



2022 Board of Trustees Retreat

May 25, 2022

*The Westin Richmond
6631 West Broad Street
Richmond, Virginia 23230*

Virginia Retirement System
1200 East Main Street

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Virginia Retirement System Board of Trustees Retreat

Wednesday, May 25, 2022

Westin Richmond Hotel ♦ Chesapeake Salon: A & B

- | | |
|--|--|
| <p>10:00 a.m. Welcome & Opening Remarks
A. Scott Andrews, Chairman, VRS Board of Trustees
Patricia Bishop, Director, VRS
Ronald Schmitz, Chief Investment Officer, VRS</p> | <p>1:15 p.m. Panel Discussion: Operations, Regulatory & Legal, and Compliance
Vera Pleasants, Operations Manager
Rick Brooks, Regulatory and Legal Officer
Laurie Fennell, Compliance Officer
<i>Curt Mattson, Chief Administrative Officer – Moderator</i></p> |
| <p>10:10 a.m. Guest Speaker: Digital Assets & Blockchain
Anirban Basu, Chairman & CEO
Sage Policy Group, Inc.</p> | <p>1:45 p.m. Panel Discussion: Portfolio Solutions Group (PSG)
Matt Lacy, Portfolio Integration Director
Kristina Koutrakos, Portfolio Strategy Director
Ross Kasarda, Risk Director
Katie Grawe, Portfolio Manager
<i>Chung Ma, Managing Director – PSG, Moderator</i></p> |
| <p>11:00 a.m. Panel Discussion: Equities
Dan Whitlock, Public Equity Program Director
Dan Schlussler, Internal Equity Management Program Director
Vu Le, Portfolio Manager
<i>J.T. Grier, Managing Director - Public Markets, Moderator</i></p> | <p>2:15 p.m. Afternoon Break – Sweets Bar</p> |
| <p>11:30 a.m. Panel Discussion: Fixed Income
Greg Oliff, Co-Director
Parham Behrooz, Co-Director
Mehtab Haleem, Portfolio Manager
<i>J.T. Grier, Managing Director – Public Markets, Moderator</i></p> | <p>3:00 p.m. Guest Speaker: China’s Impact on the Global Economy and Geo-political Landscape
Melissa J. Ma, Co-Founder & Managing Partner
Asia Alternatives Management, LLC</p> |
| <p>12:00 p.m. Lunch</p> | <p>3:45 p.m. Closing Remarks</p> |

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Virginia
Retirement
System

Welcome

A. Scott Andrews
Chairman, VRS Board of Trustees





Virginia
Retirement
System

Welcome

Patricia S. Bishop
Director, VRS





Welcome

Ronald D. Schmitz
Chief Investment Officer, VRS



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Guest Speaker:

Digital Assets & Blockchain

Anirban Basu

Chairman & CEO, Sage Policy Group, Inc.



Anirban Basu ● Chairman & CEO

Sage Policy Group, Inc.



Anirban Basu is Chairman & CEO of Sage Policy Group, Inc., an economic and policy consulting firm headquartered in Baltimore, Maryland with an office in Orlando, Florida. The firm provides strategic analytical services to energy suppliers, law firms, medical systems, government agencies, and real estate developers among others.

In 2014, Maryland Governor Larry Hogan appointed him Chair of the Maryland Economic Development Commission (2014-2021). He serves as Chairman of the Baltimore County Economic Advisory Committee. He is also the Chief Economist to Associated Builders and Contractors, the Chief Economist of the Maryland Bankers Association, and Chief Economic Advisor to the Construction Financial Management Association. He serves or has served similar functions for Visit Baltimore, Maryland Realtors, and Marcum, LLP.

He has lectured at Johns Hopkins University, most recently in Global Strategy, and has also taught international economics, urban economics, micro- and macroeconomics at Hopkins. His radio show can be heard weekdays on 88.1FM, WYPR, Baltimore.

In both 2007 and 2016, the Daily Record newspaper selected Mr. Basu as one of Maryland's 50 most influential people. The Baltimore Business Journal named him one of the region's 20 most powerful business leaders in 2010.

Dr. Basu has been on many boards over time, including First Mariner Bank, the Baltimore City Public School System, Port Discovery, the Baltimore School for the Arts, and Union Memorial Hospital. He is currently on the boards of the University of Maryland School of Law, St. Mary's College, the University of Maryland Medical Center, the University System of Maryland Foundation, the Center for Emerging Media, the Lyric Opera House and the Archdiocese of Baltimore School System.

Dr. Basu earned his B.S. in Foreign Service at Georgetown University. He earned his Master's in Public Policy from Harvard University's John F. Kennedy School of Government, and his Master's in Economics from the University of Maryland, College Park. His Juris Doctor was earned at the University of Maryland School of Law. His doctoral work was completed at UMBC with a concentration in health economics.

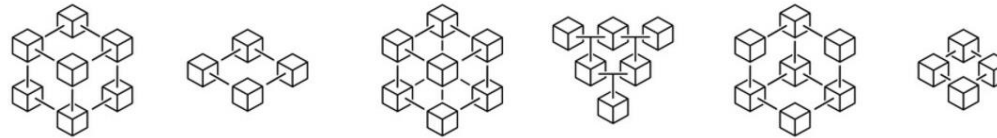
Tales from the Crypto:

Should these New Currencies Scare or Excite Us?

By: Anirban Basu

MPP, MA, JD, PhD

Sage Policy Group, Inc.



On Behalf of

Virginia Retirement System Board of Trustees

May 25th, 2022

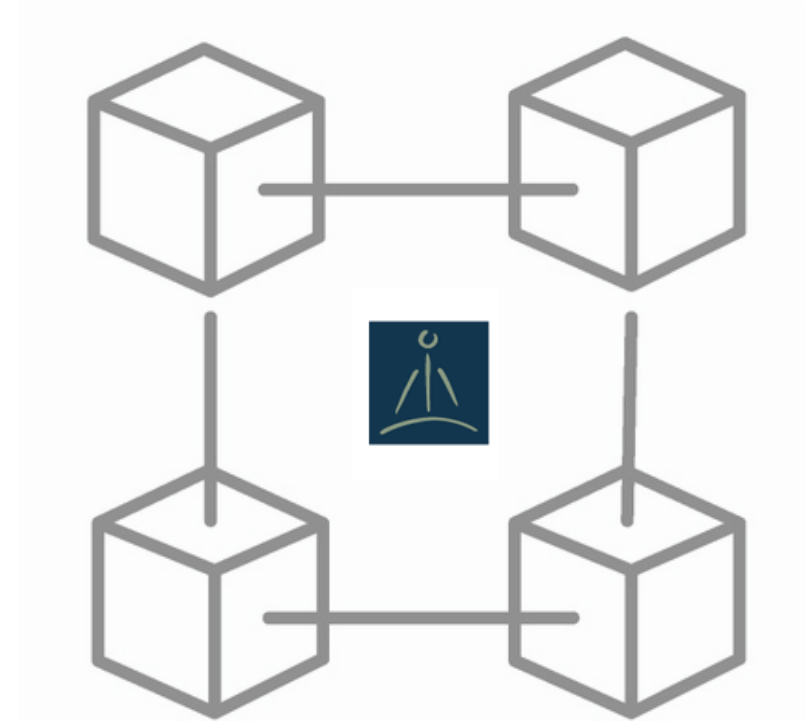


Background

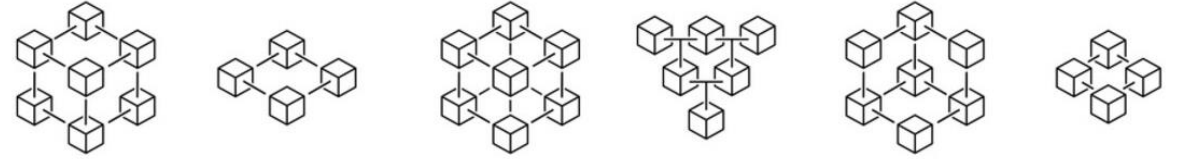
[From Blockchain to Bitcoin]

Satoshi Nakamoto

- Blockchain developed in 2008 as the accounting method for bitcoin.
- The inventor of this game-changing technology is anonymous, going by the name of Satoshi Nakamoto – the real name of this person or group of people remains unknown.
- Underlying blockchain concepts were initially developed during the 1980s and 1990s.

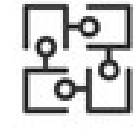


What is Blockchain?



- Blockchain is database technology; specifically, a decentralized, distributed digital ledger that stores data of any kind.
- Blockchain is unique in that it is decentralized.
- Rather than being maintained by a centralized administrator in a single location (ex. a bank database, an excel spreadsheet), many identical copies of a blockchain database/ledger are located on multiple computers (nodes) across a network.
- A blockchain ledger can record transactions between two parties efficiently and in a verifiable and permanent way.
- A blockchain ledger can also be programmed to trigger transactions automatically.

