



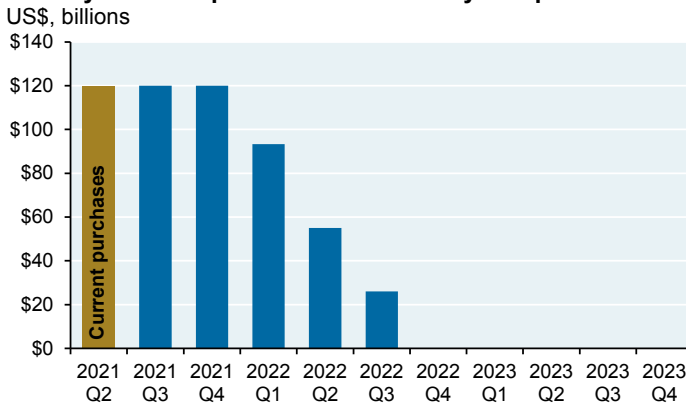
**Your Fall 2021 syllabus**

Greetings. We look forward to seeing you back on campus, although you will not be allowed to gather in groups larger than five, which we expect to reduce COVID transmission and cut down on excessive alcohol consumption and related misbehavior<sup>1</sup>. Since 85% of you experienced declining grades during online learning last year<sup>2</sup>, we've doubled up your coursework and will require you to take eight classes this semester. Your Fall 2021 syllabus appears below. **Update:** Biology BI66 "The Origins of COVID" scheduled to be taught by Professor Peter Daszak has been cancelled until further notice. No additional information is available at this time

[1] Addictive Behaviors AN103 (Anatomy): The Prefrontal Cortex and External Stimuli

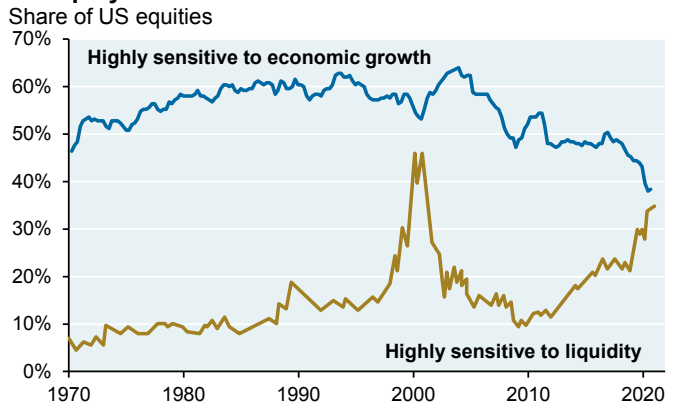
Students will explore the addictive consequences of Fed liquidity on the stock market now that the Fed is about to slow its asset purchases, and as the share of US equities more sensitive to liquidity conditions than to economic growth keeps rising. Background reading includes data on Treasury demand from foreign central banks that own 30% of the Treasury market, as well as Treasury demand from banks, pension funds and insurance companies for regulatory and liability management reasons; these demand sources may mitigate the impact of reduced Fed purchases on long term interest rates.

**Primary dealer expectations for monthly Fed purchases**



Source: Fed, JPMAM. July 2021. Bars represent median response.

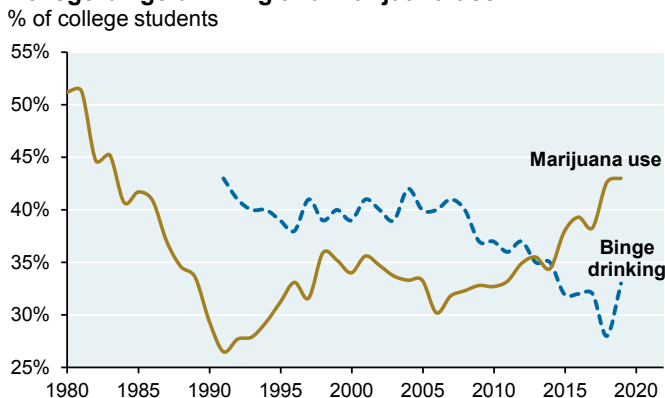
**US equity market sensitivities**



Source: Bridgewater. August 18, 2021.

<sup>1</sup> 33% of US college students engaged in binge drinking in 2019 (5+ drinks in 2 hours for men). College binge drinking has declined since the early 1990's, and is being substituted/accompanied by rising marijuana use.

**College binge drinking and marijuana use**



Source: National Institute on Drug Abuse. 2019.

<sup>2</sup> Inside Higher Ed, January 2021

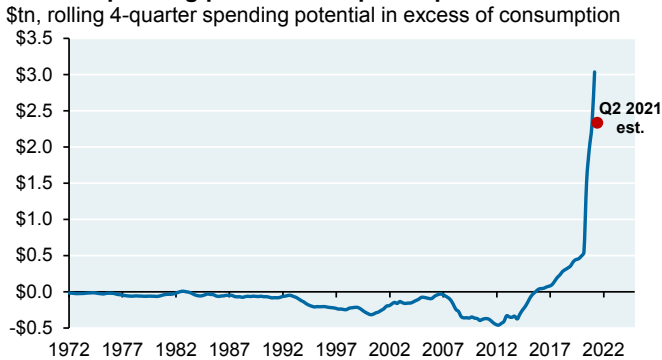


**[2] Mechanical Engineering ME89 (Engineering): Dynamics of coiled springs**

Students will review Hooke’s Law<sup>3</sup> and its application to US growth, spending, inventories and inflation. Some leading indicators have weakened recently, a reflection of intense supply chain issues which include a temporary but pronounced semiconductor shortage<sup>4</sup>. However, look at the big picture: rising wages, government transfers and pandemic issues have boosted pent-up consumer spending, and there’s unprecedented pent-up demand when looking at the gap between low inventory growth and high sales growth. Both of these coiled springs will eventually spring back. So will housing, which is now constrained by soaring prices and the tightest supply conditions since 1990 (2-3 months). There’s consumer resistance to higher prices for durables, cars and homes, but ammunition for healthy US consumer spending is firmly in place particularly given improved household balance sheets. **As drags from supply constraints and the Delta variant eventually fade, US and global growth should be supported by reopening dynamics, inventory restocking and a lot more capital spending.**

While these dynamics all point to higher GDP growth as production rises to meet demand, it’s also hard to see how inventory vs sales gaps can be closed without higher prices as well. Many companies agree, as indicated by the all-time high 45% of small business respondents planning to increase prices.

**Excess spending potential has piled up**



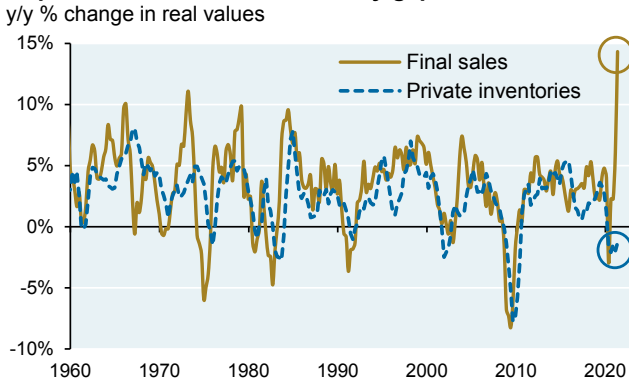
Source: Fed, BEA, JPMAM. Q1 2021. Spending potential: 65% of taxable income, 100% of transfer pmts, 10% of housing wealth and 1.5% of fin. wealth.

