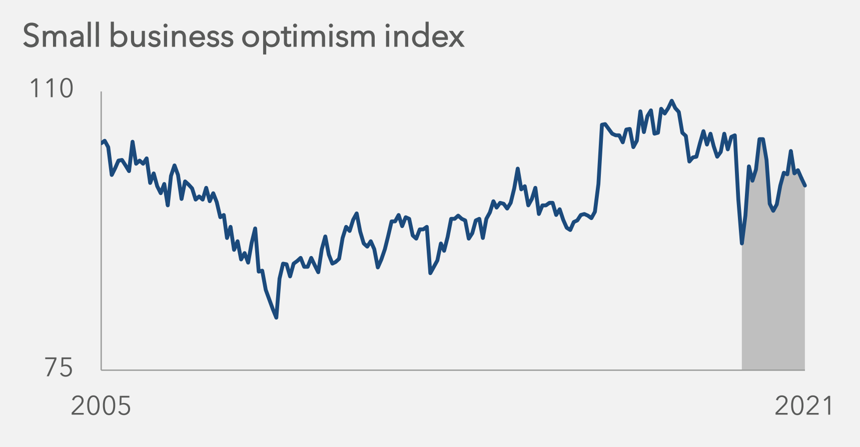
Contributions to the m/m % change in average hourly earnings, September 2021

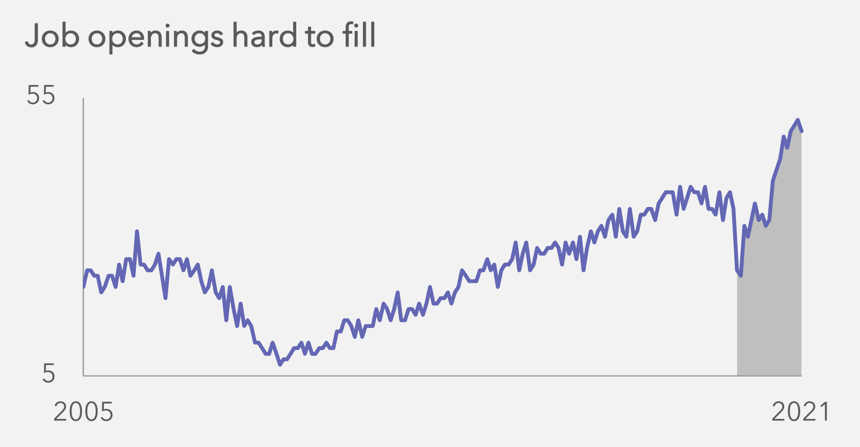


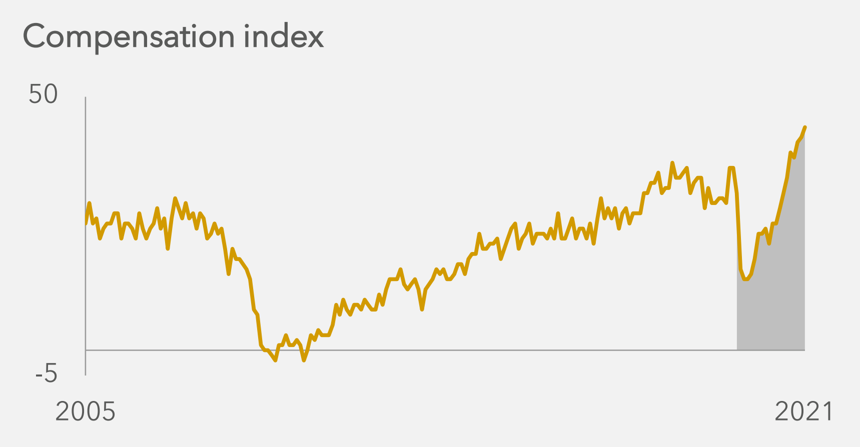
Source: (1-2) Oxford Economics "No Wage-Price Spiral, But There are Three Ps to Monitor" (October 27, 2021).

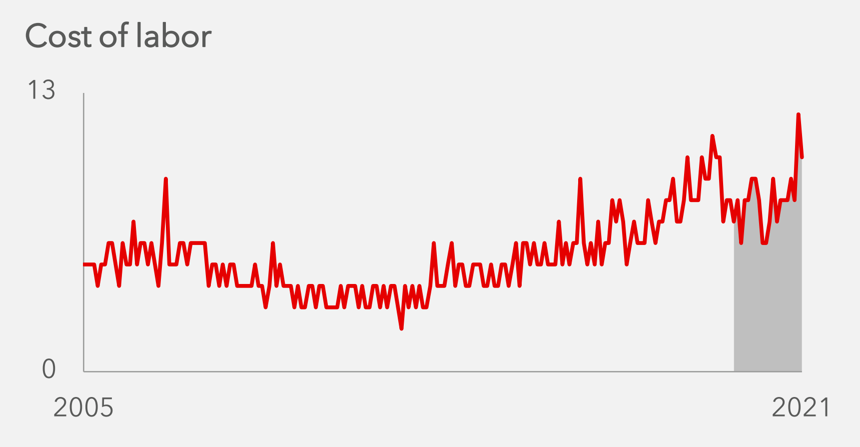
Labor Challenges Weigh on Small Business

Labor market challenges and elevated prices paid are weighing on small business optimism, which has steadily declined from its recent peak in June of this year. In a sign of continued wage pressure, a record number of small companies are planning to raise compensation in the months ahead.







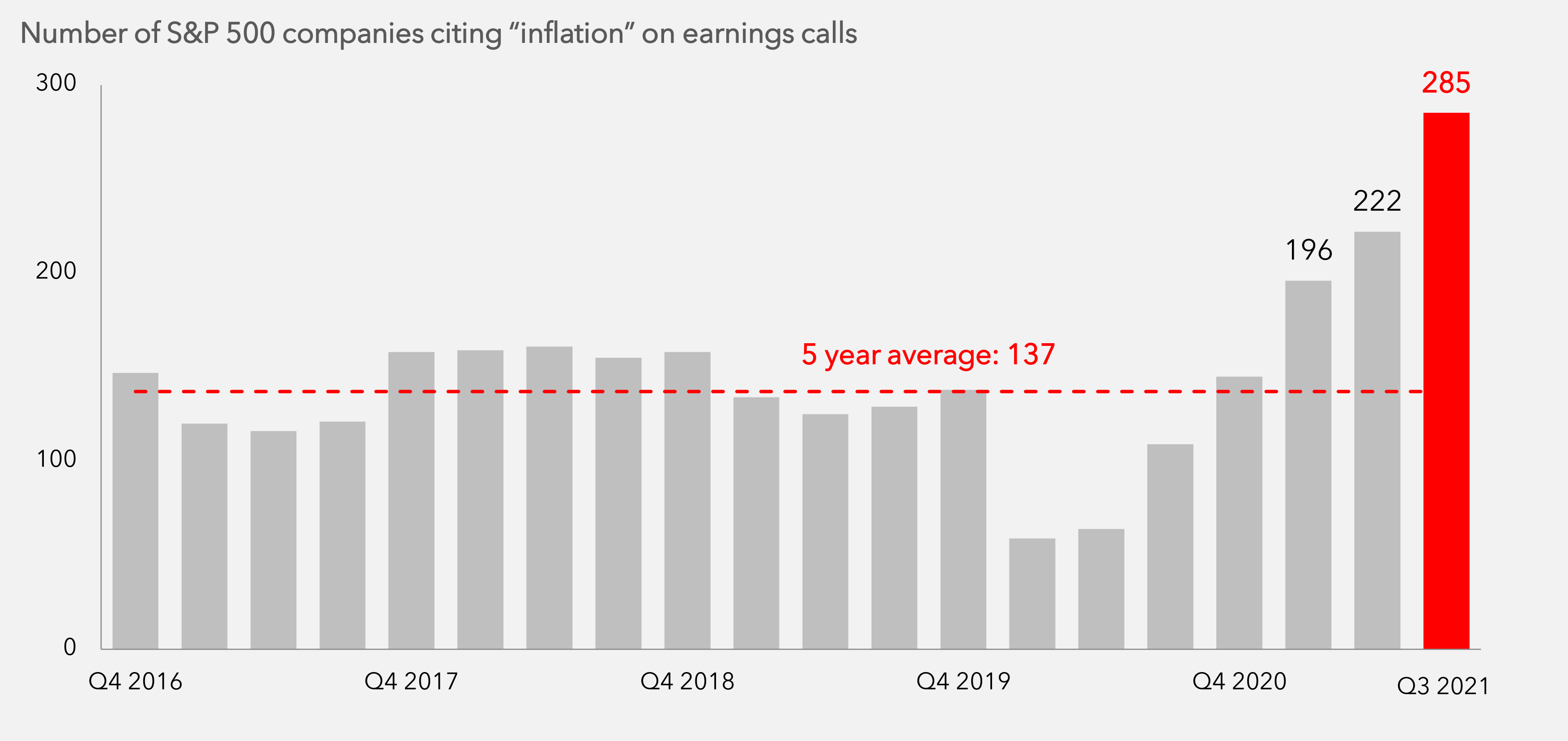


Source: (1-4) Bloomberg. Data as of November 19,2021. All indices are from the NFIB Small Business Optimism Survey.