Bitcoin Beginnings



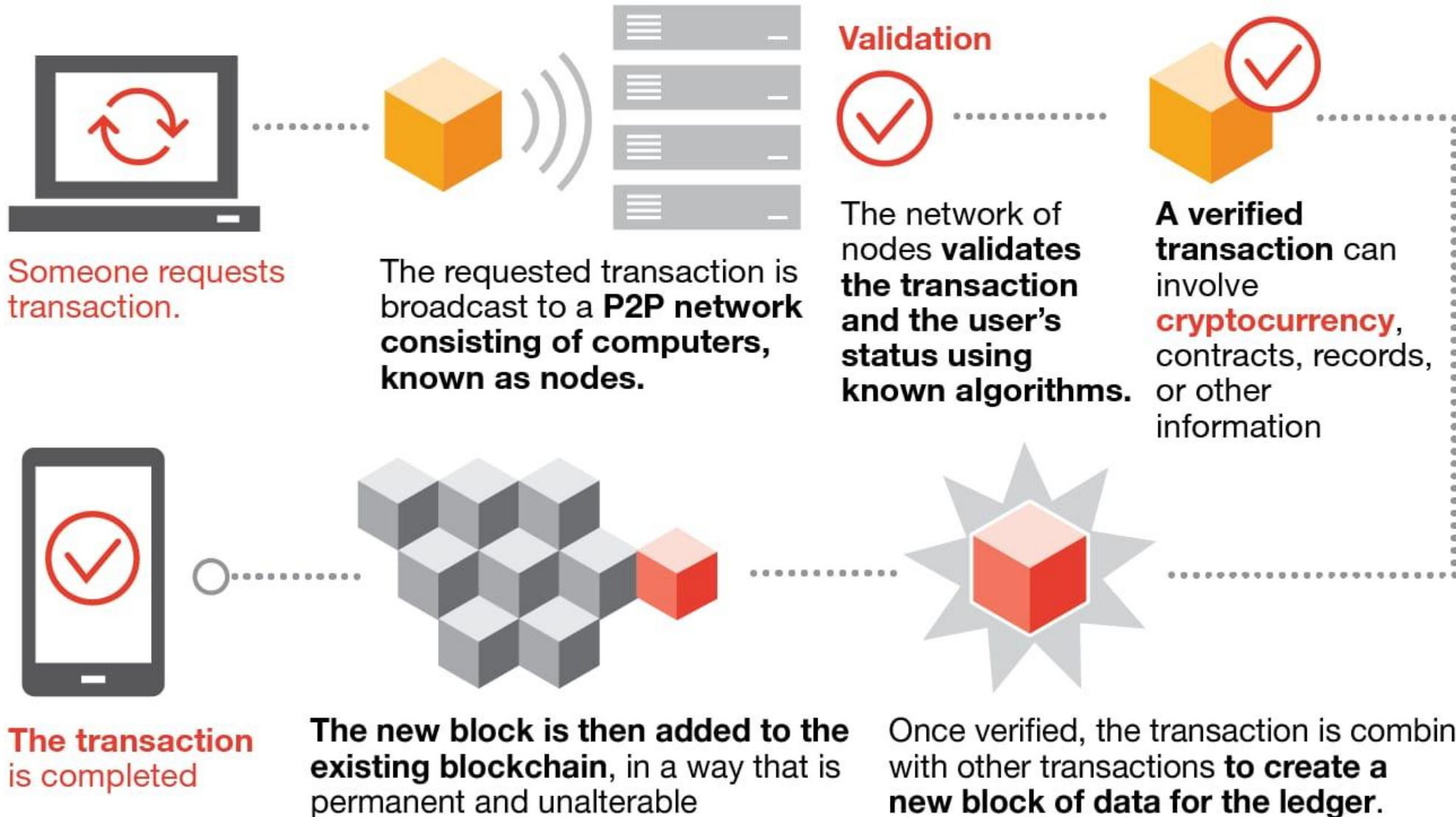
Why blockchain technology?

- Blockchain provided Bitcoin with digital trust—records important information in a public space, doesn't allow anyone to remove it.
- Bitcoin is a virtual currency system without a central authority for issuing currency, transferring ownership or confirming transaction.

Potential blockchain applications:

- Cryptocurrency, financial services (fund transfers, etc.), settling trades, voting, health records, fractional ownership in autonomous cars, more...
- Bitcoin was the first application of blockchain technology.

How a Blockchain Works





What is Cryptocurrency?

- Blockchain is a technology that enables the existence of cryptocurrency.
- A cryptocurrency is a medium of exchange that is digital, encrypted, and *decentralized*.
- The original idea behind Bitcoin was that “*a purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution.*”
- The term “cryptocurrency” is used because the technology is based on *public-key cryptography*, a well-known encryption technology used in both payment and communication systems.

Cryptocurrency...



Has no intrinsic value in that it is not redeemable for another commodity, such as gold.

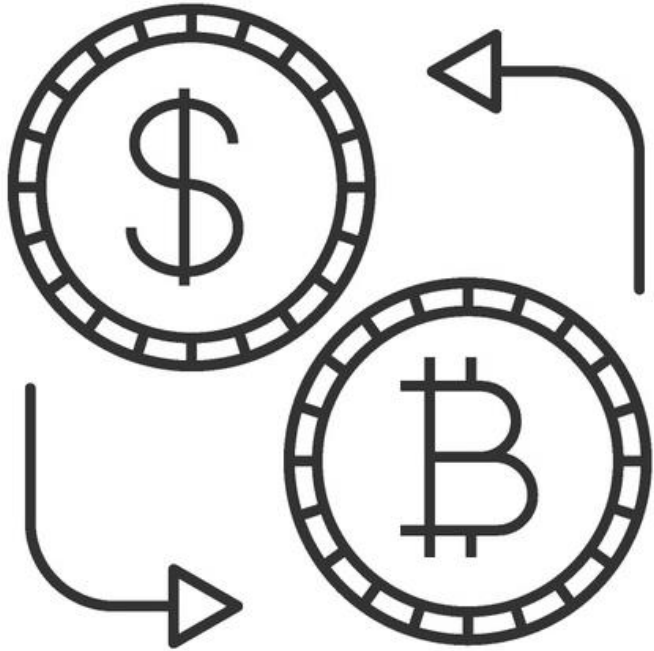


Has no physical form and exists only in the network.



Its supply is not determined by a central bank and the network is completely decentralized.

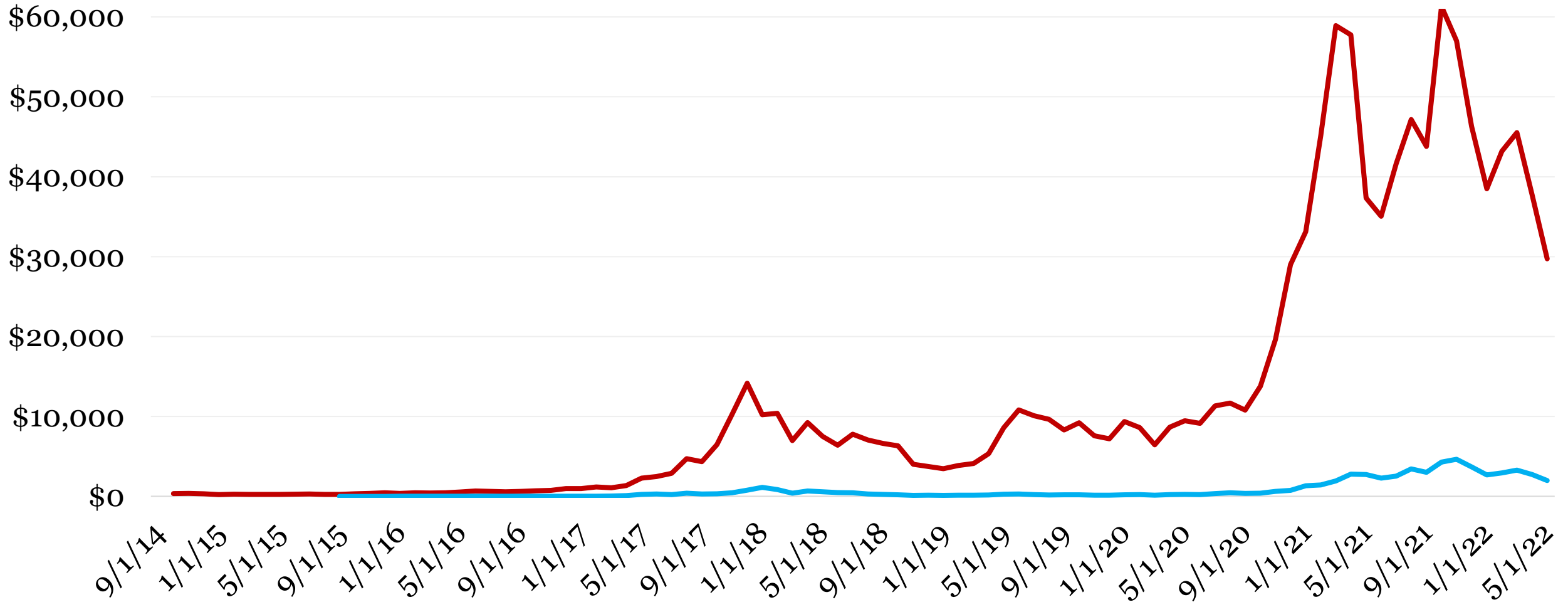
As Currency, It's Lousy



- Unit of account – Actually fabulous
- But lousy store of value, though there is potential there
- Lousy medium of exchange, but there is also potential there

Bitcoin/Ethereum Price

— BTC-USD — ETH-USD





How Does Cryptocurrency Work?

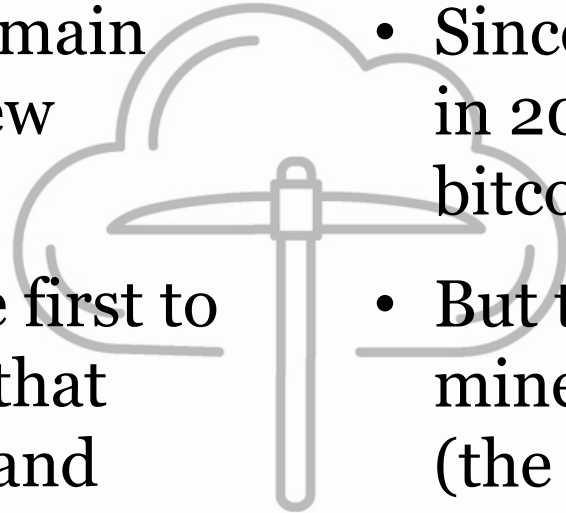


Basic idea:

- A cryptocurrency operates on a software network in which many computers run separate copies of the same program. These computers are linked, but no single computer controls the network.
- The computer network has 2 primary functions:
 - Process cryptocurrency transactions;
 - Maintain the database that records and stores those transactions.
- Anyone can download and run these software programs on any computer.
- Computers across the network gather up transactions and go through a mathematical process to verify them.
- Those transactions are batched into blocks and connected into chronological order in a chain.
- Individuals are rewarded by new cryptocurrency for contributing their computing resources to the network.