**Global manufacturing delivery times**



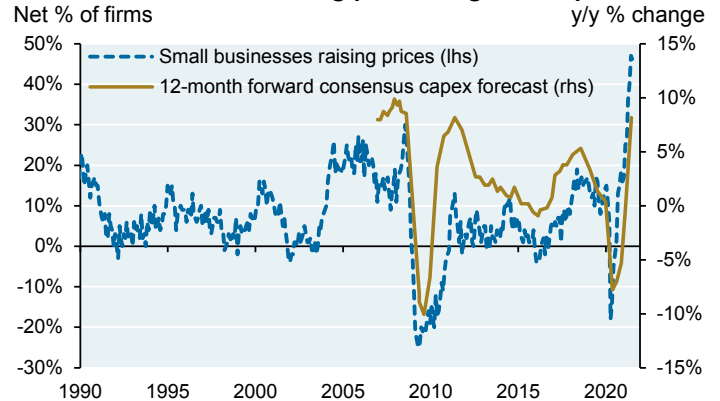
Source: Bloomberg, JP Morgan Economic Research. August 2021.

**Unprecedented sales to inventory gap**



Source: BEA, JPMAM. Q2 2021

**US small businesses raising prices vs global capex**



Source: NFIB, S&P Global, JPMAM. July 2021.

<sup>3</sup> **Hooke’s Law:** the force of a coiled spring being released is linearly proportional to the distance from its equilibrium length

<sup>4</sup> **The semiconductor shortage.** Most chip shortages are related to older and simpler 200-mm silicon wafers used in cars, computers, monitors, laptops, TVs, refrigerators and washing machines. Demand for many of these items soared during the pandemic as people built out home offices and related projects. There’s limited economic incentive to build new 200-mm chip plants given wafer-thin margins; only a handful of new ones are planned for 2022. Even so, there’s a few billion dollars being invested to expand capacity by ~20% in existing plants, in which case the semiconductor squeeze should start to ease by Q2 2022. Auto manufacturers are also discussing longer term contracts with Tier 2 suppliers that might incent them to build out new 200-mm capacity. A by-product of the semiconductor shortage: Ford is offering customers faster delivery if they agree to “lower feature content”, which translates into fewer semiconductors.

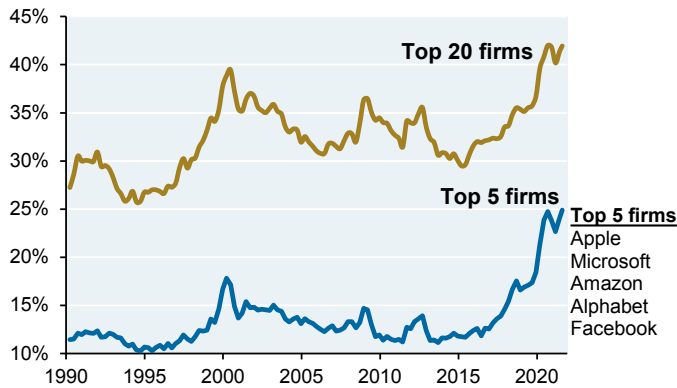


**[3] Military Strategy HS233 (History): The Art of War**

Students will learn how tech and communication services companies conquered US equity markets. Readings include David Autor’s “*The Fall of the Labor Share and the Rise of Superstar Firms*” (MIT, 2019). Implications for investors include the superior risk-reward characteristics of growth equity and venture capital investments focused on software and other high-margin businesses with low labor intensity.

Industry concentration is at an all-time high and is attracting antitrust attention. But the tech/communications services opportunity set is much bigger than the 5 megacap firms: secular growth tech stocks we discussed in our 2021 Outlook are performing in line with the megacap stocks this year, and carry a lot less antitrust baggage. As long as wages are the largest component of overall business expenses (last chart), the corporate sector will look to tech companies to help reduce their unit labor costs and improve productivity. In other words, we expect strong demand for technology goods and services to continue, and do not expect any mean reversion in sector profit margins.

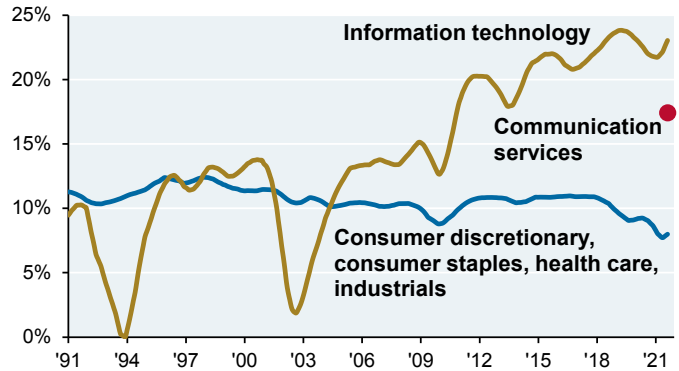
**Contribution of top firms to overall US market cap**



Source: Bloomberg. September 3, 2021.

**Tech: the primary driver for US margin expansion**

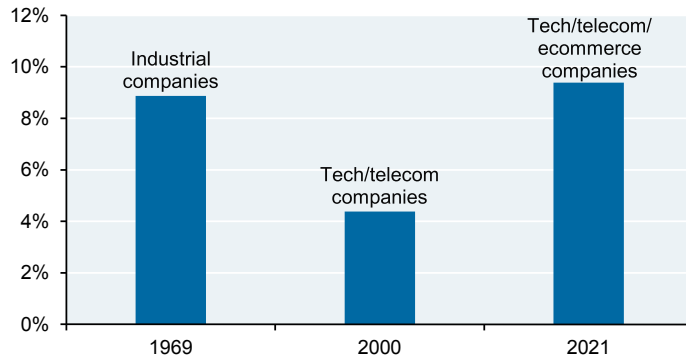
Trailing 12 month average operating margin for S&P 500 companies



Source: Bloomberg. August 2021.

**Industry consolidation surpassed prior 1969 peak**

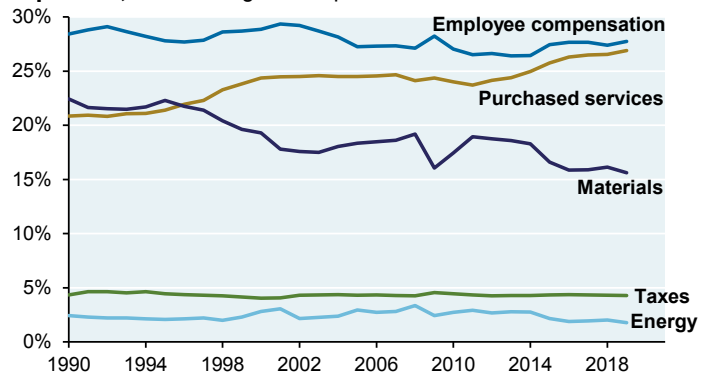
Revenues of largest 15 companies as % of US GDP



Source: Bloomberg, BEA, Fortune 500, J.P. Morgan Global Economic Research, JPMAM. 2021.