6 Inflationary Pressures

Record Number of Companies Citing "Inflation" in Earnings Calls

In Q3, 285 S&P 500 companies cited the term "inflation" in their earnings calls (the highest number since data recording began in 2010), well above the prior record of 222 in Q2 2021 and the 5 year average of 137

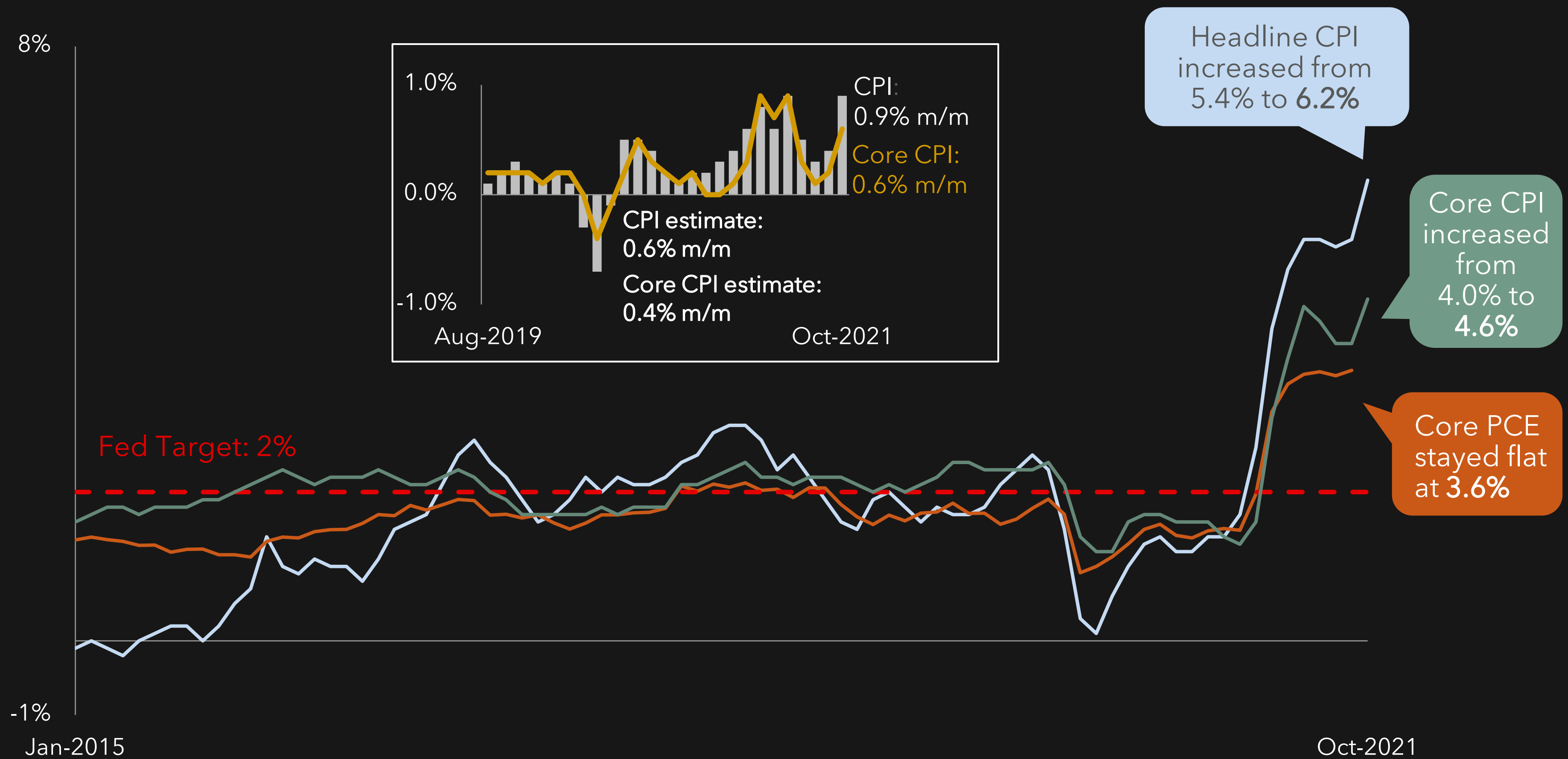


Source: (1) FactSet Earnings Insight (November 12, 2021). Based on approximately 460 companies reporting earnings.

Highest US Inflation Since 1990

In October, headline US inflation surprised markets with a 6.2% year-on-year increase, the fastest annual increase since 1990 and well above consensus expectations of 5.9%. Inflation has now exceeded 5% for five consecutive months.

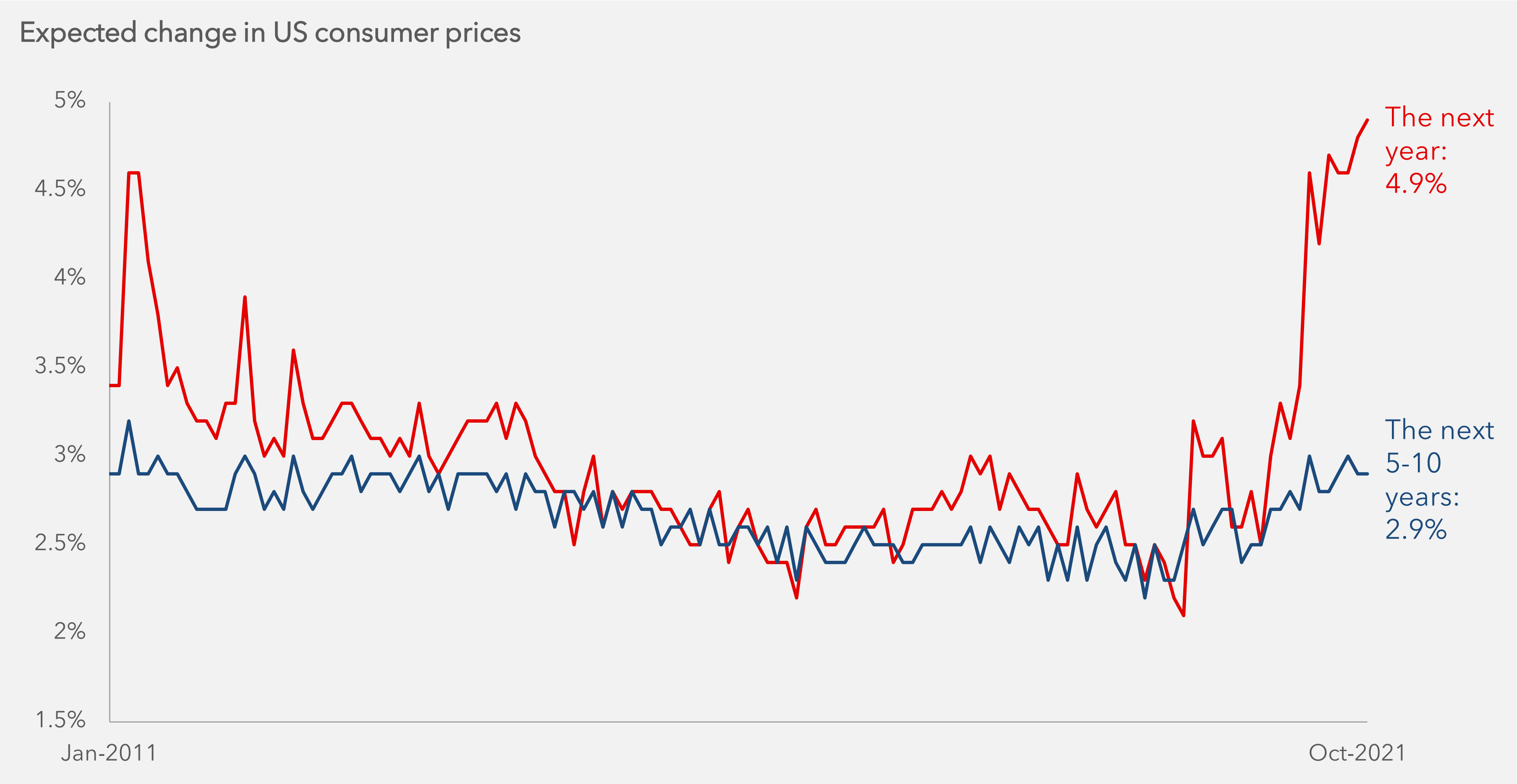
US Headline CPI & Core PCE (y/y)



Source: (1) Bloomberg. Data as of November 19, 2021. FRED.

Near Term Inflation Expectations Rising More Rapidly

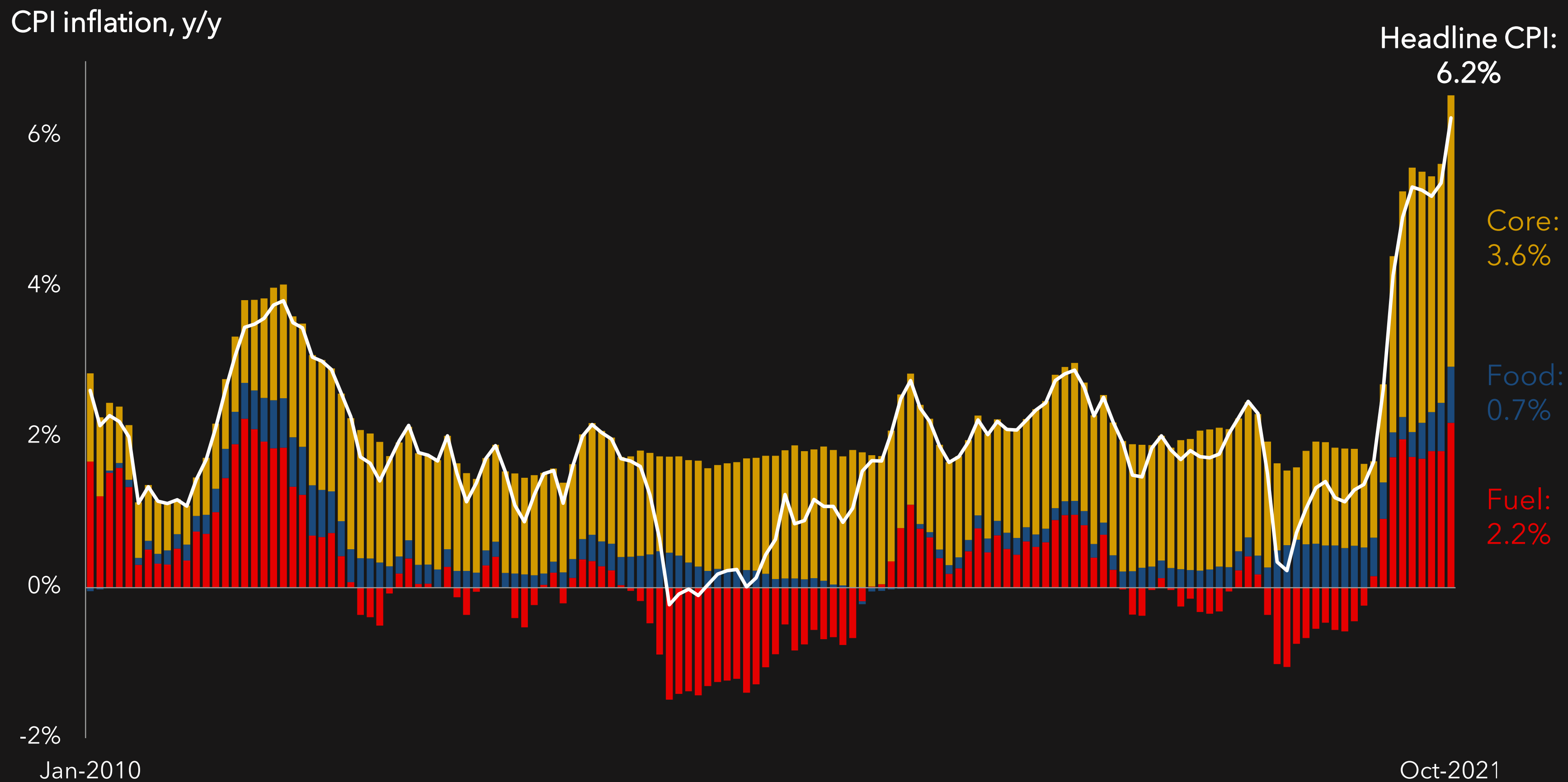
University of Michigan short-term inflation expectations increased to a 13-year high of 4.9% in October while five-to-ten-year inflation expectations dropped slightly to 2.9%, though still significantly higher than pre-pandemic levels



Source: (1) Bloomberg. Data as of November 19, 2021.