Bitcoin Mining & Supply

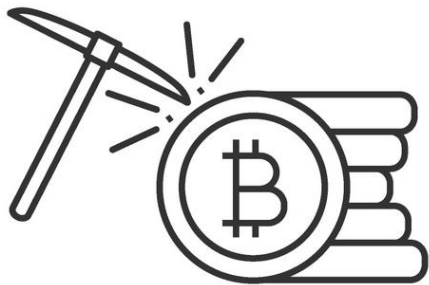
- **Bitcoin mining:** mining is a record-keeping service done through computing (see previous slide). Mining is also the main method of discovering new bitcoins.
- Miners compete to be the first to complete a computation that generates a unique hash and allows them to be the one to add the block to the blockchain.

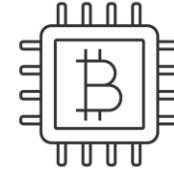
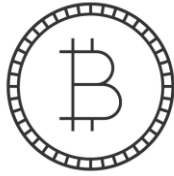


- **Bitcoin supply:** The supply of bitcoin is fixed and determined by its source code [programmed by its creator(s)]—limited to a final cap of 21 million coins.
- Since the cryptocurrency was launched in 2009 almost 19 million (90%) of bitcoin have already been mined.
- But the rate at which new bitcoin are mined is geared to slow down over time (the reward for mining each block halves every 210,000 blocks), so the final bitcoin might not be mined/minted until around 2140, according to current estimates.

Environmental Impact of Mining

- Cryptocurrency mining, particularly proof-of-work mining (the mechanism used by Bitcoin and many altcoins) requires a lot of computing power and is thus very energy intensive.
- And since the competition to mine the coins continues to rise, so does energy usage.
- The University of Cambridge estimates that Bitcoin alone consumes 123 terawatt-hours (TWh) of electricity annually, which is about the same amount of energy usage as all of Norway in 2020.
- Since China banned cryptocurrency mining in 2021, large bitcoin mining operations have been moving to places like Texas, in part due to its deregulated power grid.
- As of December 2021 nearly 38% of global Bitcoin mining takes place in the U.S.





Proliferation of Cryptocurrencies & Markets

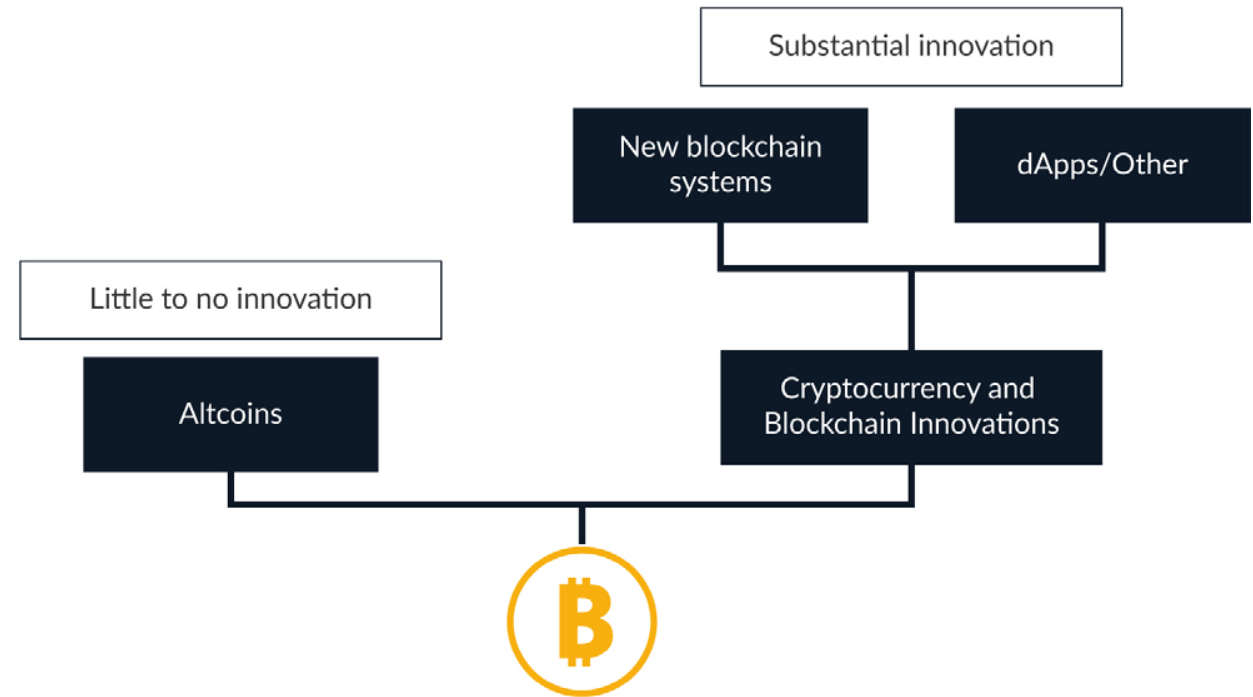
Key Terms

Cryptoasset: All public blockchain-based tokens, including cryptocurrencies. Unless specifically noted, I am going to use cryptocurrency/cryptoasset interchangeably.

Crypto Service Provider: Entities active in one or more segments:
1. payment services, 2. exchange services, 3. storage services

Cryptocurrency: The World Beyond Bitcoin

- Bitcoin was released as an open-source software, allowing anyone to take the code and create their own version of it.
- Thousands of platforms doing different things with blockchain have emerged—
 - *Decentralized versions of operating systems (Ethereum)*
 - *Digitized banking services (DeFi)*
 - *Supply-chain networks (IBM and others)*
 - *New kinds of collectibles and art (NFTs, or nonfungible tokens)*
 - *And of course, other cryptocurrencies...*

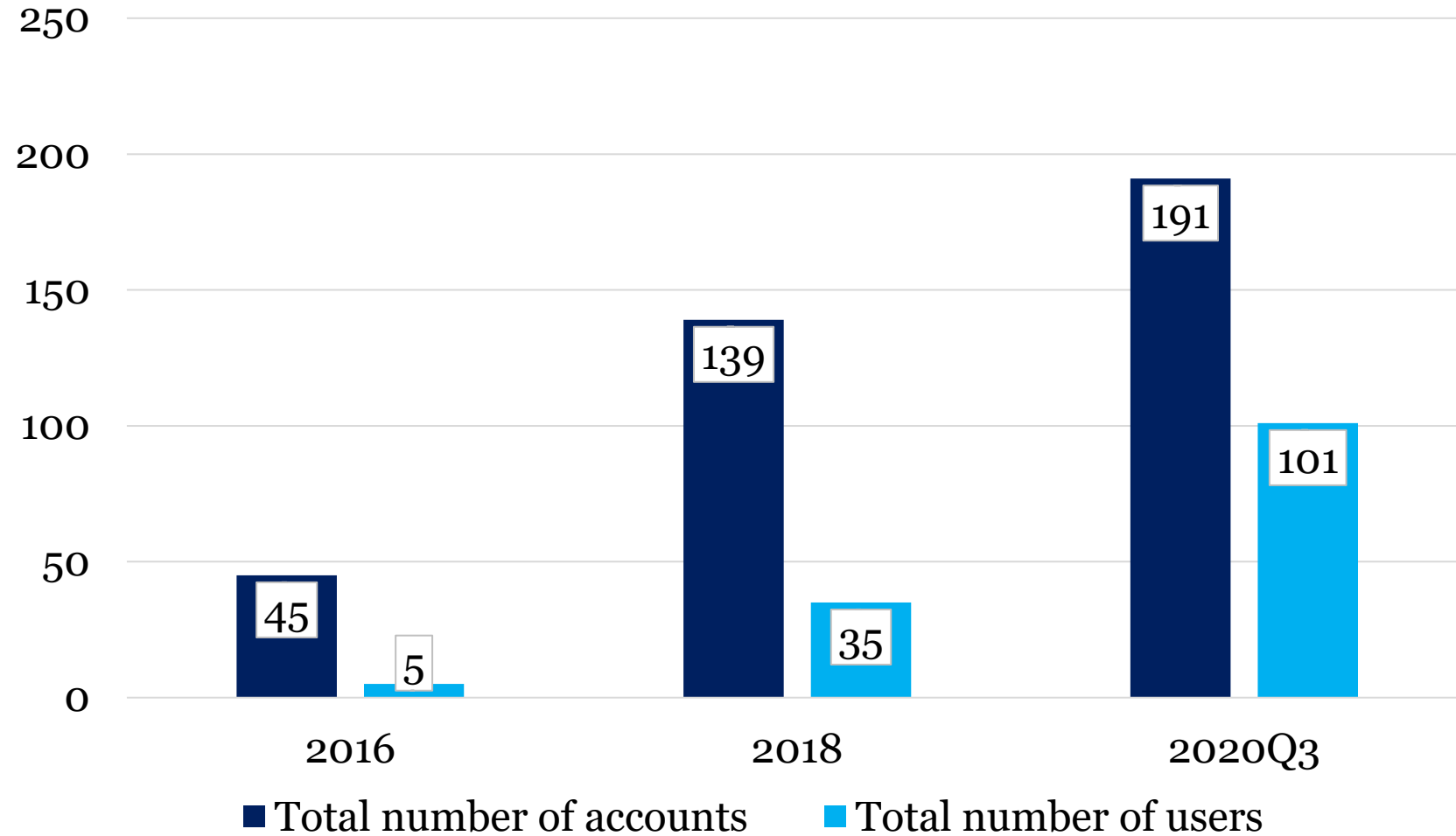


- **Altcoins:** Cryptocurrencies that are mostly clones of bitcoin; little innovation (represent majority of cryptocurrencies).
- **Cryptocurrency and blockchain innovations:** borrow some concepts from Bitcoin, but provide novel and innovative features; offer substantive differences.