**Wages are still the largest component of business expenses, Percent of gross output**

Percent of gross output



Source: BEA. 2019.



**[4] Chinese History CH04 (History): The Creation of a More Just Society**

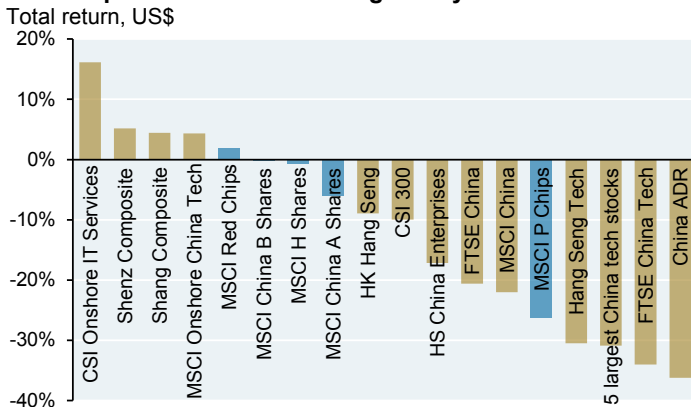
Students will review *The Great Leap Forward* and *The Cultural Revolution* as prior examples of Chinese leaders imposing sacrifices in the pursuit of societal goals. Many Chinese stocks have been clobbered after new rules and critical gov't commentary on the internet<sup>5</sup>, e-commerce, for-profit tutoring, data sharing, overseas equity listings, cryptocurrency, online finance, real estate, labor practices, anti-trust and competition, drug prices, food product disclosure and corrosive Western decadence such as celebrity-watching, social media and gaming.

Since the Chinese government described online gaming as “spiritual opium”, students will also revisit materials on the Opium Wars of the 1840’s and its consequences: a proliferation of drug addicts and opium dens, a surge in corruption and other criminal behavior, a breakdown in public morality and an exodus of silver shipped abroad by addicts. Around 25% of China’s adult males were addicted to opium, a level of mass addiction not equaled by any nation before or since<sup>6</sup>. From 1820 to 1870, China’s share of global output fell in half, from 33% to 14%.

**For long term investors with patience, there are some attractive opportunities here, but selectivity is key.**

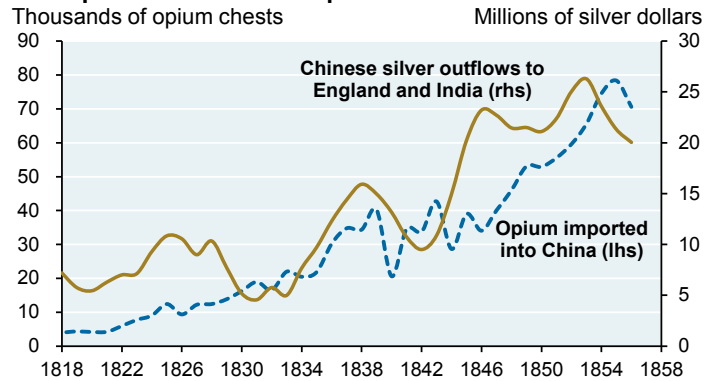
Despite the large selloff in Chinese equities, the valuation gap vs the US shown in the last 2 charts is not as large since China traded at higher multiples before the crackdown began. We use enterprise value to projected free cash flow to minimize the impact of regional accounting differences and to capture the impact of new rules on future company profits, even though it is probably too early to expect analysts to fully adjust their forecasts.

**China equities since Feb 8th regulatory crackdown**



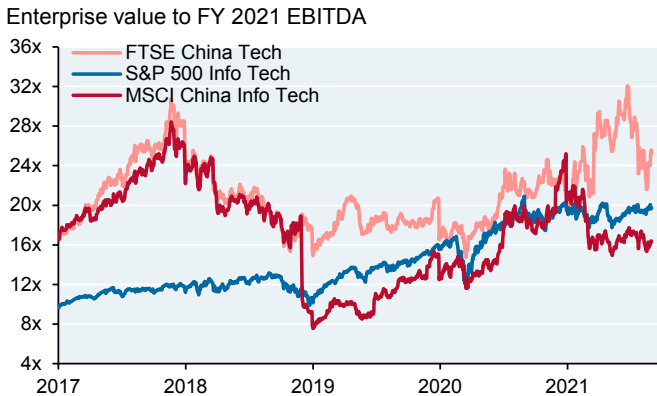
Source: Bloomberg. 9/5/2021. China ADR: 70% tech + comm services

**The Opium War and the Capital Exodus**



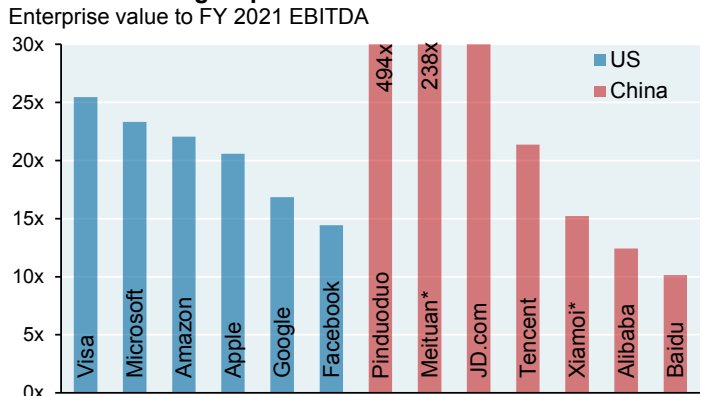
Source: "China Upside Down: Currency, Society, and Ideologies, 1808-1856", Man-houng Lin, Harvard University Asia Center. 2007.

**US and China tech valuations**



Source: Bloomberg, J.P. Morgan. September 3, 2021.

**US vs China megacap valuations**



Source: Bloomberg. September 3, 2021. \*Indicates EV/FY 2022 EBITDA est.