Inflation Pressures Broadening

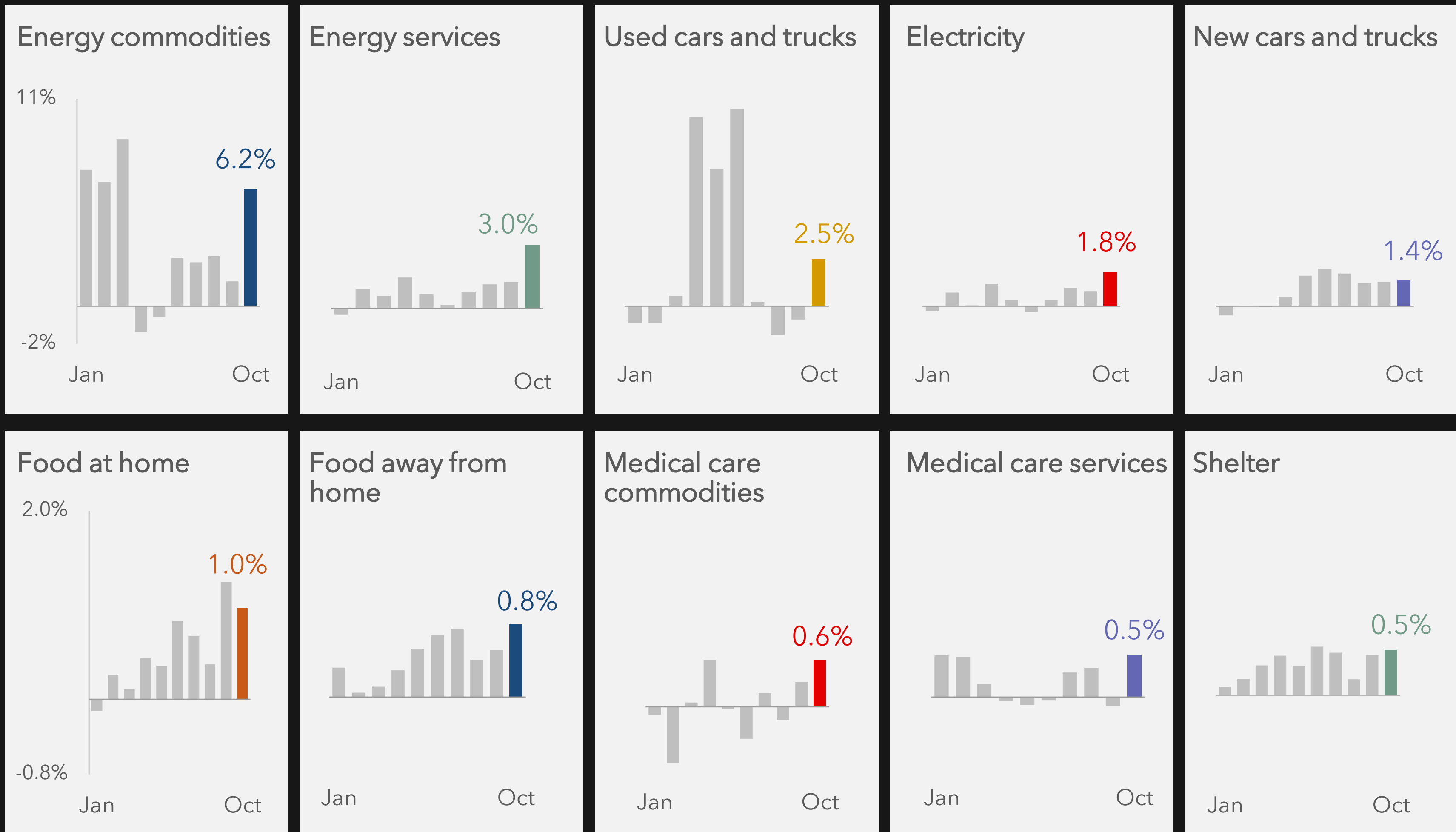
While increases in food and fuel did contribute to October's surprisingly high inflation print, growth in "core" factors were an even larger driver. Within the "core" component, numerous sectors are facing rising inflationary pressures, not just those directly impacted by the re-opening.



Source: (1) Bloomberg. Data as of November 12, 2021.

Inflation Rising Across Multiple Sectors

US CPI m/m in 2021

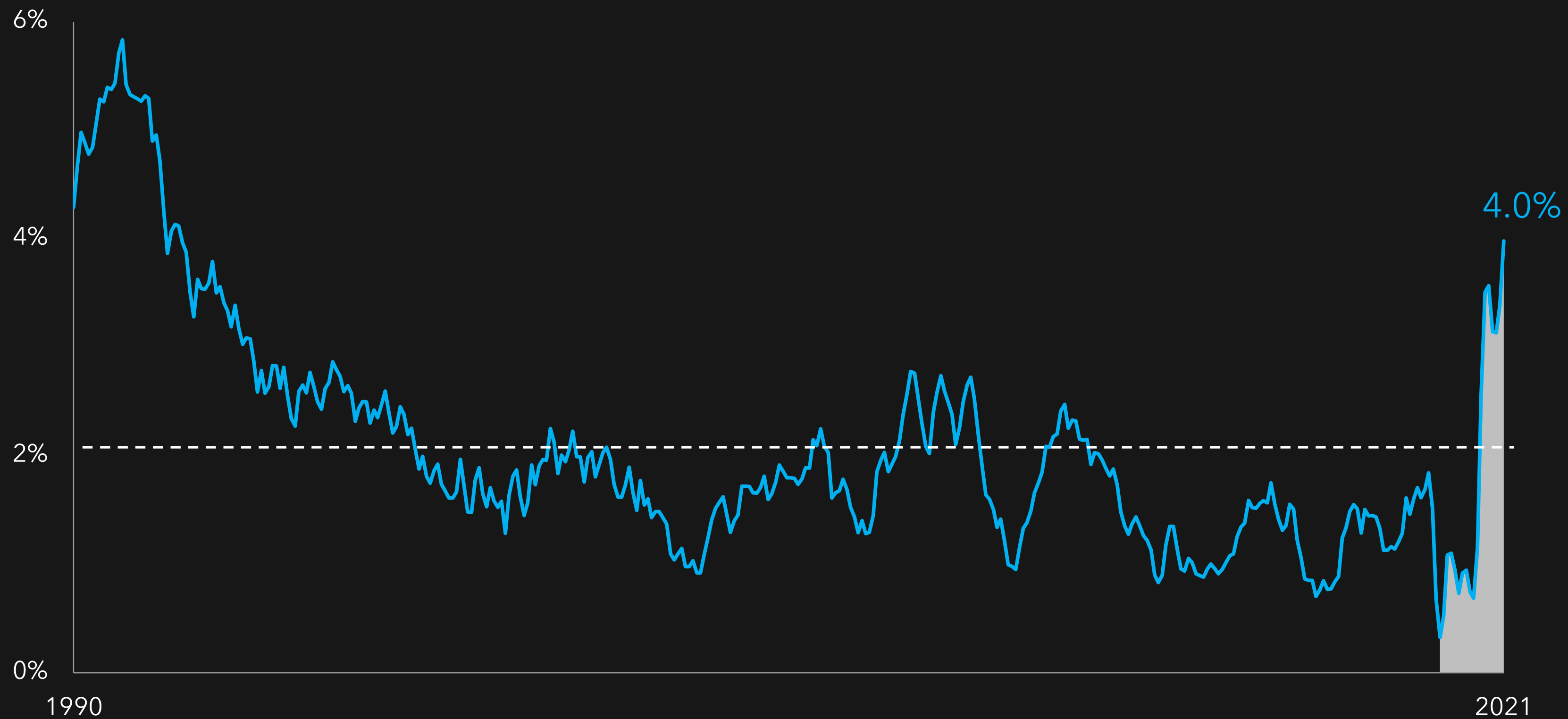


Source: (1-10) Bloomberg. Data as of November 12, 2021. Bureau of Labor Statistics. Seasonally adjusted.

Inflation in Non-Pandemic-Impacted Sectors

In 2021, the Bureau of Labor Statistics started publishing a version of core inflation that excluded food, shelter, energy and used cars and trucks, sectors that were severely impacted by rising commodity prices and the pandemic related shutdown and re-opening. In October, this measure of inflation moved above 4%, its highest level since 1991, indicating inflationary pressures are broadening across the economy.

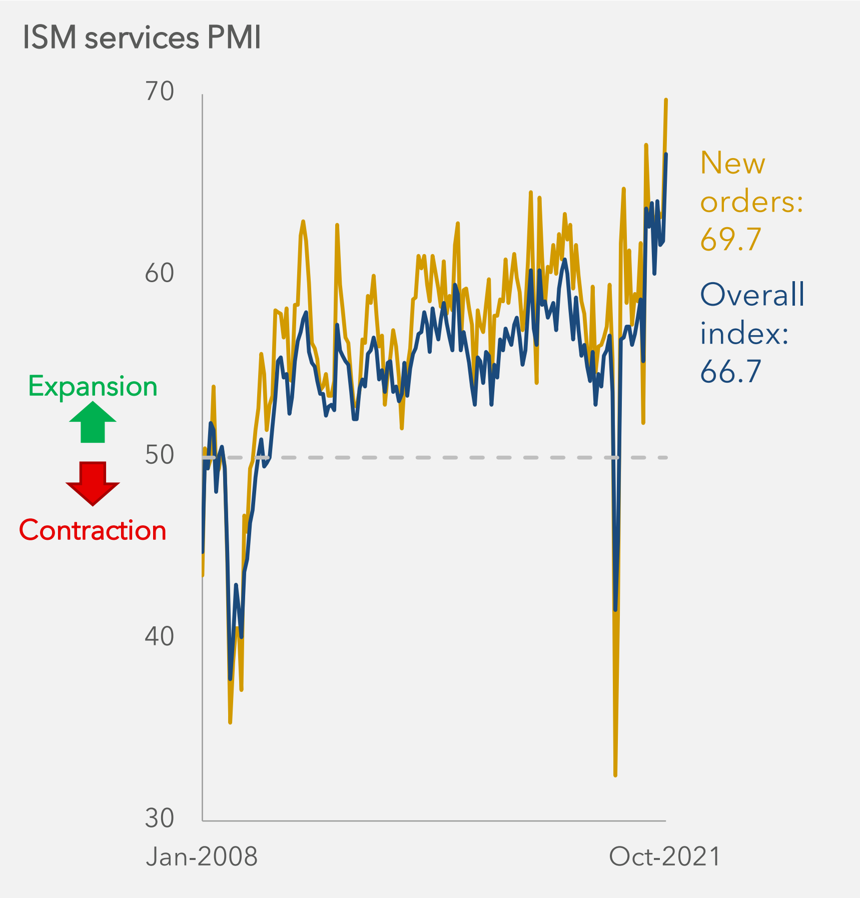
US CPI all items less food, shelter, energy and used cars & trucks