Cryptocurrency Users

Estimates Indicate Number of Users Crypto Users Nearly Tripled from 2018 to 2020

Lower Bound Estimate of Total Cryptoasset Users & Accounts
(Millions)

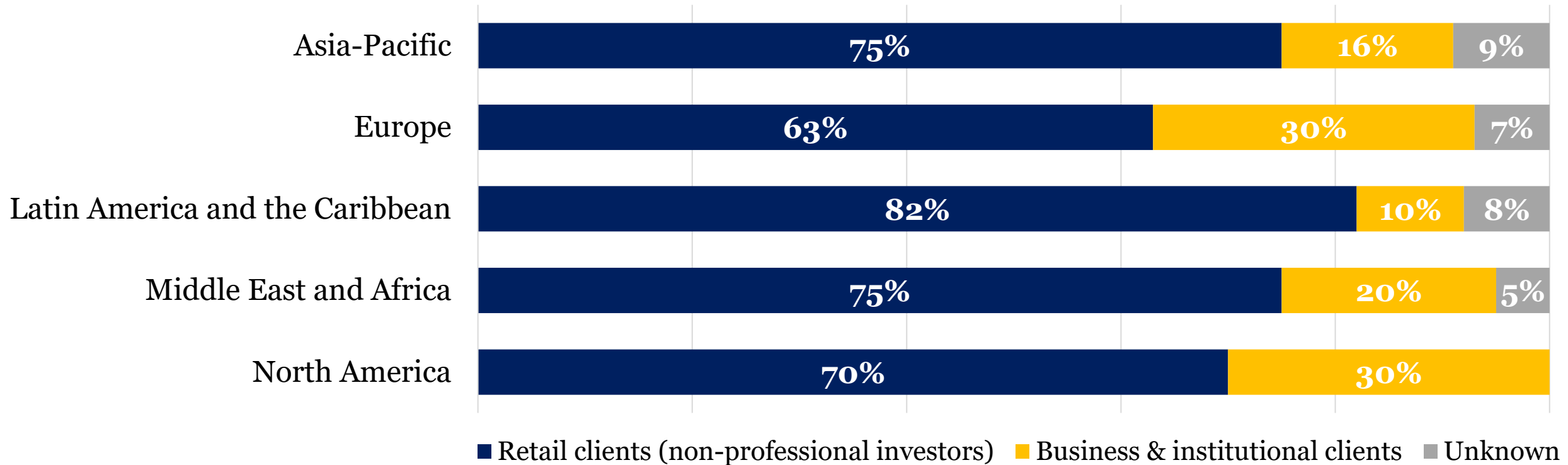


- Estimates of cryptocurrency users vary (and are challenging to confirm), but one estimate indicates that there were 101 million unique users across 191 million accounts opened at service providers as of Q3 2020.
- That is up from an estimated 35 million unique users in 2018.

Cryptocurrency Users

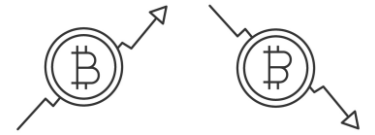
Individuals Still Constitute the Majority of Customer Base of Most Cryptocurrency Service Providers

Cryptoasset Customer Base by Type, Share of Total Users



- Service providers operationally headquartered in North America and Europe have the highest shares of business and institutional customers.

MSTR's Bitcoin Strategy

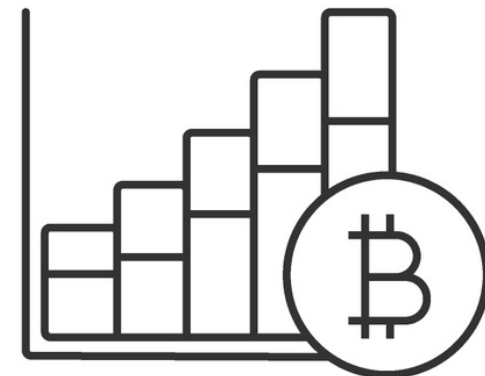


- MicroStrategy Incorporated (MSTR): independent, publicly traded business intelligence company.
- Strategy: in July 2020 MicroStrategy announced a new capital allocation strategy of investing cash (and then debt) in alternative assets.
- Over almost 2 years it has purchased over 129,000 bitcoins, spending just under \$4 billion for an average cost of \$30,700/bitcoin.
- Bitcoin prices have tumbled recently, and so have shares of publicly-traded MicroStrategy (MSTR).
- MSTR share prices have fallen about 56% since January of this year while bitcoin (BTC) has fallen about 30% during the same period (as of 5/18).
- According to recent statements by the company's CFO Andrew Kang, the company doesn't plan to alter its strategy.

Cryptocurrency Uses

Speculation Remains the Major Cryptoasset Use

- While cryptocurrency is designed to be a medium of exchange to buy regular goods and services, many people buy cryptocurrencies like an asset (like stocks or commodities).
- Major categories of cryptocurrency uses:
 - Speculative digital asset/investment
 - Medium of exchange
 - Payment platform
 - Non-monetary uses
- Growth in the cryptocurrency market has been driven more by venture capitalists investing in tech infrastructure and other investors seeking to profit from price fluctuations and less by consumers/businesses actually using crypto.



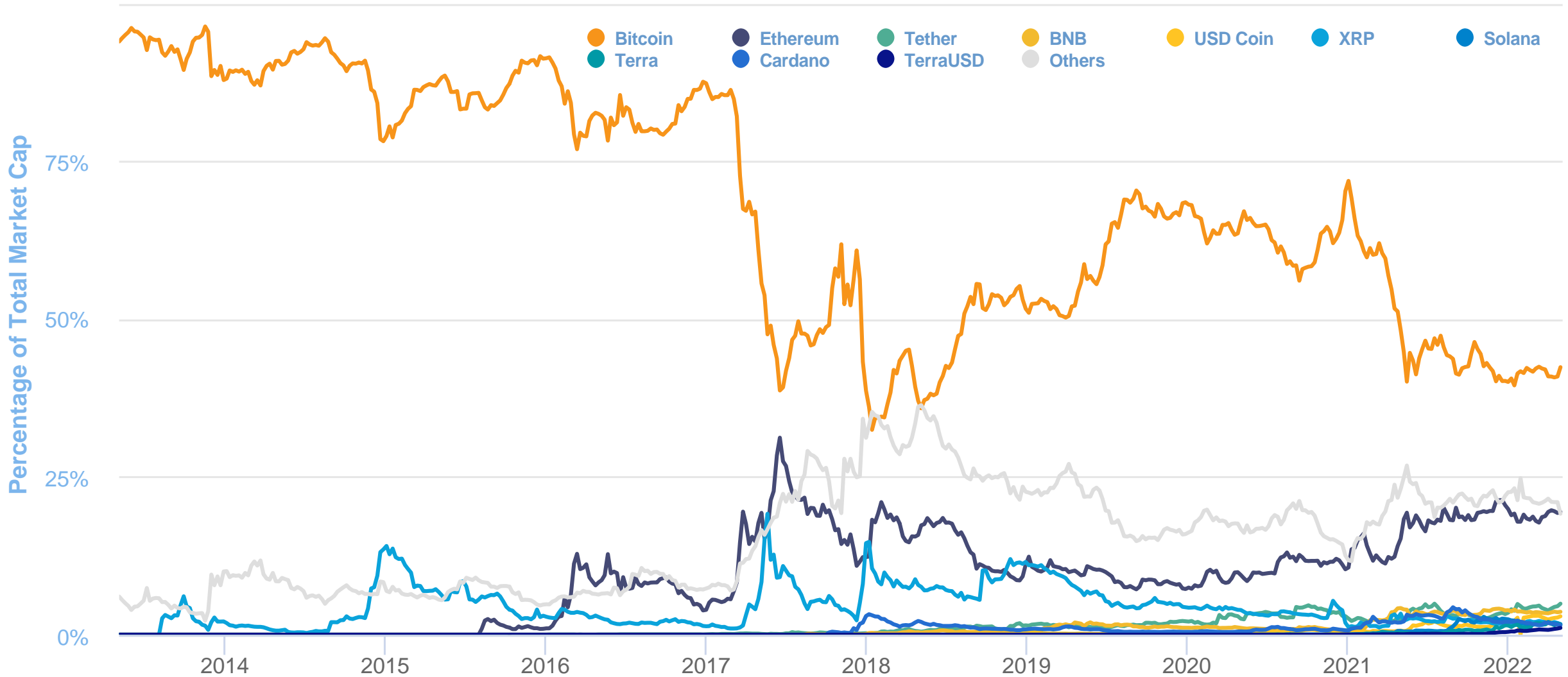
Growth in Cryptocurrencies & Markets

- In 2013 there were 7 cryptocurrencies.
- As of 2022 there are around 10,000 active cryptocurrencies in existence (and there have been thousands more that are now “dead”).
- It’s estimated that the top 20 cryptocurrencies make up around 90% of the total market.
- Cryptocurrency market capitalization has grown from around \$5-10 billion in 2014 to more than \$1.6 trillion in 2022.