<sup>5</sup> Fang Xingdong (Director of the Center for Internet and Society at Zhejiang University) explains the motivation: the Chinese government needs to prevent internet platforms from “breaking the existing institutional framework and challenging the power and governance capacity of the state” [Source: Gavekal Research]

<sup>6</sup> Alfred McCoy, University of Wisconsin-Madison Center for Southeast Asian Studies



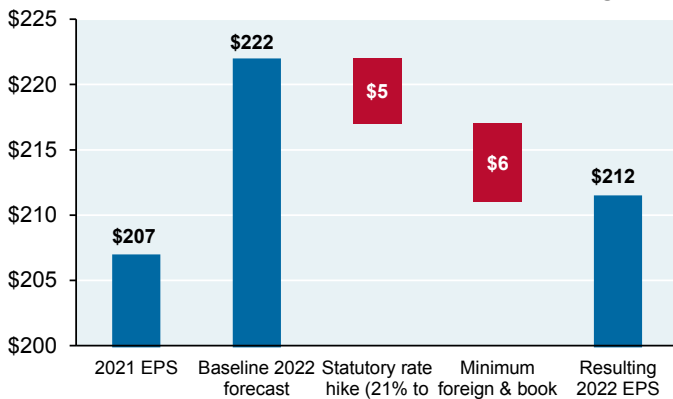
[5] Progressivism in Film FA08 (Arts): Raiding the Temple Granaries

Students will re-enact one of the most progressive scenes in film history: when Moses raids the temple granaries in Cecil B DeMille’s *Ten Commandments*. The class will then pivot to the current Administration’s progressive plans to raise corporate taxes to pay for infrastructure and other initiatives (clean energy and EV subsidies, child care, family leave, pre-K education and Obamacare premium expansion). At the time this syllabus was prepared, Democrats had not reconciled their competing visions. **The most likely scenario is an infrastructure bill with ~\$1 trillion in new spending and a reconciliation bill with ~\$2 trillion in new spending.**

Students will review the base case scenario for corporate taxes: 25% corporate tax rate (up from 21%); an increase in the effective tax rate applied to low tax jurisdictions from 13% to 18%-19% (GILTI tax); a minimum book tax of 15% on large US companies that is unlikely to have much bite given prevailing effective tax rates (see second chart); and partial commingling of foreign tax credits. **The bottom line is a modest 5% hit to 2022 S&P earnings per share, with slightly higher tax hikes for tech, healthcare and communication services.** While the tax impact on S&P earnings appears modest, students will review the overall cost of the two bills (including tax increases on individuals and pass-through entities), which is large compared to tax bills in the post-war era; see third chart “infrastructure + negotiated reconciliation bill” and fourth chart on marginal effective corporate tax rates across countries, and the impact of the proposed bills.

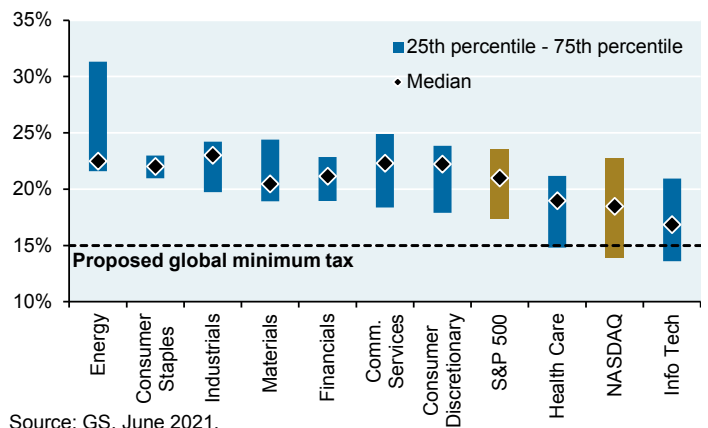
**Note from the Dean:** we cannot guarantee film majors anything resembling a viable financial future; you will have to hit the jackpot. One example: recent film graduates of Columbia University who took out student loans had median debt of \$181,000, and two years after earning master’s degrees, half earned less than \$30,000 a year. Recent Columbia film alumni had the highest debt compared with earnings among graduates of any major university master’s program [WSJ, “Hobbled for Life”, July 8, 2021].

Potential 2022 S&P 500 EPS impact of Biden's tax agenda



Source: Goldman Sachs. August 2021.

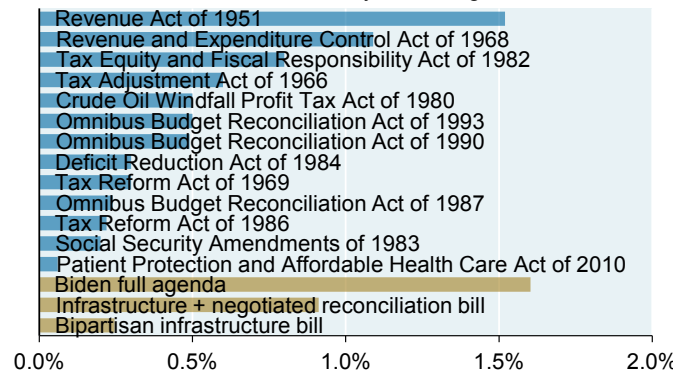
Consensus 2022 effective tax rates before new bills



Source: GS. June 2021.

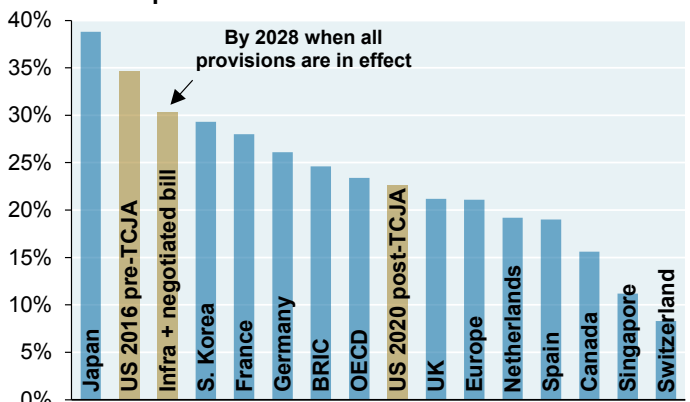
Revenue impact of major tax bills

Annual tax increase as % of GDP; 2-year average for historical bills



Source: Treasury, CBO, Cornerstone Macro, JPMAM. August 2021.

Effective corporate tax rate on new investment



Source: Mintz and Bazel (University of Calgary). August 2021.



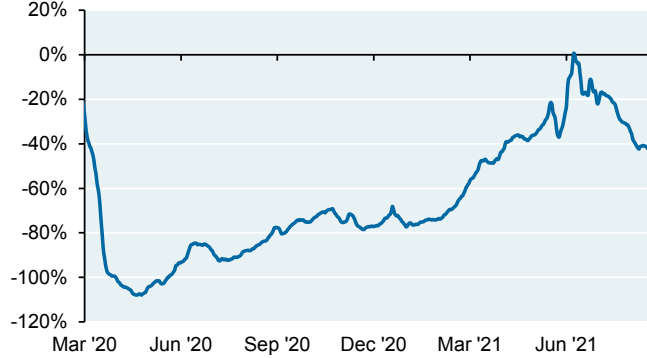
[6] American Literature of the 1970's AL400 (English): Fear of Flying

After discussing Erica Jong's 1973 second-wave feminist novel *Fear of Flying*, students will analyze consumer reactions to the Delta variant, which so far also indicate a revived fear of flying<sup>7</sup>. Other social distancing categories such as bars, restaurants, lodging, parks and theaters are starting to decline as well, but not by nearly as much. As a result, the sharp decline in "COVID recovery" stocks shown in the third chart might represent an interesting opportunity as the Delta variant eventually fades and booster shots rise. While social distancing spending indicates that Americans are circulating and spending in large pre-pandemic numbers, they're still demonstrating a pronounced aversion to office settings as shown in the last chart.