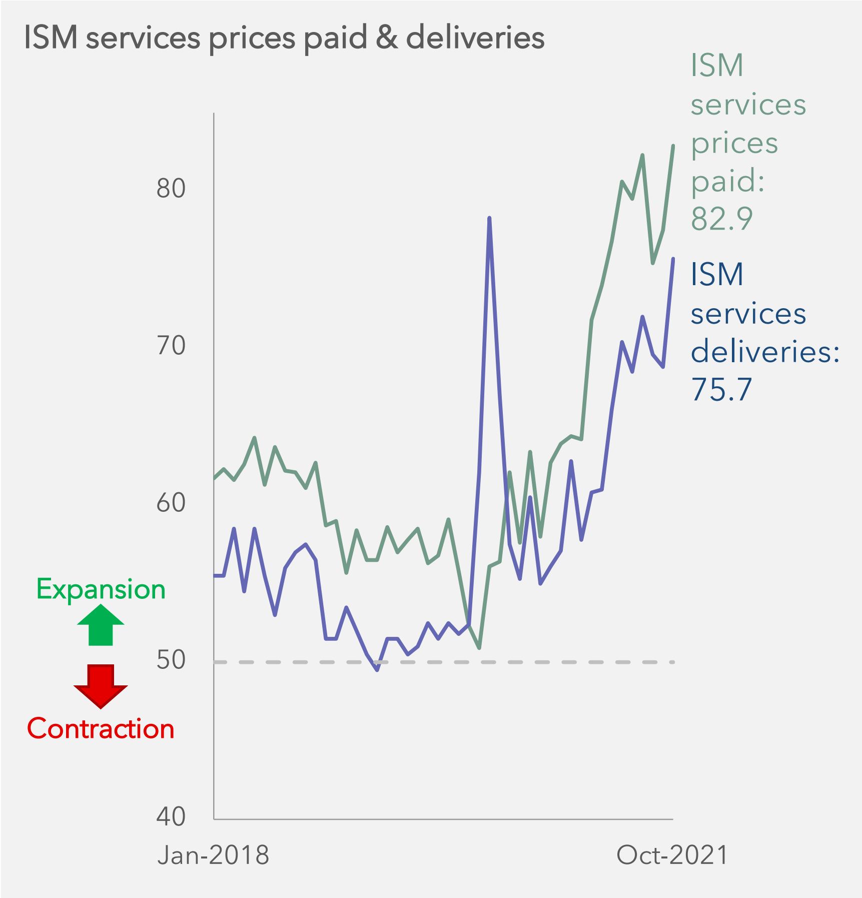


Source: (1) Bloomberg. Data as of November 19, 2021. IUS CPI all items less food, shelter, energy & used cars & trucks is NSA.

Demand and Prices for Services Also Soaring

As consumer spending normalizes post-pandemic, and shifts back to services from goods, the services sector will face many of the same supply side dislocations as manufactures. In October, the ISM services PMI rose to 66.7, its highest level on record with data going back to 1997.



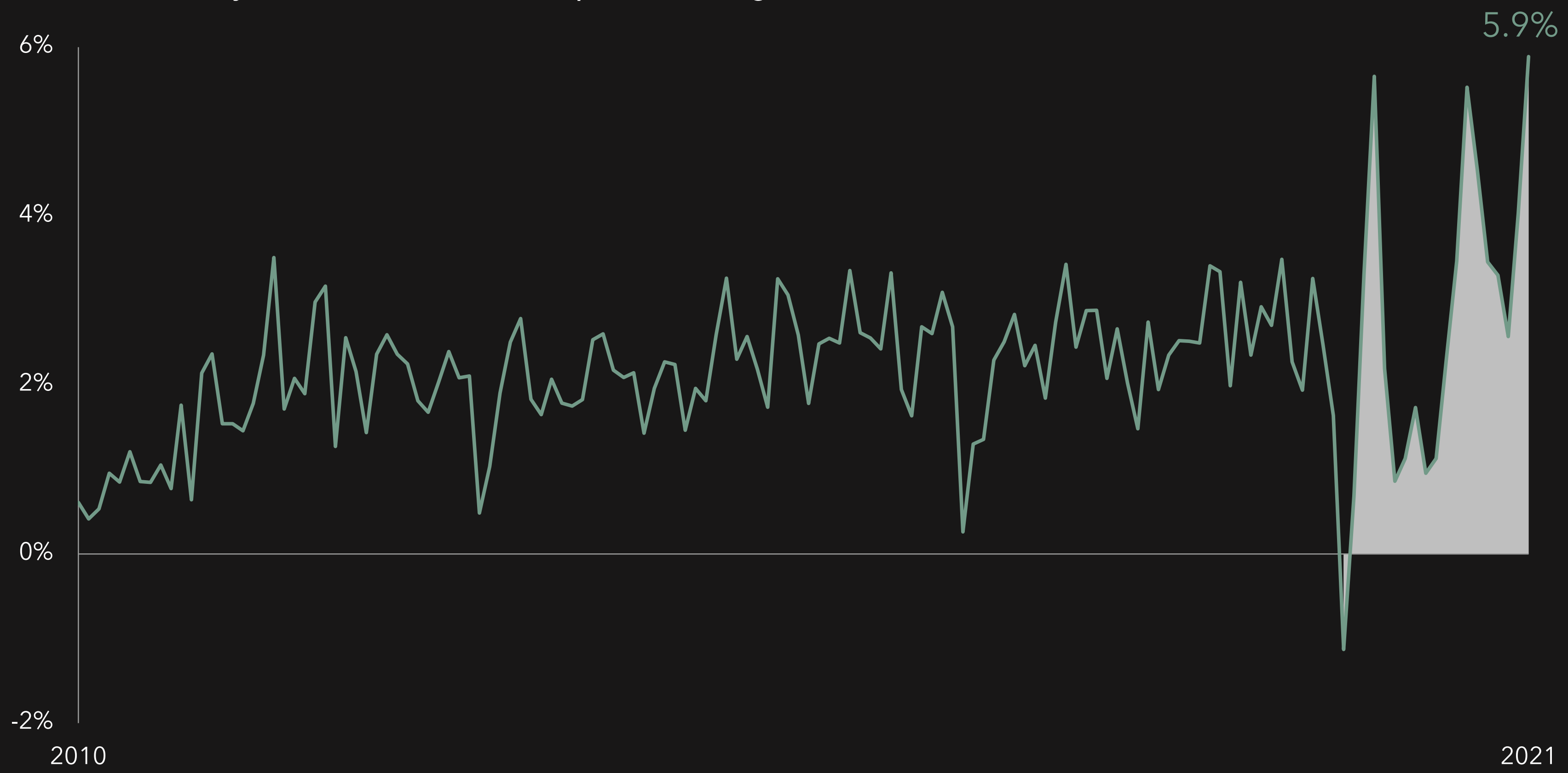


Source: (1-2) Bloomberg. Data as of November 19, 2021.

Fed's "Sticky" Inflation at 30 Year High

The Atlanta Fed produces a "sticky" inflation index that tracks prices of products that typically take several months to adjust and, by definition, are more difficult to manage. In October, the Atlanta Fed "sticky" inflation index reached it's highest level since 1991 on an annualized basis.

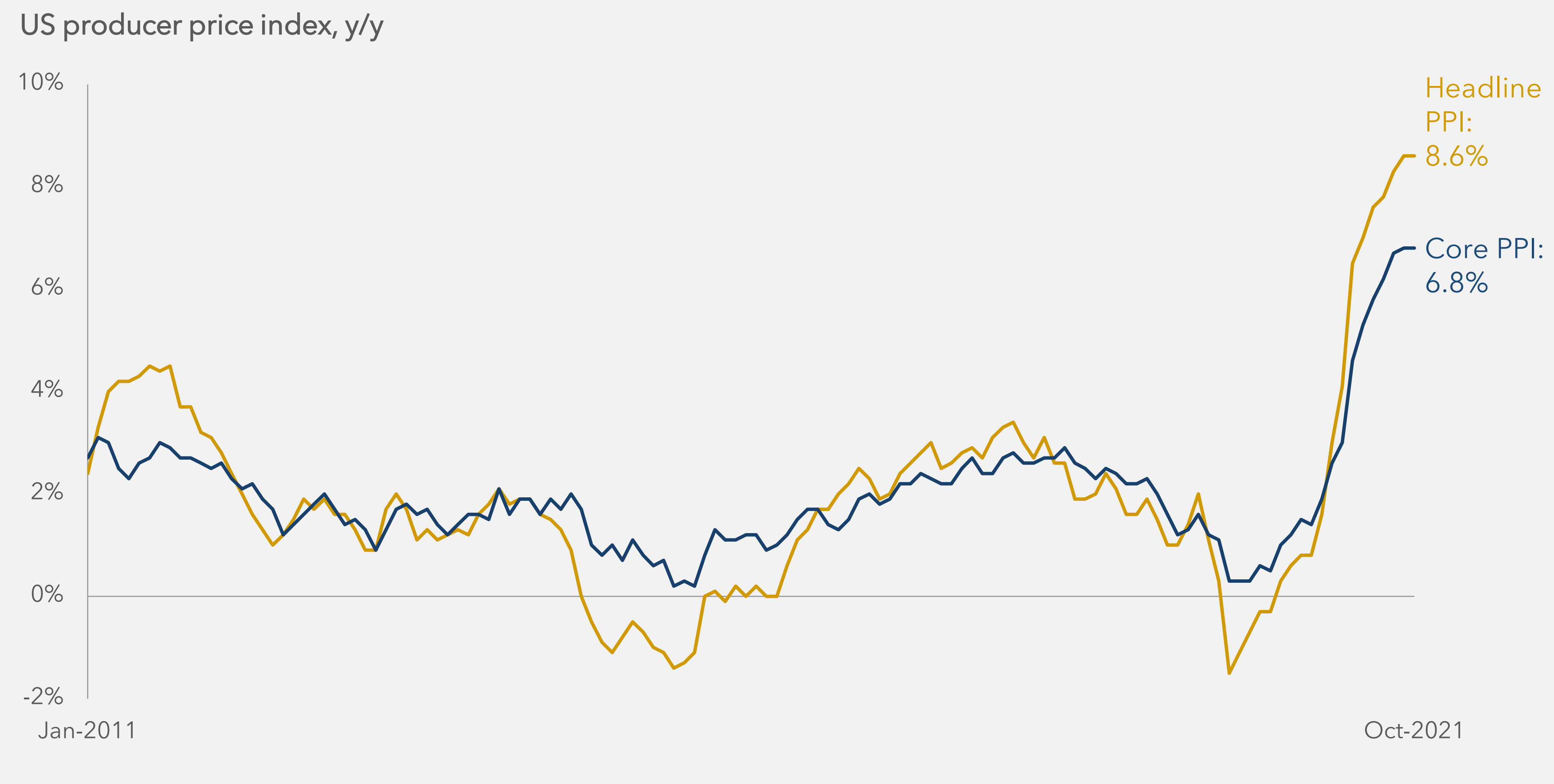
Atlanta Fed sticky CPI 1 month annualized percent change



Source: (1) Bloomberg. Data as of November 19, 2021. IUS CPI all items less food, shelter, energy & used cars & trucks is NSA.