Bitcoin Dominates

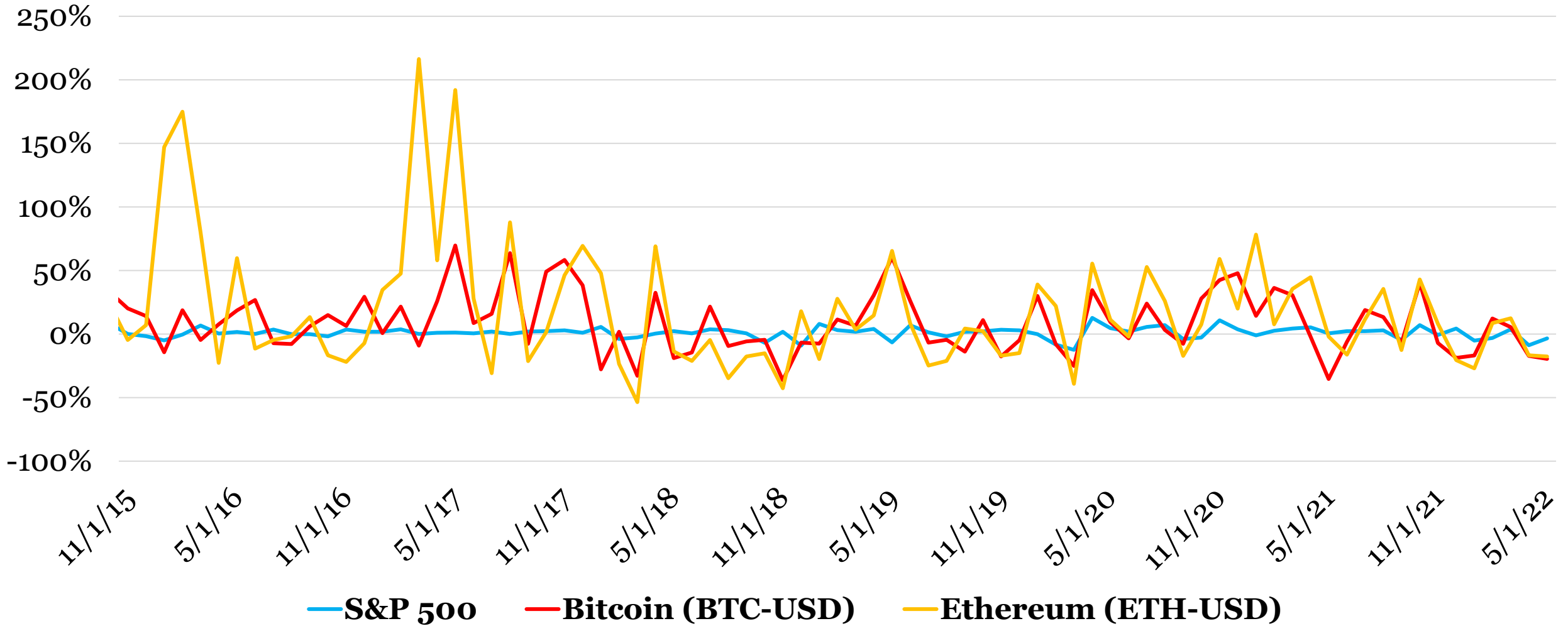
Major Cryptoassets* By Percentage of Total Market Capitalization



Source: CoinMarketCap *CoinMarketCap describes the assets tracked in this chart as cryptoassets because it includes tokens and stablecoins.

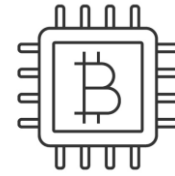
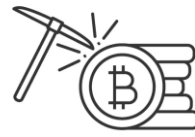
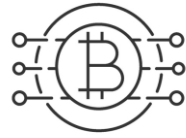
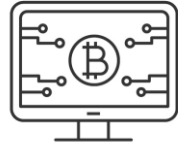
Cryptocurrency Risks: Price Volatility

Monthly % Change in Adjusted Close Values



Cryptocurrency Risks: Auditing, IT & Uncertainty

- **IT security risks:** *Greater retail adoption post-2017 has made cryptoasset service providers prime targets for hackers. According to blockchain analytics firm Chainalysis, the number of attacks on service providers has been on the rise with the total value of stolen funds peaking at nearly \$900 million in 2018.*
- **Many crypto service providers don't engage in internal/external security audits:** *Between 7%-18% of service providers surveyed by the Cambridge Centre for Alternative Finance indicate that they had never engaged in an internal security audit and between 4%-8% indicated they had never engaged in an external security audit.*
- **Half of crypto service providers don't have any kind of insurance:** *46% of service providers surveyed indicated not being insured against any risk. Companies that did have insurance plans were primarily insured against cybercrime, professional errors (including directors and officers liability insurance), loss or theft of private keys, and hazards.*
- **Cryptoasset service providers not required to perform audits of cryptoasset reserves:** *Regulations governing traditional financial institutions mandate banks to hold minimum reserve requirements and to perform independent audits. There is no similar requirement for cryptoasset reserve audits and survey results found that about 2 out of 5 service providers did not conduct an independent audit of their cryptoasset reserves in the past 12 months.*
- **Regulatory uncertainty...**



Regulatory Landscape

Regulatory Issues Abound

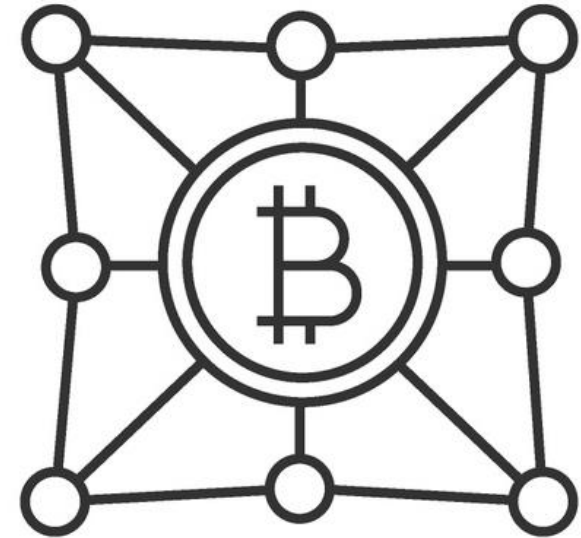
Taxonomy & Terminology



- Cryptoasset, virtual asset, cryptocurrency, digital asset, digital currency, virtual currency...
- The lack of standard terminology for cryptoassets across regulators and jurisdictions hampers a coordinated global regulatory response.
 - Even “cryptoasset” lacks a specific definition.
- Some argue that existing taxonomies of digital assets developed by various authorities have failed to capture the relevant features of digital assets and the true novelty introduced by cryptoassets.
 - Not all digital assets are cryptoassets and not all cryptoassets are the same—there are a wide range of characteristics.

Crypto & Crime

- According to Chainalysis, cryptocurrency-based crime hit a new all-time high in 2021, with illicit addresses receiving \$14B over the course of the year, up 79% from \$7.8B in 2020.
- But legitimate cryptocurrency transaction volume grew even faster (+567%), so illicit activity as a share of all crypto activity actually hit an all-time low (0.15% of crypto transaction volume).
- Ability of law enforcement to combat cryptocurrency-based crime is evolving.
- High-profile examples from 2021: the FBI's takedown of the prolific REvil ransomware strain; Department of the Treasury's sanctioning Suex and Chatex (two Russia-based cryptocurrency services heavily involved in money laundering).



Bitcoin Bans & Crypto Restrictions I

- Regulatory treatment of cryptocurrencies varies. While many countries have placed limitations on how cryptocurrencies can be used, a few have established outright bans.
- A few countries with particularly strained relationships with crypto (where cryptocurrency trading and/or mining is particularly restricted or illegal):
 - *Algeria, Bolivia, China, Columbia, Egypt, Indonesia, Iran, India, Iraq, Kosovo, Nepal, North Macedonia, Russia, Turkey, Vietnam.*
- Two big players, **China** and **India** have made moves to ban cryptocurrencies; hinted at establishing their own central bank digital currencies.

Bitcoin Bans & Crypto Restrictions II

- **China** cracked down on cryptocurrencies (both mining and currency exchanges) with increasing intensity throughout 2021.
- Finally in September 2021 the People's Bank of China (PBoC) published a statement declaring all cryptocurrency transactions illegal in China.
- Efforts to undermine Bitcoin (a decentralized currency outside of the government's control) are widely viewed as a pre-cursor to Chinese authorities floating their own e-currency.
- **India** is becoming increasingly hostile towards crypto. In November 2021, the government announced its intention to introduce a new bill to the Indian parliament that would ban almost all cryptocurrencies and also establish a new central bank-backed digital currency.
- Earlier in 2021, the government had considered criminalizing the possession, issuance, mining, trading, and transference of crypto assets.
- Prime minister Narendra Modi said he wanted to ensure crypto “does not end up in wrong hands, which can spoil our youth”.

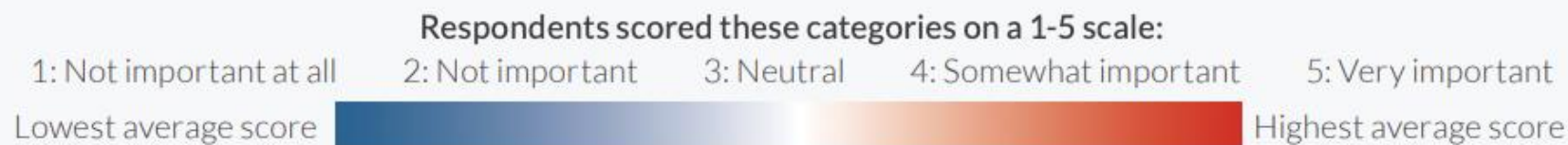


Looking Ahead

Future Developments

- Future developments cryptocurrency service providers ranked as most important: **stablecoins, staking, DeFi**.
- North American crypto service providers ranked **stablecoins** as the most important future development in the crypto sphere.
- North American crypto service providers were neutral on the importance of a Central Bank Digital Currency (**CBDC**).