**On aviation, challenges are not just a fear of flying but electronic means for companies to now avoid it.** A Bloomberg survey showed 84% of companies expect to spend less on aviation, with budget declines of 20%-40%. While corporate customers normally only represent 12% of seats, they can represent as much as 75% of airline profits. Hotels could see revenue declines of 15%-20% as virtual meetings replace one quarter of corporate travel volumes (mostly internal non-client trips). A Conference Board survey cited reduced business travel as the most likely long term impact of the pandemic.

**Airline spending, all transactions**

Spending change vs 2019, 7 day smoothing



Source: Internal Chase data, JPMAM. August 28, 2021.

**Social distancing spending, card present transactions**

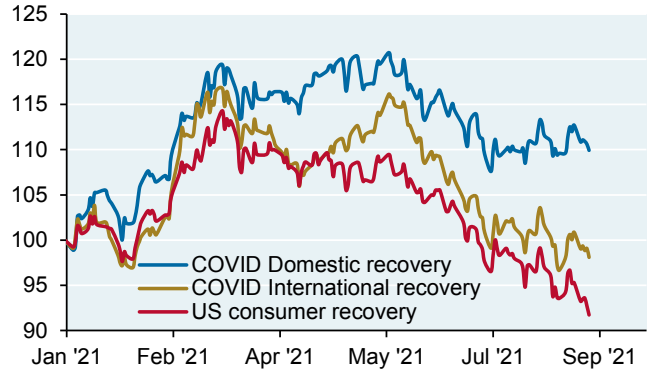
Spending change vs 2019, 7 day smoothing



Source: Internal Chase data, JPMAM. August 28, 2021. Social distancing: retail, lodging, restaurants, parks, theaters and other recreational services.

**COVID recovery vs S&P 500**

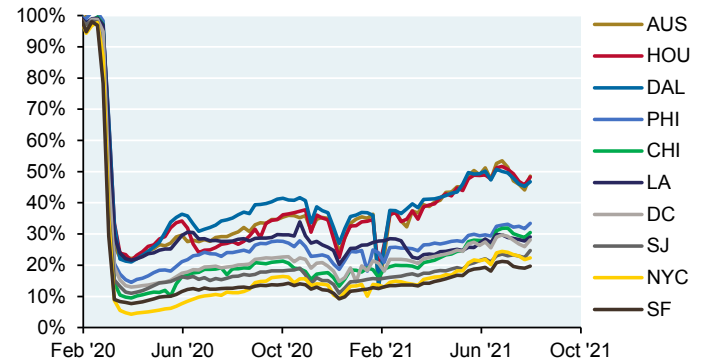
Index (100 = Jan 2021)



Source: Bloomberg. September 3, 2021.

**Office utilization rates by metro area**

Based on keycard/fob data



Source: Kastle. August 25, 2021.

<sup>7</sup> I flew to Canada last week for 3-days of sturgeon fishing. Direct routes from NYC to Vancouver are gone, so you have to connect through Montreal or Toronto and plan for missed connections due to delays related to COVID document checking. My largest catch was a [massive 9-foot Fraser River sturgeon](#) near the town of Hope.

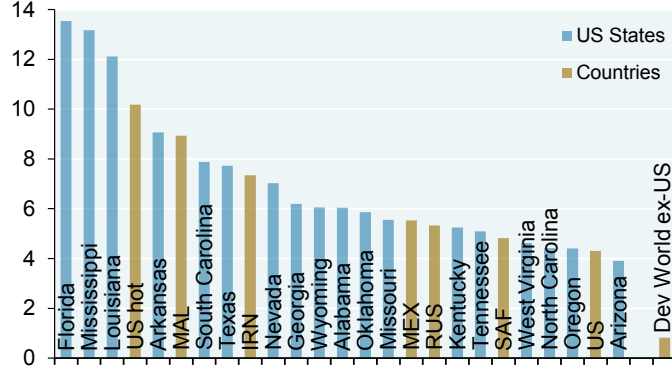


[7] Fundamentals of Organisms BIO50 (Biology): Natural Selection and its rare deviations

Students will review examples of natural selection (peppered moths, rat snakes, Galapagos finches, warrior ants) and rare examples of **reverse natural selection**, in which species adapt behaviors that are contrary to their own survival. Examples of the latter include COVID vaccine-resistant communities in the United States, where hospitalizations are rising sharply for unvaccinated people and for younger people as well. US hotspot mortality rates are now the highest in the world, alongside Malaysia and Iran, and are 10x higher than mortality rates in the rest of the developed world. Of US states, Florida now has the highest mortality rate, edging out Mississippi and Louisiana.

**25 highest mortality rates vs Dev World ex-US**

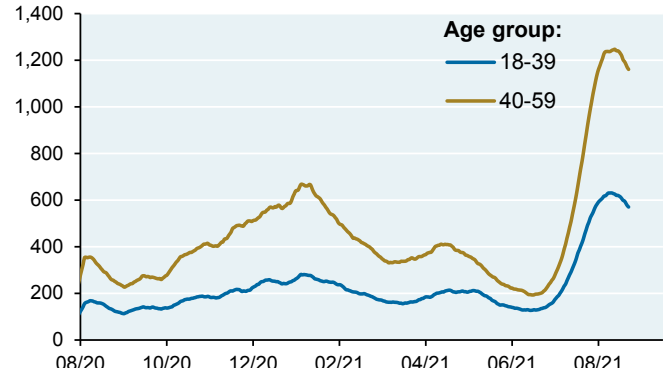
Daily deaths, # per mm; US states, top 50 countries by GDP



Source: Johns Hopkins University, IMF, JPMAM. September 5, 2021.

**Hotspots: FL KY MS SC TN WV WY: hosp. by age**

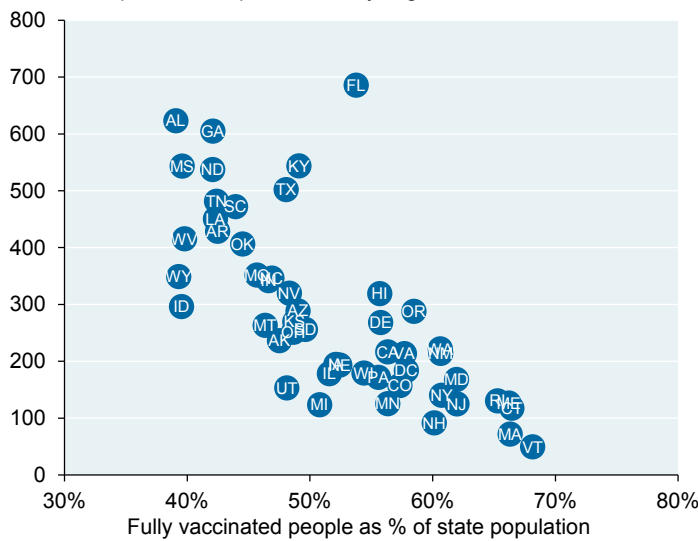
Prior day admissions, 14 day average



Source: HHS, JPMAM. September 5, 2021.