Producer Prices at Decade High

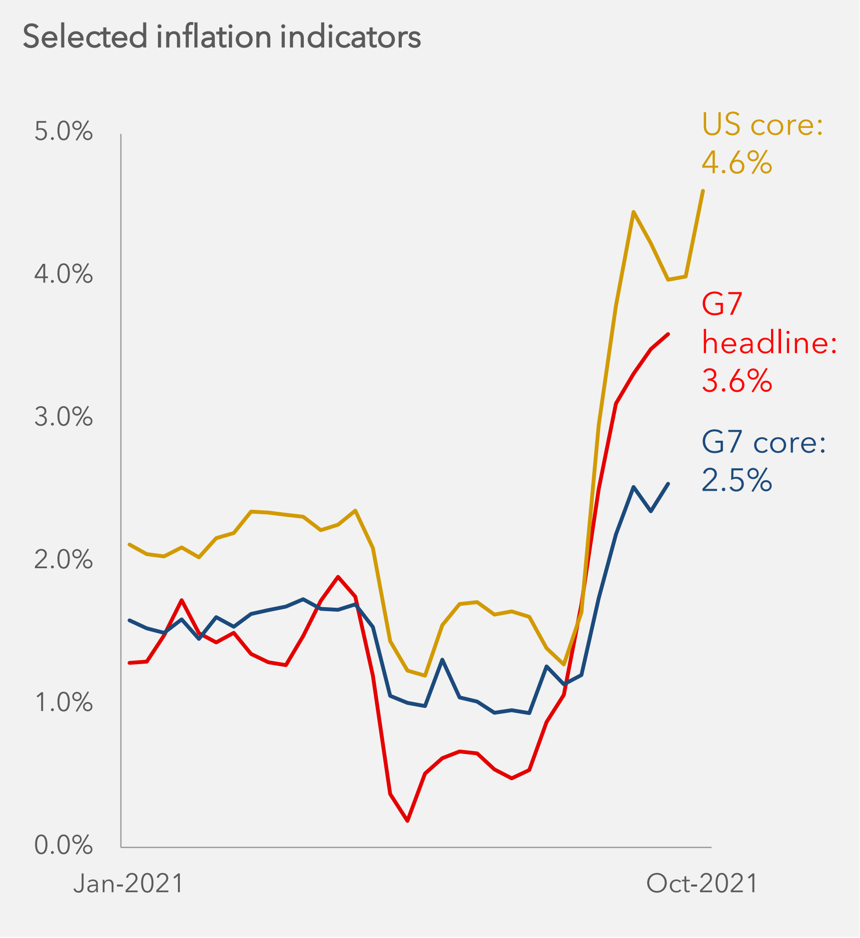
The US producer price index rose 8.6% y/y, the same as September and the highest on record since late 2010. While rising producer prices don't always translate into higher consumer prices as businesses absorb some of the additional costs, they do indicate the role of supply side dislocations in rising inflationary pressure.

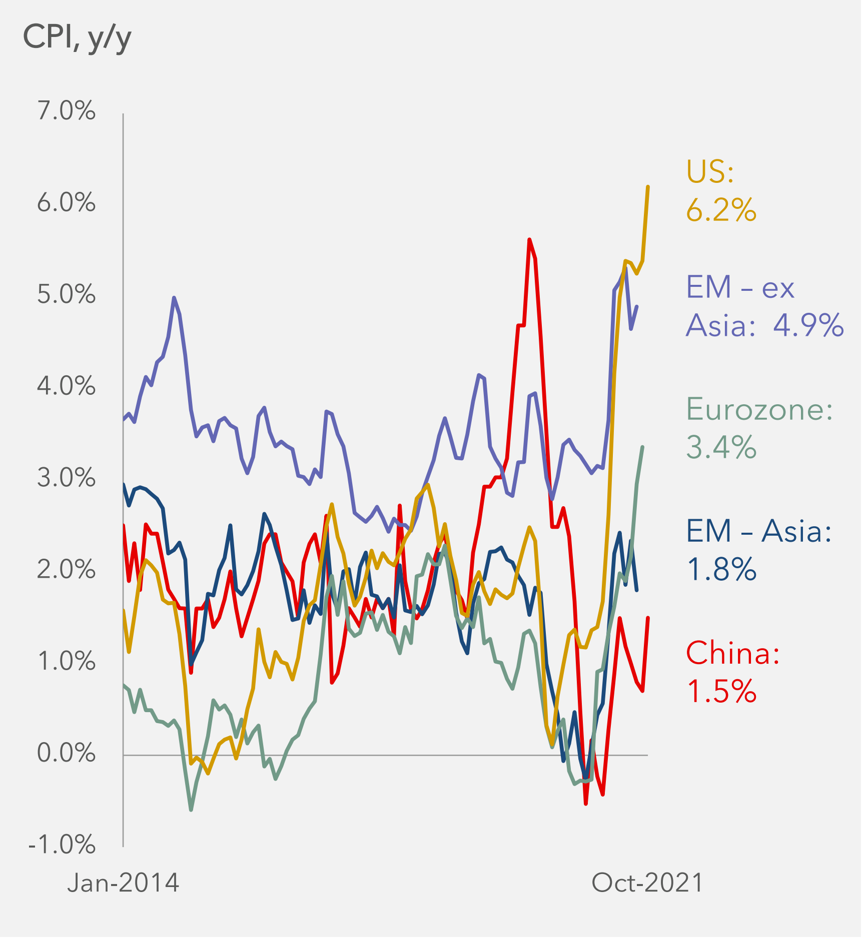


Source: (1) Bloomberg. Data as of November 19, 2021.

Global Inflation Also Rising

Global inflation has been rising since the end of 2020. G7 headline inflation is up from less than 1% y/y to 3.6%, and core from 1% to 2.5%. US headline inflation, at 6.2%, is at its highest level in 30 years.

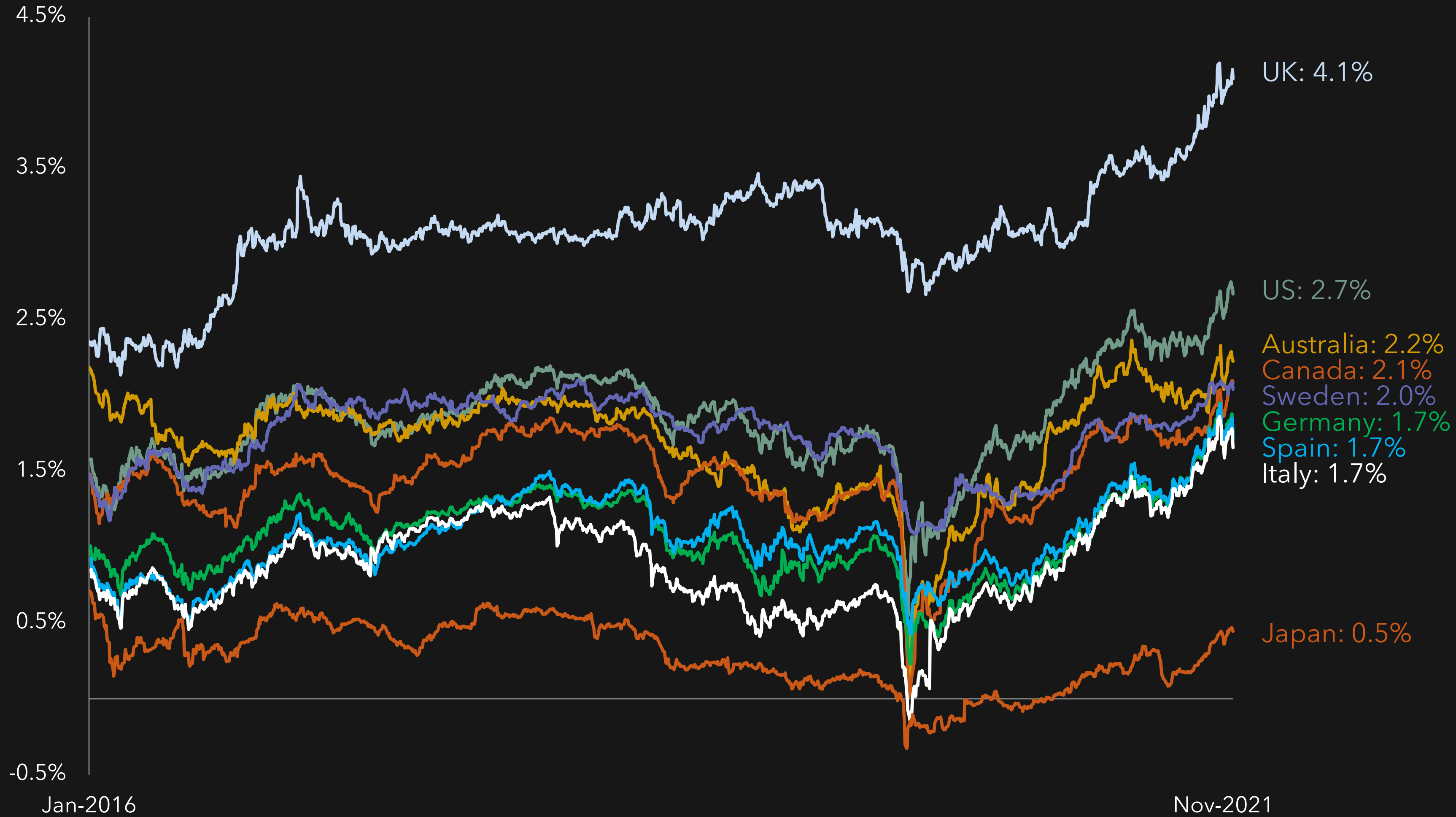




Source: (1) Oxford Economics, "Rising Inflation is a Demand as well as Supply Issue" (October 26, 2021). (2) BIS. Bloomberg. Data as of November 19, 2021.