Service providers' sentiment over future developments, by region of operations	Asia-Pacific	Europe	Latin America & Caribbean	Middle East & Africa	North America
Stablecoins	4.0	3.7	3.5	4.1	4.3
Staking/Proof of Stake/Verification	3.8	3.3	2.8	3.3	3.1
Decentralised finance (DeFi)	3.6	3.2	3.4	3.4	3.2
Layer-2 solutions (e.g., Lightning network)	3.0	3.1	2.9	3.3	3.0
Central Bank Digital Currencies (CBDCs)	3.3	2.9	2.7	3.5	3.1
Security tokens issued on a public blockchain	3.2	2.9	3.1	3.4	2.7
Sidechain	2.9	2.8	2.5	3.3	2.9
Privacy enhancing overlays	3.1	2.7	2.8	3.5	3.1
Non-fungible Tokens (e.g., ERC-721)	2.8	2.5	2.9	2.3	2.5
Other developments	1.8	3.1	4.0	3.5	N/A

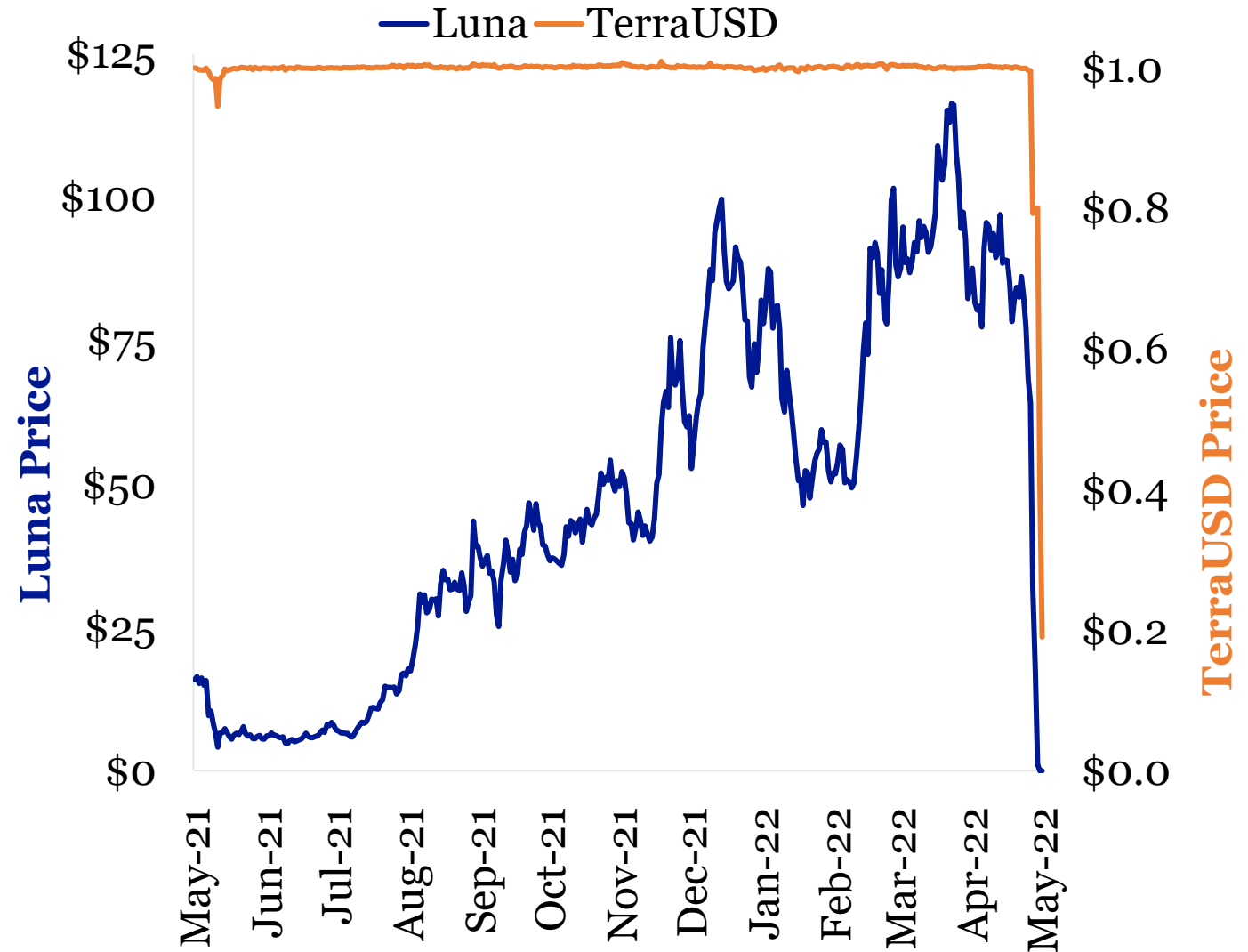


Source: Cambridge Centre for Alternative Finance, “3rd Global Cryptoasset Benchmarking Study” (September 2020). Note: “Other” includes ‘tokenized rights’, ‘FATF guidance’, ‘lending’.

Current Events: Stable Coins Not So Stable

Luna Falls Back To Earth—The Crash of Terra

- TerraUSD is a stable coin (i.e. supposed to always be worth \$1) that pays interest.
- TerraUSD can always be exchanged for \$1 worth of Terra Luna; if the price dropped below \$1, it would be bought for the arbitrage opportunity until it returned to \$1 (that was the idea, anyway).
- This worked excellently, right until it became **unpegged** on May 9.
- The price of the Luna plunged so quickly (from about \$80 on May 6th to below \$0.01 by May 13th) that arbitrage wasn't feasible, causing the value of the TerraUSD to fall below \$0.20.



Central Bank Digital Currency?

Central bank digital currency (CBDC): a digital liability of a central bank that is widely available to the general public (analogous to a digital form of paper money).

Note: A CBDC as envisioned by the Fed would complement, not replace cash.

- The technological advances that have ushered in a wave of new private-sector financial products and services (digital wallets, mobile payment apps, new digital assets) have prompted central banks around the globe to explore the potential benefits and risks of issuing a CBDC.
- The Federal Reserve Board has initiated consideration—kicking off with a discussion paper issued in January 2022 examining the pros and cons of a potential U.S. CBDC.
- The Federal Reserve is also seeking public input from a wide range of stakeholders on the issue.



If/when?

The Federal Reserve has stated that it:

- “will only take further steps toward developing a CBDC if research points to benefits for households, businesses, and the economy overall that exceed the downside risks, and indicates that CBDC is superior to alternative methods.”
- “does not intend to proceed with issuance of a CBDC without clear support from the executive branch and from Congress, ideally in the form of a specific authorizing law.”

Central Bank Digital Currency—Benefits/Risks

Potential Benefits:

- Provide households and businesses a convenient, electronic form of central bank money (and the safety and liquidity that would entail);
- Give entrepreneurs a platform on which to create new financial products and services;
- Support faster and cheaper payments (including cross-border payments);
- Expand consumer access to the financial system/promote financial inclusion.

Potential Risks:

- A CBDC raises a variety of important policy questions, including how it might affect—
 - financial-sector market structure;
 - the cost and availability of credit;
 - the safety and stability of the financial system;
 - the efficacy of monetary policy.

Future of Crypto: Integration, Innovation & Participation

- As the crypto industry enters a new decade, it faces various challenges to expansion, particularly the **balance** between:
- **Integrating** with traditional market infrastructures:
 - *Industry participants will likely need to invest more in compliance and industry restructuring*
- Maintaining a sustained pace of **innovation**
 - *Industry participants will need to make continuous improvements to innovative solutions like stablecoins*
- To reach the next phase in its evolution towards mainstream use and stability—all **key market participants** will need to buy in/play a role—merchants and consumers, technology developers, service providers, investors, financial institutions, and regulators.
- These key participant groups will set the pace of development of the cryptocurrency space.

Thank You



Please follow me on Twitter -- @sageanirban

Please look for updates of information at www.sagepolicy.com.

Please contact us when you require economic research & policy analysis.

Sign up for our newsletter at [**Basu.substack.com**](http://Basu.substack.com)

- A “Week in Review” post every Friday covering all the economic data releases, the best things I read, and, of course, my absence of humor
- An overview of the BLS jobs report on the first Friday of every month
- A monthly Q&A session
- Occasional posts on specific economic & policy related subjects

ECON BY
ANIRBAN



Notes

Panel Discussion: Equities

- Dan Whitlock, Public Equity Program Director
- Dan Schlussler, Internal Equity Management Program Director
- Vu Le, Portfolio Manager

*Moderated by J.T. Grier
Managing Director, Public Markets*

Notes

Panel Discussion: Fixed Income

- Greg Oliff, Fixed Income Co-Director
- Parham Behrooz, Fixed Income Co-Director
- Mehtab Haleem, Portfolio Manager

*Moderated by J.T. Grier
Managing Director, Public Markets*

Lunch: 12:00 – 1:15 p.m.



100.00	6.78				
827.24					
115.67	5.14				
90.31	7.81				
84.27					
105.32					
05.97					
04.47					
77.50					
58.79					3248.44
4.11					913.57
0.27					679.09
19.83	8.40				295.28
12.58					601.82
12.65					1021.19
20.00	6.95				100.00
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866.96		0.00	3111.25		2856.95
1209.13		0.00	2319.71		7209.13
1302.84		0.00	1316.80		72.84
2092.68		0.00	2200.80		7.68
1123.48		0.00	1531.47		407.99
1481.67		0.00	1531.47		128.48
2848.49		0.00	3087.61		2848.49
5.70	286.71	11.23	288.29	254.41	
5.70	287.77	12.57	288.95	224.41	
1.14	152.31	8.24	10.76	155.64	147.89
1.14	152.35	8.24	11.18	155.70	147.37
5.70	105.08		0.44	105.81	97.29
5.70	480.89		9.49	518.81	214.90
5.70	480.35		8.44	518.28	308.78
5.70	481.97		10.77	519.87	216.07
5.70	263.46		4.82	291.45	128.24
5.70	262.71		5.10	291.45	175.81
5.70	264.05		5.77	291.45	128.24
5.70	7225.90		145.83	7813.21	5159.56
5.70	7242.68		178.50	7819.41	5168.57
1.14	1282.28	7.17	96.32	1290.24	1258.83
1.14	1282.81	7.17	99.91	1291.14	1258.84
5.70	296.59		0.84	293.28	251.56
6.70	297.21		2.83	294.01	251.90
5.70	226.49		0.00	237.07	128.63
5.70	226.73		0.00	237.08	170.30
5.70	1026.75		14.52	925.85	653.66
5.70	1025.81		12.36	925.82	653.52
5.70	1029.03		18.80	925.94	653.84
5.70	130.50		3.50	131.85	122.82
5.70	124.66		0.00	121.80	101.49
5.70	177.91		0.00	170.25	137.03

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Panel Discussion: Operations, Regulatory & Legal, and Compliance

- Vera Pleasants, Operations Manager
- Rick Brooks, Regulatory & Legal Officer
- Laurie Fennell, Compliance Officer