**US state hospitalizations vs vaccinations**

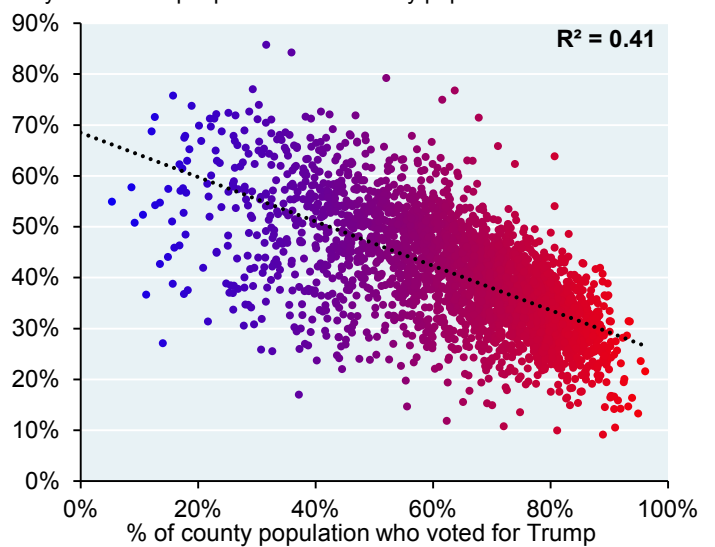
Current hospitalizations per mm, 7 day avg



Source: OWID, HHS, IMF, JPMAM. September 5, 2021.

**Trump share of 2020 vote and vaccination by county**

Fully vaccinated people as a % of county population



Source: Harvard Dataverse, CDC, State Health Depts, JPMAM. September 5, 2021.



[8] Poetry PY51 (English): Emily Dickinson and mortality

Students will analyze Dickinson’s famous poem “Because I could not stop for death”. For most vaccinated people, you won’t have to either, at least based on the latest vaccine efficacy data. While there is evidence of declining vaccine efficacy over time, such data has to be analyzed carefully to avoid an amalgamation paradox which can produce misleading results when applied to heterogeneous populations with “hidden” variables that explain results more accurately<sup>8</sup>. In the case of COVID, the hidden variable is age.

**The most useful efficacy information comes from studies with data on specific age groups.** As shown below, age-specific data from Israel and the UK show that efficacy vs hospitalization and severe infection remain high vs the Delta variant (85%-95%); results for total populations in these studies is misleading (red shaded values due to the paradox cited above). Even so, as with other vaccines, COVID appears to require a three shot regimen for maximum efficacy. I recommend getting a booster as soon as you are eligible: early evidence from Israel shows a 10-fold reduction in infection risk with a booster shot compared to a 2-shot regimen, and shows an increase in implied Pfizer efficacy against severe infection for people aged 60+ from 80% to 93%.

Source	Vaccine	Obs period	Vax pd or age group	Ref group	Infection	Symptomatic infection	Hospitalization	Severe infection/ICU	Mortality
<b>mRNA vaccine efficacy analysis with age bucketing</b>									
<b>Red shading indicates confirmed misleading result due to the amalgamation paradox</b>									
IMH/J Morris	Pfizer	Aug	<50	Unvax				92%	
IMH/J Morris	Pfizer	Aug	>50	Unvax				85%	
IMH/J Morris	Pfizer	Aug	All	Unvax				68%	
Israel Min Health	Pfizer	Aug	>60	Unvax				89%	
Israel Maccabi Health	Pfizer (booster)	Aug	>60	2 shots	86%			92%	
Public Health England		Feb-Aug	<50	Unvax			87%		
Public Health England		Feb-Aug	>50	Unvax			94%		
Public Health England		Feb-Aug	All	Unvax			75%		
Oxford UK	Pfizer	May-Aug	18-34	Unvax	90%	96%			
Oxford UK	Pfizer	May-Aug	35-64	Unvax	77%	88%			
Kaiser Permanente	Pfizer	Dec-Aug	Dec-Mar; >65	Unvax	43%				
Kaiser Permanente	Pfizer	Dec-Aug	Dec-Mar; All	Unvax	47%				
<b>mRNA vaccine efficacy analysis without age bucketing</b>									
Mayo Clinic	Pfizer	Jan-Jul		Unvax	76%		85%	93%	100%
Mayo Clinic	Moderna	Jan-Jul		Unvax	86%		92%	87%	100%
Mayo Clinic	Pfizer	Jul		Unvax	42%		75%		
Mayo Clinic	Moderna	Jul		Unvax	76%		81%		
Israel Min Health	Pfizer	Jul	Jan	Unvax	16%	16%		86%	
Israel Min Health	Pfizer	Jul	Feb	Unvax	44%	44%	91%	91%	
Israel Min Health	Pfizer	Jul	Mar	Unvax	67%	69%	89%	94%	
Israel Min Health	Pfizer	Jul	Apr	Unvax	75%	79%	83%	84%	
Israel Min Health	Pfizer	Jul	Jan-Apr	Unvax	39%	41%	91%	88%	
Israel Min Health	Pfizer (booster)	Aug		Unvax	95%				
Public Health England	Pfizer	Oct-May		Unvax		88%			
Public Health England	Pfizer	Apr-Jun		Unvax			96%		
Public Health Scotland	Pfizer	Apr-Jul		Unvax	79%				
Public Health Ontario	Pfizer	Dec-May		Unvax		87%	100%		
Qatar Min Health	Pfizer	Aug		Unvax	54%			90%	
Qatar Min Health	Moderna	Aug		Unvax	85%			100%	
<b>Vector and Attenuated vaccines with age bucketing</b>									
Oxford UK	AstraZeneca	May-Aug	18-34	Unvax	73%	76%			
Oxford UK	AstraZeneca	May-Aug	35-64	Unvax	54%	57%			
<b>Vector and Attenuated vaccines without age bucketing</b>									
Public Health England	AstraZeneca	Dec-May		Unvax		67%			
Public Health England	AstraZeneca	Apr-Jun		Unvax			92%		
J&J trial	J&J	Sep-Jan		Unvax		66%	85%		
Bharat Biotech trial	Covaxin	Nov-Jan		Unvax	64%	78%		93%	
Chile Ministry of Health	Sinovac	Feb-May		Unvax	66%	88%		90%	86%
S Afr Med Res Council	J&J	Feb-Aug		Unvax			71%		94%

Source: JPMAM. August 2021.

See our virus web portal linked above for the latest COVID charts and tables, the latest data on acquired vs natural immunity, and a discussion on new variants and immunity escape.

<sup>8</sup> For more details, see our August 19, 2021 Eye on the Market “Spaccine Efficacy”



**IMPORTANT INFORMATION**

This report uses rigorous security protocols for selected data sourced from Chase credit and debit card transactions to ensure all information is kept confidential and secure. All selected data is highly aggregated and all unique identifiable information, including names, account numbers, addresses, dates of birth, and Social Security Numbers, is removed from the data before the report's author receives it. The data in this report is not representative of Chase's overall credit and debit cardholder population.

The views, opinions and estimates expressed herein constitute Michael Cembalest's judgment based on current market conditions and are subject to change without notice. Information herein may differ from those expressed by other areas of J.P. Morgan. This information in no way constitutes J.P. Morgan Research and should not be treated as such.