Global Inflation Expectations Rising

10 year breakeven rate



Source: (1) Bloomberg. Data as of November 19, 2021.

Inflation Moderation in 2H 2022?

In a non-COVID world, supply side gaps can be closed relatively quickly, which raises questions about whether the current rising inflation environment represents a fundamental "regime change" or a short term phenomenon vulnerable to "normalization". Looking ahead, numerous factors could converge to drive a moderation in inflation pressures as soon as the 2H of 2022.

More favorable base effects (Y/Y comparisons)

Continued deceleration in global growth

Massive global production and supply increases underway

Global monetary and fiscal stimulus tightening

Energy prices approaching cyclical highs / demand destruction at higher prices

Rebalancing of consumer behavior from goods to services (if global pandemic eases)

Gradual easing of supply chain disruptions

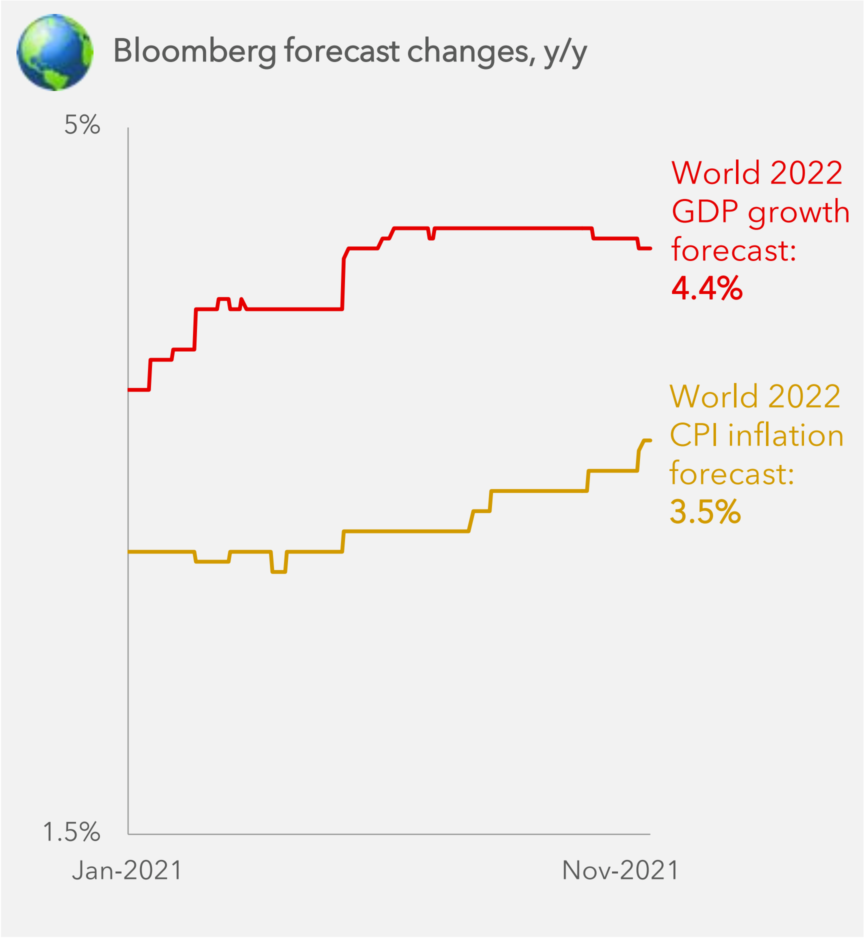
Pre-COVID disinflationary forces remain intact (aging populations, rising debt, declining productivity)

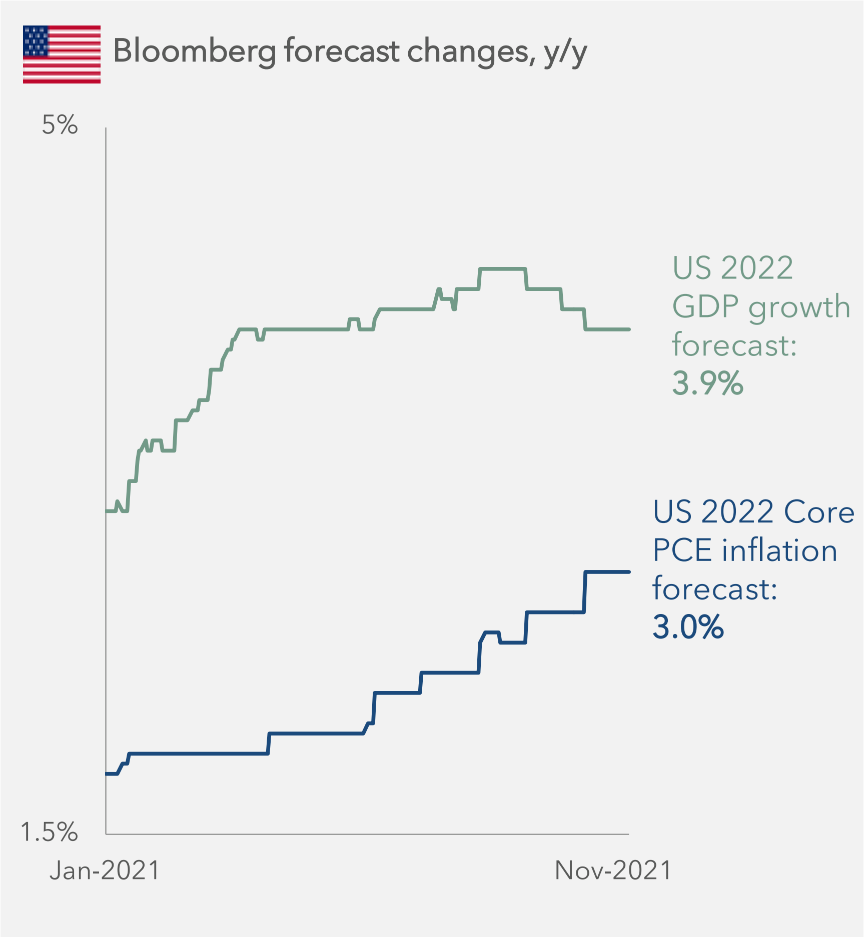
Source: (1) MUFG Macro Strategy, "November 2021 FOMC Recap" (George Goncalves).

7 Desynchronized Global Growth

Growth & Inflation Expectations Diverging

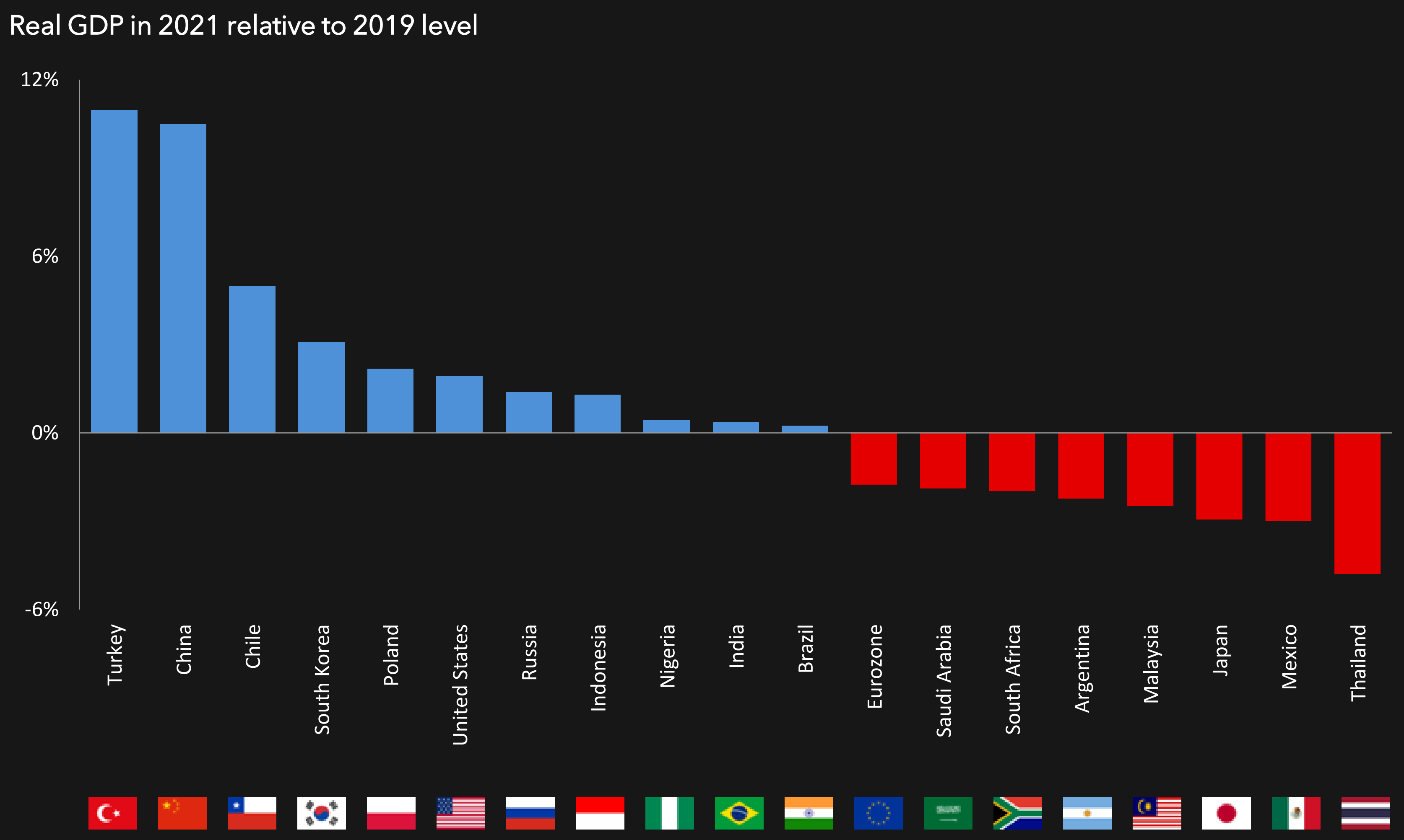
Persistent supply side dislocations have driven inflation expectations higher and growth forecasts lower





Source: (1-2) Bloomberg. Data as of November 19, 2021.