*Moderated by Curt Mattson
Chief Administrative Officer*

Panel Discussion: Portfolio Solutions Group (PSG)

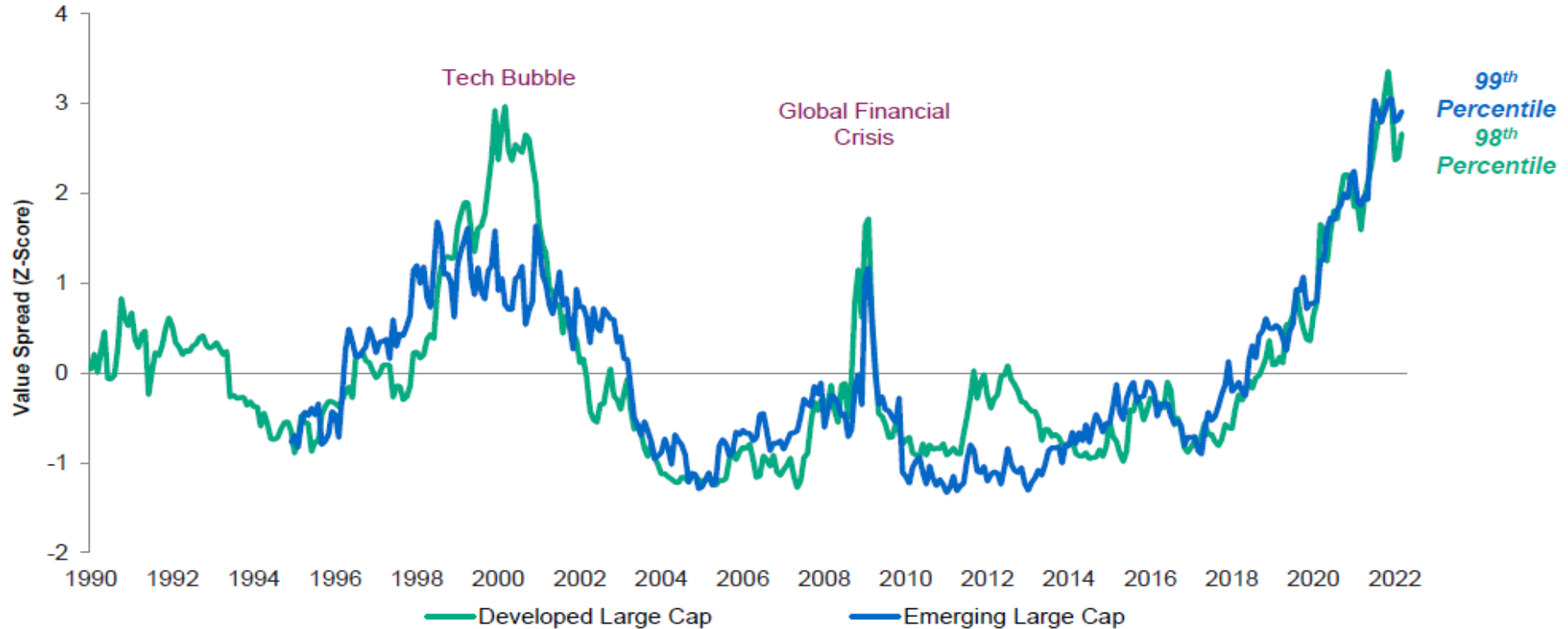
- Matt Lacy, Portfolio Integration Director
- Kristina Koutrakos, Portfolio Strategy Director
- Ross Kasarda, Risk Director
- Katie Grawe, Portfolio Manager

*Moderated by Chung Ma
Managing Director, Portfolio Solutions Group*

Factor Spreads are Attractive

Value Spreads for Hypothetical AQR Industry-and-Dollar-Neutral Value Portfolios*

January 1, 1990 – March 31, 2022



*Spreads are constructed using the Hypothetical AQR Value portfolio as described below, and are adjusted to be dollar-neutral, but not necessarily beta-neutral through time.

Source: AQR. Hypothetical value composite includes five value measures: book-to-price, earnings-to-price, forecast earnings-to-price, sales-to-enterprise value, and cash flow-to-enterprise value; spreads are measured based on ratios. To construct industry-neutrality, the value spreads are constructed by comparing the aforementioned value measures within each industry, which are then aggregated up to represent an entire portfolio. Hypothetical data has inherent limitations, some of which are disclosed in the Appendix. Please see the Hypothetical AQR Developed and Emerging Markets Valuation Theme Model Descriptions in the Appendix. For illustrative purposes only and not representative of an actual portfolio AQR currently manages. Please read the Appendix for important disclosures.

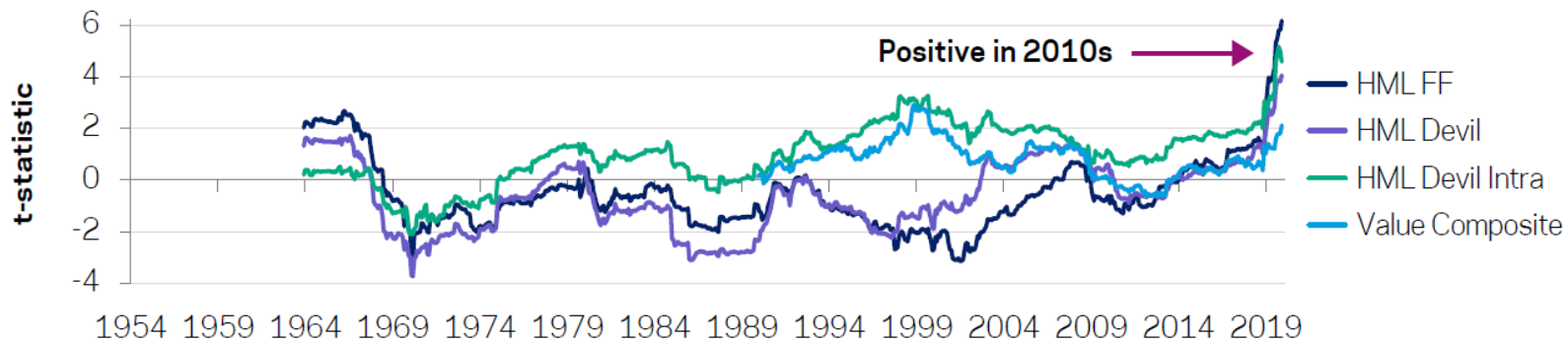


Exhibit 2: Time variation in contemporaneous rates sensitivities

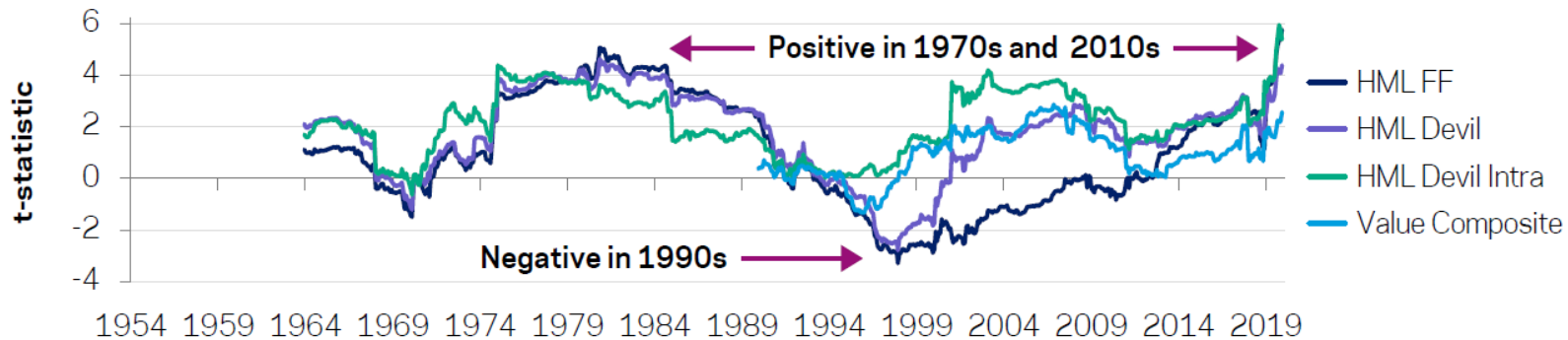
Regressions are based on monthly data and each includes two RHS variables: the market as a control variable (t-statistic not shown) and one rates variable. The LHS value factor variants are described in the text.

Panel A: U.S. Factors 1954 - 2019

i. Sensitivity to 10-Year Yield Changes (rolling 10-year t-statistics)



ii. Sensitivity to Yield Curve Slope Changes (rolling 10-year t-statistics)





Virginia
Retirement
System

Notes

Break: 2:15 – 3:00 p.m.



The background image shows a white coffee cup and saucer with a silver spoon. The cup is filled with a light-colored liquid. The saucer is white and has a silver spoon resting on it. The entire scene is set against a background of a document with a financial table and a pen. The table contains numerical data and labels for various investment funds. The pen is a dark red or maroon color and is positioned diagonally across the bottom right of the image.

Label	Value 1	Value 2	Value 3	Value 4
Income A	104.22			
Income R	102.95			
Balanced A				
Global Balanced R				
Global Equity FF A				
Global Equity FF B				
Growth A				
Growth A1				
Growth R				
Inflation Baseline A				
Global Balanced FF A				

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Guest Speaker:

China's Impact on the Global Economy & Geo-political Landscape

Melissa J. Ma

Co-Founder & Managing Partner,
Asia Alternatives Management, LLC

Melissa J. Ma ● Co-Founder & Managing Partner

Asia Alternatives Management, LLC



Melissa J. Ma is a Co-Founder and Managing Partner of Asia Alternatives. She splits her time between Asia Alternatives' Hong Kong and San Francisco offices. Ms. Ma is on the Firm's Investment Committee and co-leads Asia Alternatives' investments in buyout and direct co-investments. In addition, she oversees investor relations, asset allocation and investment strategy and process.