The views contained herein are not to be taken as advice or a recommendation to buy or sell any investment in any jurisdiction, nor is it a commitment from J.P. Morgan or any of its subsidiaries to participate in any of the transactions mentioned herein. Any forecasts, figures, opinions or investment techniques and strategies set out are for information purposes only, based on certain assumptions and current market conditions and are subject to change without prior notice. All information presented herein is considered to be accurate at the time of production. This material does not contain sufficient information to support an investment decision and it should not be relied upon by you in evaluating the merits of investing in any securities or products. In addition, users should make an independent assessment of the legal, regulatory, tax, credit and accounting implications and determine, together with their own professional advisers, if any investment mentioned herein is believed to be suitable to their personal goals. Investors should ensure that they obtain all available relevant information before making any investment. It should be noted that investment involves risks, the value of investments and the income from them may fluctuate in accordance with market conditions and taxation agreements and investors may not get back the full amount invested. Both past performance and yields are not reliable indicators of current and future results.

Non-affiliated entities mentioned are for informational purposes only and should not be construed as an endorsement or sponsorship of J.P. Morgan Chase & Co. or its affiliates.

**For J.P. Morgan Asset Management Clients:**

J.P. Morgan Asset Management is the brand for the asset management business of JPMorgan Chase & Co. and its affiliates worldwide.

To the extent permitted by applicable law, we may record telephone calls and monitor electronic communications to comply with our legal and regulatory obligations and internal policies. Personal data will be collected, stored and processed by J.P. Morgan Asset Management in accordance with our privacy policies at <https://am.jpmorgan.com/global/privacy>.

**ACCESSIBILITY**

For U.S. only: If you are a person with a disability and need additional support in viewing the material, please call us at 1-800-343-1113 for assistance.

This communication is issued by the following entities:

In the United States, by J.P. Morgan Investment Management Inc. or J.P. Morgan Alternative Asset Management, Inc., both regulated by the Securities and Exchange Commission; in Latin America, for intended recipients' use only, by local J.P. Morgan entities, as the case may be.; in Canada, for institutional clients' use only, by JPMorgan Asset Management (Canada) Inc., which is a registered Portfolio Manager and Exempt Market Dealer in all Canadian provinces and territories except the Yukon and is also registered as an Investment Fund Manager in British Columbia, Ontario, Quebec and Newfoundland and Labrador. In the United Kingdom, by JPMorgan Asset Management (UK) Limited, which is authorized and regulated by the Financial Conduct Authority; in other European jurisdictions, by JPMorgan Asset Management (Europe) S.à r.l. In Asia Pacific ("APAC"), by the following issuing entities and in the respective jurisdictions in which they are primarily regulated: JPMorgan Asset Management (Asia Pacific) Limited, or JPMorgan Funds (Asia) Limited, or JPMorgan Asset Management Real Assets (Asia) Limited, each of which is regulated by the Securities and Futures Commission of Hong Kong; JPMorgan Asset Management (Singapore) Limited (Co. Reg. No. 197601586K), which this advertisement or publication has not been reviewed by the Monetary Authority of Singapore; JPMorgan Asset Management (Taiwan) Limited; JPMorgan Asset Management (Japan) Limited, which is a member of the Investment Trusts Association, Japan, the Japan Investment Advisers Association, Type II Financial Instruments Firms Association and the Japan Securities Dealers Association and is regulated by the Financial Services Agency (registration number "Kanto Local Finance Bureau (Financial Instruments Firm) No. 330"); in Australia, to wholesale clients only as defined in section 761A and 761G of the Corporations Act 2001 (Commonwealth), by JPMorgan Asset Management (Australia) Limited (ABN 55143832080) (AFSL 376919). For all other markets in APAC, to intended recipients only.

**For J.P. Morgan Private Bank Clients:****ACCESSIBILITY**

J.P. Morgan is committed to making our products and services accessible to meet the financial services needs of all our clients. Please direct any accessibility issues to the Private Bank Client Service Center at 1-866-265-1727.

**LEGAL ENTITY, BRAND & REGULATORY INFORMATION**

In the **United States**, bank deposit accounts and related services, such as checking, savings and bank lending, are offered by **JPMorgan Chase Bank, N.A.** Member FDIC.

**JPMorgan Chase Bank, N.A.** and its affiliates (collectively "**JPMCB**") offer investment products, which may include bank-managed investment accounts and custody, as part of its trust and fiduciary services. Other investment products and services, such as brokerage and advisory accounts, are offered through **J.P. Morgan Securities LLC ("JPMS")**, a member of [FINRA](#) and [SIPC](#). Annuities are made available through Chase Insurance Agency, Inc. (CIA), a licensed insurance agency, doing business as Chase Insurance Agency Services, Inc. in Florida. JPMCB, JPMS and CIA are affiliated companies under the common control of JPM. Products not available in all states.

In **Luxembourg**, this material is issued by **J.P. Morgan Bank Luxembourg S.A. (JPMBL)**, with registered office at European Bank and Business Centre, 6 route de Treves, L-2633, Senningerberg, Luxembourg. R.C.S Luxembourg B10.958. Authorized and regulated by Commission de Surveillance du Secteur Financier (CSSF) and jointly supervised by the European Central Bank (ECB) and the CSSF. J.P. Morgan Bank Luxembourg S.A. is authorized as a credit institution in accordance with the Law of 5th April 1993. In the **United Kingdom**, this material is issued by **J.P. Morgan Bank Luxembourg S.A., London Branch**, registered office at 25 Bank Street, Canary Wharf, London E14 5JP. Authorized and regulated by Commission de Surveillance du Secteur Financier (CSSF) and jointly supervised by the European Central Bank (ECB) and the CSSF. Deemed authorised by the Prudential Regulation Authority. Subject to regulation by the Financial Conduct Authority and limited regulation by the Prudential Regulation Authority. Details of the Temporary Permissions Regime, which allows EEA-based firms to operate in the UK for a limited period while seeking full authorisation, are available on the Financial Conduct Authority's website. In **Spain**, this material is distributed by **J.P. Morgan Bank Luxembourg S.A., Sucursal en España**, with registered office at Paseo de la Castellana, 31, 28046 Madrid, Spain. J.P. Morgan Bank Luxembourg S.A., Sucursal en