Desynchronized Global Economic Recovery



Source: (1) Oxford Economics. Data as of November 19, 2021.

Headwinds for Global Growth

Following the largest positive global demand shock since WW2, numerous supply side bottlenecks have begun to create formidable headwinds for global growth

Virus-related restrictions

Supply chain dislocations / labor shortages

Inflationary pressures

Rising energy prices

China slowdown
(property and energy sectors)

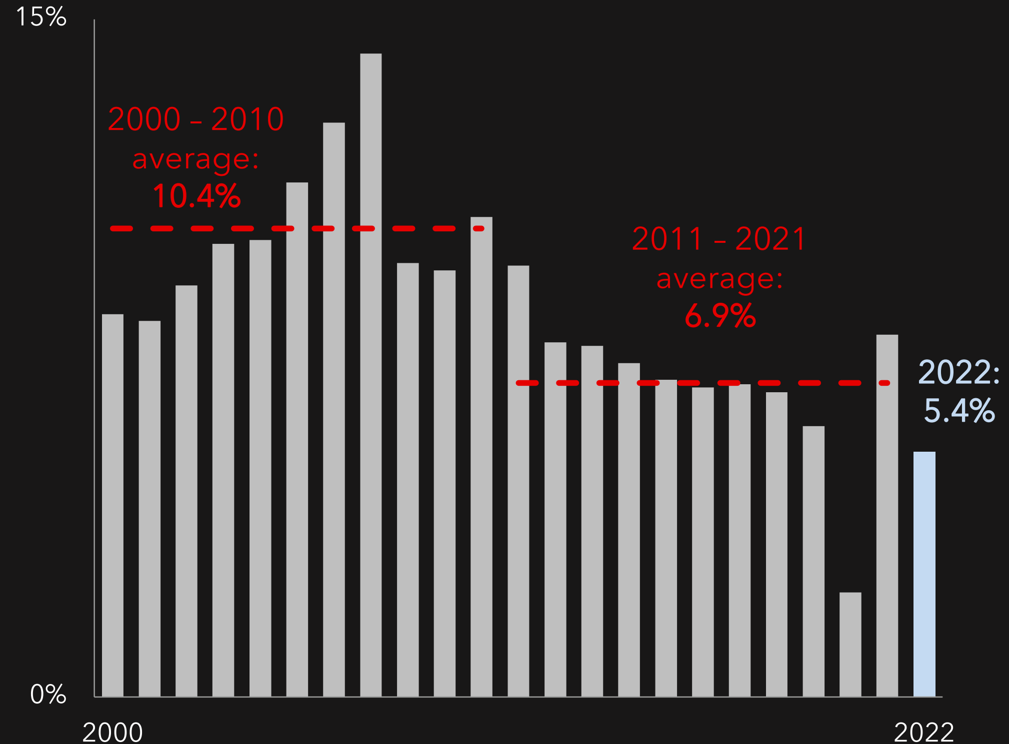
Fed and central bank policy tightening

Washington risk
(debt ceiling concerns, tax code change)

China's Economy Slowing Down

Evergrande's crisis is both a driver and symptom of China's slowing growth. President Xi's pivot to lower but "higher quality" growth may have positive implications in the long term, but in the near term, a more activist regulatory stance toward many industries, a focus on deleveraging, and a cooling property sector will adversely impact China's economic growth outlook. China's economy is expected to grow at just 5-5.5% in 2022, roughly half the rate of growth a decade ago.

China GDP growth, y/y



Headwinds for China's economy

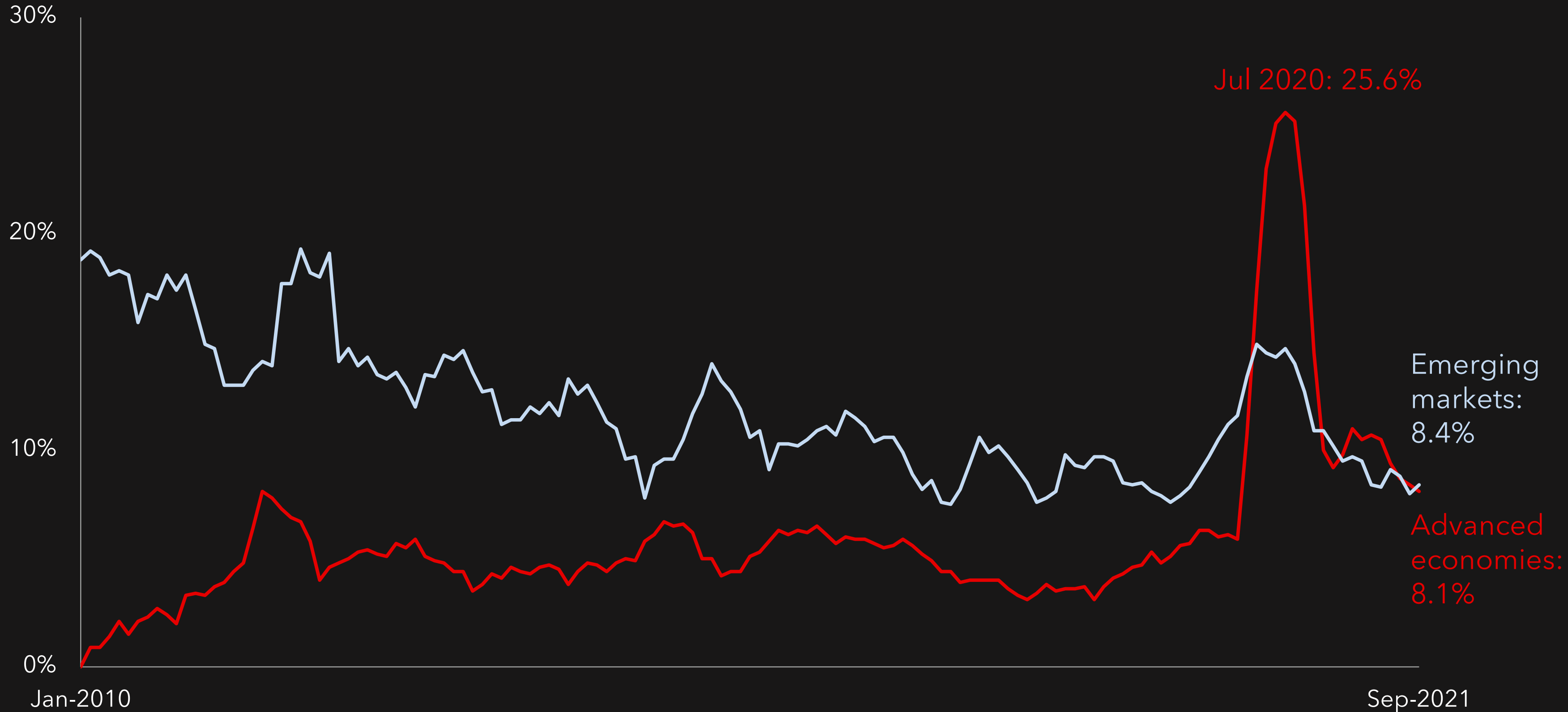
- Recent fiscal & monetary tightening
- Recent regulatory activism in private sector
- Cooling property market
- Virus related restrictions
- Power & electricity shortages
- Production cuts related to climate policy
- Supply side / chain pressures

Source: (1) Oxford Economics. Data as of November 19, 2021.

Global Monetary Growth Normalizing

Global broad money supply growth soared in 2020 but has started to normalize over recent months. In advanced economies, broad money growth is down from a peak of 25.6% y/y to 8.1% y/y – still higher than the average of the past decade. In EM, broad money growth has returned pre-crisis norms.

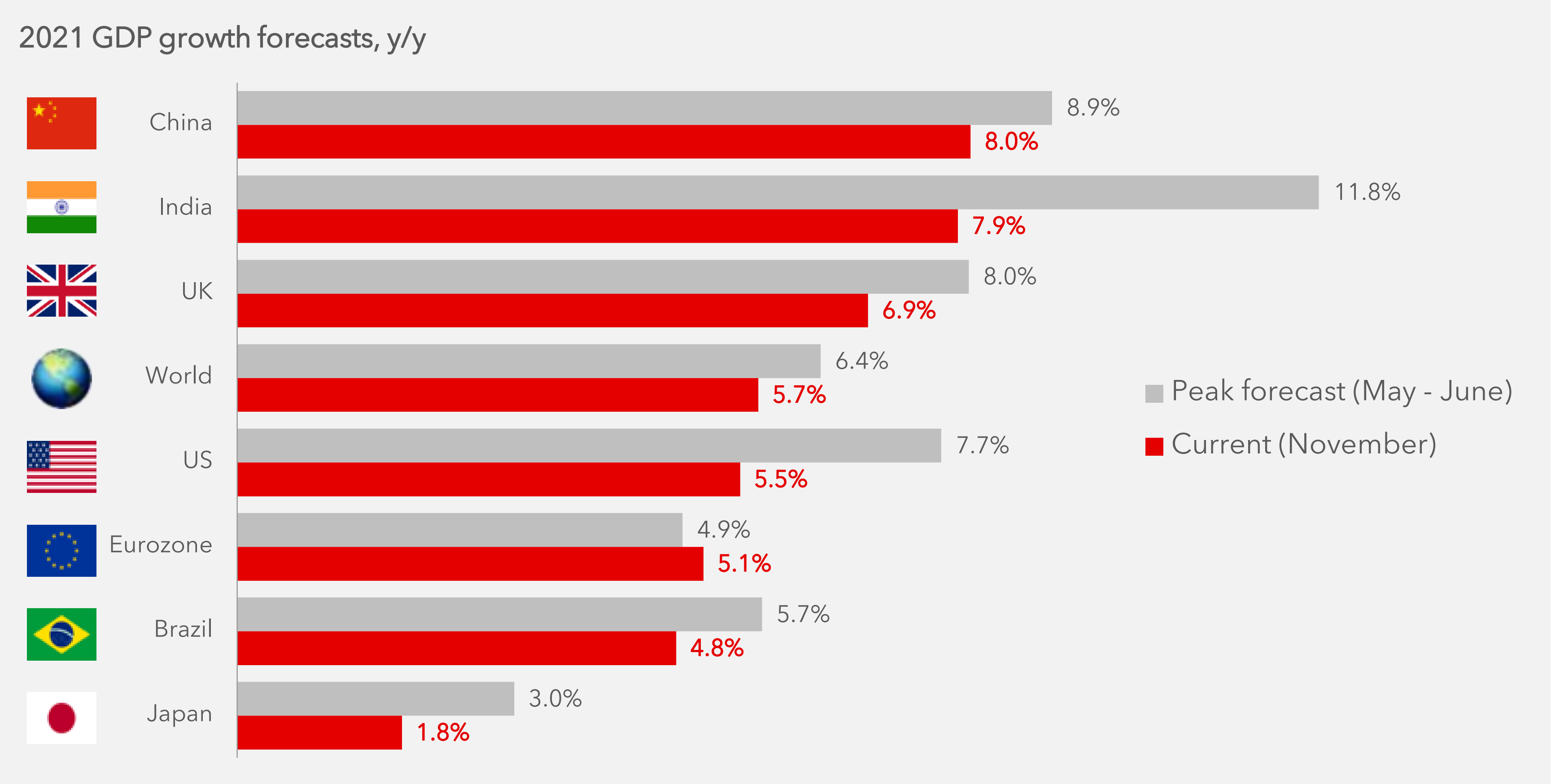
Broad money growth, 6 month annualized change



Source: (1) Oxford Economics "Normalizing Money Growth is Reducing Inflation Risks" (November 9, 2021). Advanced economies include US, Eurozone, UK, Canada, Australia & Japan. EM includes China, India, Brazil, Russia, South Africa, Nigeria, Indonesia, Turkey & Mexico. Excess money growth is 6m annualized broad money growth minus a target rate consisting of the inflation target, trend GDP growth and trend velocity growth.

Global Growth Reassessment

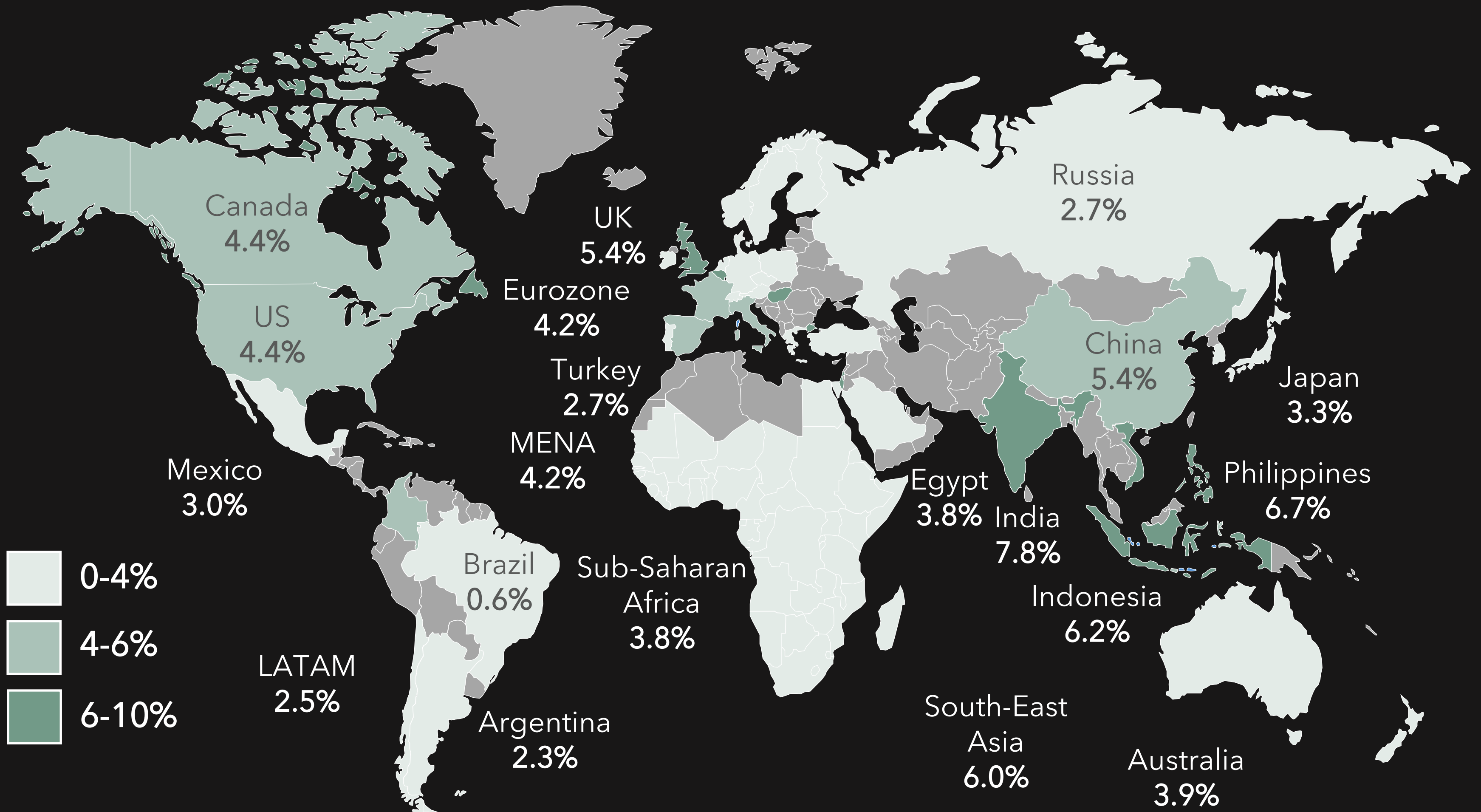
While the initial early-cycle stages of the COVID recovery were highly synchronized on a strong and simultaneous global policy response, we expect the economic recovery in this mid-cycle stage to decelerate in terms of rate of growth, and to also become more de-synchronized and uneven



Source: (1) Oxford Economics. Data as of November 19, 2021. Eurozone peak forecast in July.

Desynchronized Global Growth in 2022

2022 GDP growth forecasts



Source: Oxford Economics. Data as of November 19, 2021.

Appendix: Top 100 Ports in CPPI 2020 Global Ranking

Top 100 Ports in CPPI 2020 Global Ranking

Rank	Port Name	Country
1	Yokohama	Japan
2	King Abdullah Port	Saudi Arabia
3	Chiwan	China
4	Guangzhou	China
5	Kaohsiung	Taiwan
6	Salalah	Oman
7	Hong Kong, SAR	China
8	Qingdao	China
9	Shekou	China
10	Algeciras	Spain
11	Beirut	Lebanon
12	Shimizu	Japan
13	Tanjung Pelepas	Malaysia

Rank	Port Name	Country
14	Port Klang	Malaysia
15	Singapore	Singapore
16	Nagoya	Japan
17	Colombo	Sri Lanka
18	Sines	Portugal
19	Kobe	Japan
20	Zhoushan	China
21	Jubail	Saudi Arabia
22	Yeosu	South Korea
23	Fuzhou	China
24	Ningbo	China
25	Lazaro Cardenas	Mexico

Source: (1) Transport Global Practice "The Container Port Performance Index 2020" World Bank Group. IHS Markit. Ranking based on statistical approach.

Top 100 Ports in CPPI 2020 Global Ranking

Rank	Port Name	Country
26	Khalifa Port	UAE
27	Tanger Mediterranean	Morocco
28	Yangshan	China
29	Yantian	China
30	Taipei, Taiwan	China
31	Da Chan Bay Terminal One	China
32	Mawan	China
33	Dalian	China
34	Incheon	South Korea
35	Tokyo	Japan
36	Hamad Port	Qatar
37	Lianyungang	China
38	Pipavav	India

Rank	Port Name	Country
39	Halifax	Canada
40	Caucedo	Dominican Republic
41	Bremerhaven	Germany
42	Cartagena	Colombia
43	Salvador	Brazil
44	Aarhus	Denmark
45	Aguadulce	Colombia
46	Cai Lan	Vietnam
47	Haiphong	Vietnam
48	Magdalla	India
49	Cai Mep	Vietnam
50	Mundra	India

Source: (1) Transport Global Practice "The Container Port Performance Index 2020" World Bank Group. IHS Markit. Ranking based on statistical approach.

Top 100 Ports in CPPI 2020 Global Ranking

Rank	Port Name	Country
51	Gemlik	Turkey
52	Busan	South Korea
53	Jeddah	Saudi Arabia
54	Diliskelesi	Turkey
55	Laem Chabang	Thailand
56	Jawaharlal Nehru Port	India
57	Ambarli	Turkey
58	Port Said	Egypt
59	Pecem	Brazil
60	Aqaba	Jordan
61	Djibouti	Djibouti
62	Xiamen	China
63	Shanghai	China

Rank	Port Name	Country
64	Tanjung Priok	Indonesia
65	Keelung, Taiwan	China
66	Tripoli	Lebanon
67	Osaka	Japan
68	Yarimca	Turkey
69	Itapoa	Brazil
70	Santos	Brazil
71	Sohar	Oman
72	Buenaventura	Colombia
73	Sepetiba	Brazil
74	Rio Grande	Brazil
75	Karachi	Pakistan

Source: (1) Transport Global Practice "The Container Port Performance Index 2020" World Bank Group. IHS Markit. Ranking based on statistical approach.

Top 100 Ports in CPPI 2020 Global Ranking

Rank	Port Name	Country
76	Barcelona	Spain
77	Posorja	Ecuador
78	Oslo	Norway
79	Quy Nhon	Vietnam
80	Cat Lai	Vitenam
81	Suape	Brazil
82	London	UK
83	Philadelphia	US
84	Danang	Vietnam
85	Port of Virginia	US
86	Antwerp	Belgium
87	Zeebrugge	Belgium
88	Santa Cruz de Tenerife	Spain

Rank	Port Name	Country
89	New York & New Jersey	US
90	Gdynia	Poland
91	Shantou	China
92	Naha	Japan
93	Piraeus	Greece
94	Puerto Limon	Costa Rica
95	Charleston	US
96	Port Akdeniz	Turkey
97	Taichung, Taiwan	China
98	Ulsan	South Korea
99	Hakata	Japan
100	Colon	Panama

Source: (1) Transport Global Practice "The Container Port Performance Index 2020" World Bank Group. IHS Markit. Ranking based on statistical approach.

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The MUFG Capital Markets Strategy team provides monthly publications and weekly policy notes, presenting to Boards and C-Suite executives, on a broad range of transformative themes driving the FX, rates and credit markets including: the COVID-19 recovery, ESG's acceleration, tax code policy changes, US-China decoupling, corporate strategy, geopolitical risk and central bank monetary policy.

MUFG’s Capital Markets Strategy Team

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