España is registered under number 1516 within the administrative registry of the Bank of Spain and supervised by the Spanish Securities Market Commission (CNMV). In **Germany**, this material is distributed by **J.P. Morgan Bank Luxembourg S.A., Frankfurt Branch**, registered office at Taunustor 1 (TaunusTurm), 60310 Frankfurt, Germany, jointly supervised by the Commission de Surveillance du Secteur Financier (CSSF) and the European Central Bank (ECB), and in certain areas also supervised by the Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin). In **Italy**, this material is distributed by **J.P. Morgan Bank Luxembourg S.A.– Milan Branch**, registered office at Via Cordusio 3, 20123 Milano, Italy and regulated by Bank of Italy and the Commissione Nazionale per le Società e la Borsa (CONSOB). In the **Netherlands**, this material is distributed by **J.P. Morgan Bank Luxembourg S.A., Amsterdam Branch**, with registered office at World Trade Centre, Tower B, Strawinskyalaan 1135, 1077 XX, Amsterdam, The Netherlands. J.P. Morgan Bank Luxembourg S.A., Amsterdam Branch is authorized and regulated by the Commission de Surveillance du Secteur Financier (CSSF) and jointly supervised by the European Central Bank (ECB) and the CSSF in Luxembourg; J.P. Morgan Bank Luxembourg S.A., Amsterdam Branch is also authorized and supervised by De Nederlandsche Bank (DNB) and the Autoriteit Financiële Markten (AFM) in the Netherlands. Registered with the Kamer van Koophandel as a branch of J.P. Morgan Bank Luxembourg S.A. under registration number 71651845. In **Denmark**, this material is distributed by **J.P. Morgan Bank Luxembourg, Copenhagen Br**, filial af J.P. Morgan Bank Luxembourg S.A. with registered office at Kalvebod Brygge 39-41, 1560 København V, Denmark. J.P. Morgan Bank Luxembourg, Copenhagen Br, filial af J.P. Morgan Bank Luxembourg S.A. is authorized and regulated by Commission de Surveillance du Secteur Financier (CSSF) and jointly supervised by the European Central Bank (ECB) and the CSSF. J.P. Morgan Bank Luxembourg, Copenhagen Br, filial af J.P. Morgan Bank Luxembourg S.A. is also subject to the supervision of Finanstilsynet (Danish FSA) and registered with Finanstilsynet as a branch of J.P. Morgan Bank Luxembourg S.A. under code 29009. In **Sweden**, this material is distributed by **J.P. Morgan Bank Luxembourg S.A., Stockholm Bankfilial**, with registered office at Hamngatan 15, Stockholm, 11147, Sweden. J.P. Morgan Bank Luxembourg S.A., Stockholm Bankfilial is authorized and regulated by Commission de Surveillance du Secteur Financier (CSSF) and jointly supervised by the European Central Bank (ECB) and the CSSF. J.P. Morgan Bank Luxembourg S.A., Stockholm Bankfilial is also subject to the supervision of Finansinspektionen (Swedish FSA). Registered with Finansinspektionen as a branch of J.P. Morgan Bank Luxembourg S.A. In **France**, this material is distributed by **JPMorgan Chase Bank, N.A. (“JPMCB”), Paris branch**, which is regulated by the French banking authorities Autorité de Contrôle Prudentiel et de Résolution and Autorité des Marchés Financiers. In **Switzerland**, this material is distributed by **J.P. Morgan (Suisse) SA**, which is regulated in Switzerland by the Swiss Financial Market Supervisory Authority (FINMA).

In **Hong Kong**, this material is distributed by **JPMCB, Hong Kong branch**. JPMCB, Hong Kong branch is regulated by the Hong Kong Monetary Authority and the Securities and Futures Commission of Hong Kong. In Hong Kong, we will cease to use your personal data for our marketing purposes without charge if you so request. In **Singapore**, this material is distributed by **JPMCB, Singapore branch**. JPMCB, Singapore branch is regulated by the Monetary Authority of Singapore. Dealing and advisory services and discretionary investment management services are provided to you by JPMCB, Hong Kong/Singapore branch (as notified to you). Banking and custody services are provided to you by JPMCB Singapore Branch. The contents of this document have not been reviewed by any regulatory authority in Hong Kong, Singapore or any other jurisdictions. You are advised to exercise caution in relation to this document. If you are in any doubt about any of the contents of this document, you should obtain independent professional advice. For materials which constitute product advertisement under the Securities and Futures Act and the Financial Advisers Act, this advertisement has not been reviewed by the Monetary Authority of Singapore. JPMorgan Chase Bank, N.A. is a national banking association chartered under the laws of the United States, and as a body corporate, its shareholder’s liability is limited.

With respect to countries in **Latin America**, the distribution of this material may be restricted in certain jurisdictions. We may offer and/or sell to you securities or other financial instruments which may not be registered under, and are not the subject of a public offering under, the securities or other financial regulatory laws of your home country. Such securities or instruments are offered and/or sold to you on a private basis only. Any communication by us to you regarding such securities or instruments, including without limitation the delivery of a prospectus, term sheet or other offering document, is not intended by us as an offer to sell or a solicitation of an offer to buy any securities or instruments in any jurisdiction in which such an offer or a solicitation is unlawful. Furthermore, such securities or instruments may be subject to certain regulatory and/or contractual restrictions on subsequent transfer by you, and you are solely responsible for ascertaining and complying with such restrictions. To the extent this content makes reference to a fund, the Fund may not be publicly offered in any Latin American country, without previous registration of such fund’s securities in compliance with the laws of the corresponding jurisdiction. Public offering of any security, including the shares of the Fund, without previous registration at Brazilian Securities and Exchange Commission— CVM is completely prohibited. Some products or services contained in the materials might not be currently provided by the Brazilian and Mexican platforms.

JPMorgan Chase Bank, N.A. (JPMCBNA) (ABN 43 074 112 011/AFS Licence No: 238367) is regulated by the Australian Securities and Investment Commission and the Australian Prudential Regulation

Authority. Material provided by JPMCBNA in Australia is to “wholesale clients” only. For the purposes of this paragraph the term “wholesale client” has the meaning given in section 761G of the Corporations Act 2001 (Cth). Please inform us if you are not a Wholesale Client now or if you cease to be a Wholesale Client at any time in the future.

JPMorgan Chase Bank, N.A. (JPMCBNA) (ABN 43 074 112 011/AFS Licence No: 238367) is regulated by the Australian Securities and Investment Commission and the Australian Prudential Regulation Authority. Material provided by JPMCBNA in Australia is to “wholesale clients” only. For the purposes of this paragraph the term “wholesale client” has the meaning given in section 761G of the Corporations Act 2001 (Cth). Please inform us if you are not a Wholesale Client now or if you cease to be a Wholesale Client at any time in the future.

JPMS is a registered foreign company (overseas) (ARBN 109293610) incorporated in Delaware, U.S.A. Under Australian financial services licensing requirements, carrying on a financial services business in Australia requires a financial service provider, such as J.P. Morgan Securities LLC (JPMS), to hold an Australian Financial Services Licence (AFSL), unless an exemption applies. **JPMS is exempt from the requirement to hold an AFSL under the Corporations Act 2001 (Cth) (Act) in respect of financial services it provides to you, and is regulated by the SEC, FINRA and CFTC under U.S. laws, which differ from Australian laws.** Material provided by JPMS in Australia is to “wholesale clients” only. The information provided in this material is not intended to be, and must not be, distributed or passed on, directly or indirectly, to any other class of persons in Australia. For the purposes of this paragraph the term “wholesale client” has the meaning given in section 761G of the Act. Please inform us immediately if you are not a Wholesale Client now or if you cease to be a Wholesale Client at any time in the future.

This material has not been prepared specifically for Australian investors. It:

- May contain references to dollar amounts which are not Australian dollars;
- May contain financial information which is not prepared in accordance with Australian law or practices;
- May not address risks associated with investment in foreign currency denominated investments; and
- Does not address Australian tax issues.