Prior to launching Asia Alternatives, Ms. Ma was a Director at H&F, a San Francisco-based private equity firm. She was involved with sourcing and monitoring H&F's investments in financial and professional services. She helped manage H&F's relationships with its investors and had a leading role in its fundraising activities.

Previously, Ms. Ma worked at McKinsey & Co., Inc. in the Hong Kong and San Francisco offices. From 1995-2000, she worked in the Hong Kong office of McKinsey in the Corporate Finance Practice and the Financial Institutions Practice. Ms. Ma was also a Financial Analyst in the Financial Institutions Group in the Investment Banking Division at Goldman, Sachs & Co.

Ms. Ma received an M.B.A. from Harvard Business School and holds an A.B. in Economics and East Asian Studies, magna cum laude, from Harvard College. She is proficient in Mandarin Chinese.

Ms. Ma currently sits on a number of Advisory Boards for several of Asia Alternatives' private equity and special situations funds. In addition, she serves on the Boards of the CAIA Association, Burke's School, One Sky (formerly Half the Sky), San Francisco Zoo and Harvard Alumni Association. She serves as a Co-Chair for the Harvard College Fund Executive Committee. She is also on the Advisory Board for the Asia Society (Northern California) and is a member of the Young Presidents Organization (YPO) Gold, the Council on Foreign Relations and the National Committee on United States-China Relations.



China:
Pragmatism over Ideology

Presentation to
Virginia Retirement System

May 25, 2022

External

Short term

Russia-Ukraine War

Longer term

US-China Relations and Accelerated Global Polarization

“The Perfect Storm”

- **Stock market volatility:** For first four months of 2022, HSI down ~10%, CSI 300 down ~19% and Hang Seng Tech Index down ~25%, compared to Nasdaq down ~21% and S&P down 13%*
- **Downward GDP forecast:** Analyst estimates for China full year 2022 GDP at 4-5%, below government target of 5.5% for 2022. Q2 2022 basically a write off
- **Social outcry and supply chain disruption over Covid-19 lockdowns:** As of end of April, over 350 mil Chinese in partial or full lockdown, across 44 cities, representing ~25% of population and ~38% of GDP

Domestic

Short term

Omicron and Zero-Covid Policy (ZCP)

Longer term

Transition to Common Prosperity

* As of April 29, 2022

Hang Seng Tech Index

— Hang Seng Tech Index – Last Price

— Hang Seng Tech Index – Volume

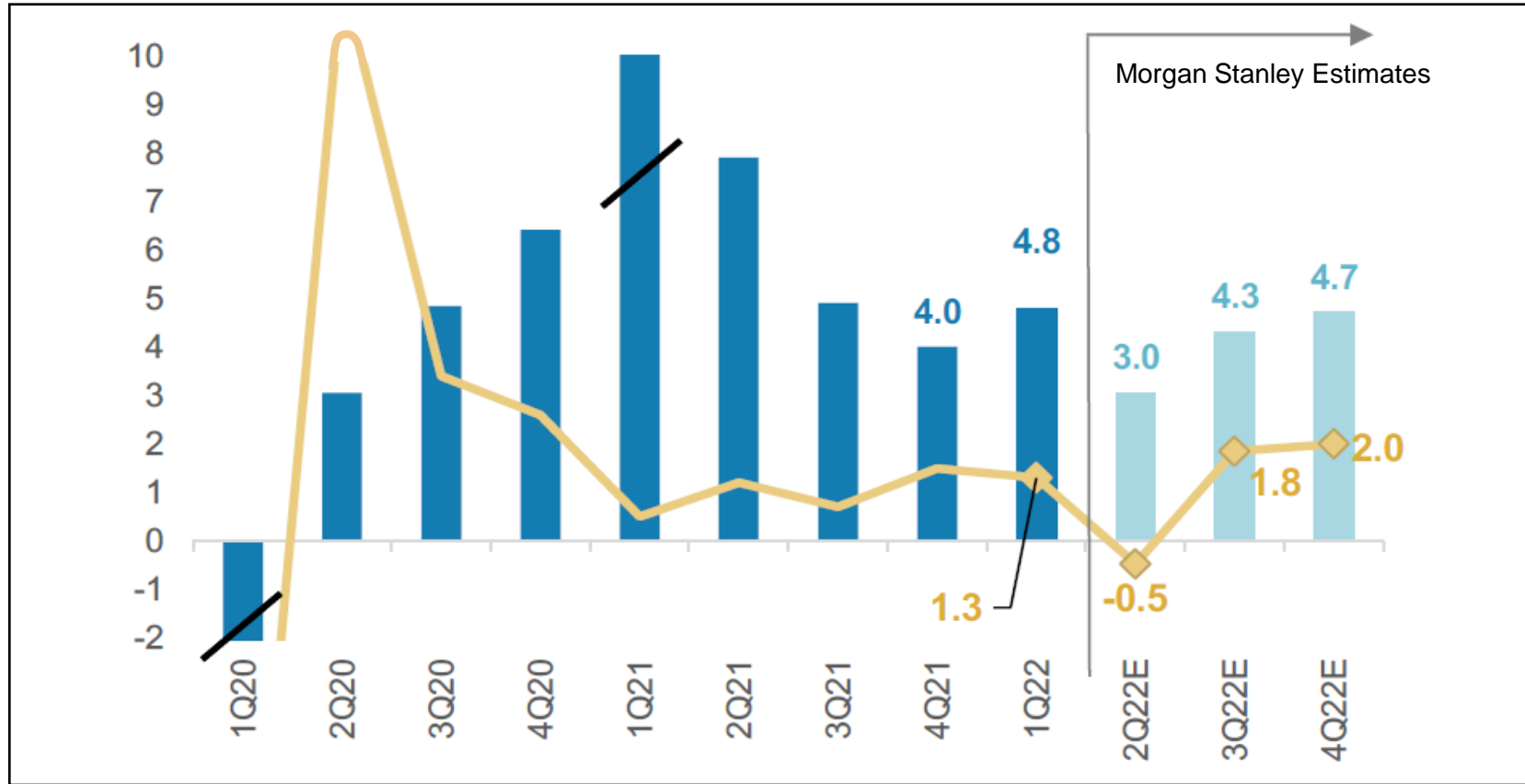


Hang Seng Tech Index has risen close to breaking a trendline resistance

China's GDP Growth Outlook

GDP Growth

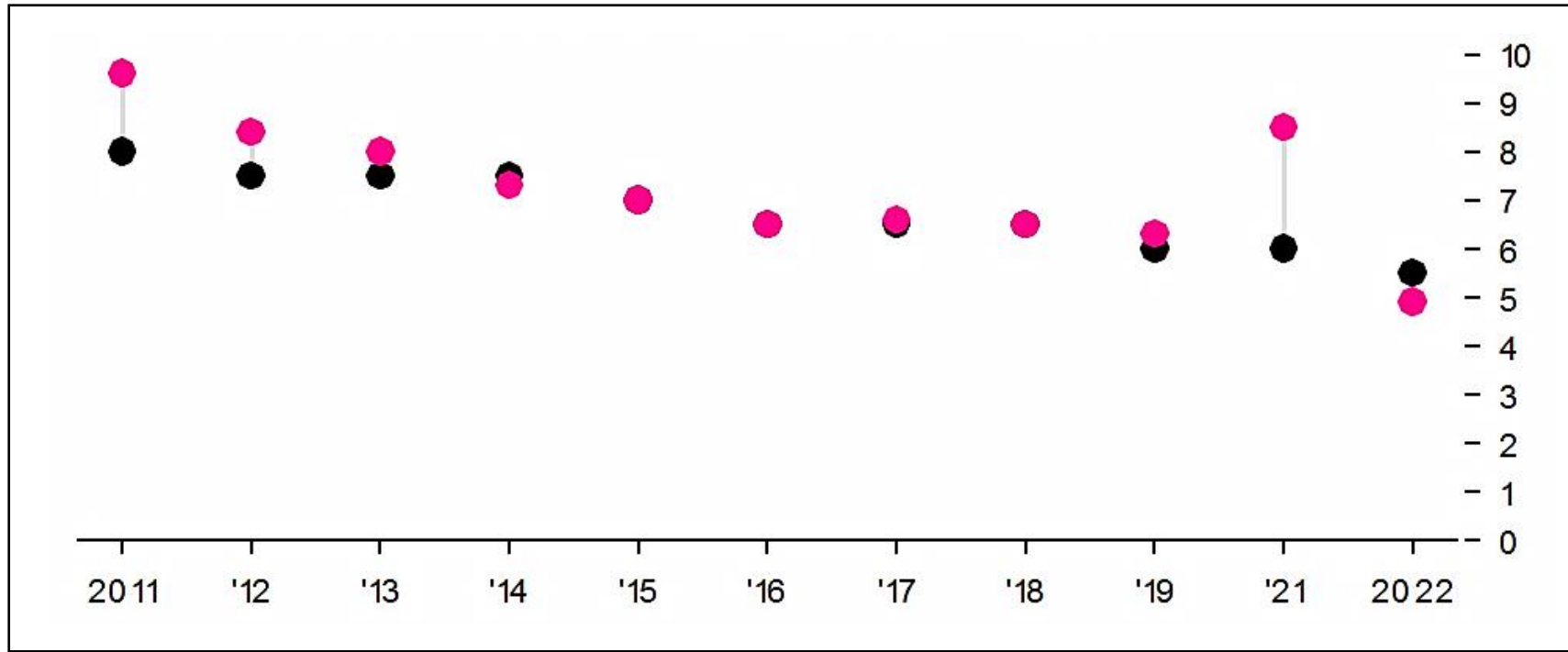
YoY% QoQ SA



Growth recovery remains back-loaded, though risks less skewed to the downside now

China GDP Targets

- Official target
- Median economist forecast in April of each year



Economists forecast China growth below target for the first time since 2014

Note: No official target was given in 2020. If official target given as a range, middle of the range is used
Source: Bloomberg surveys, China National People's Congress documents

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Domestic

Short term

Omicron and Zero-Covid Policy (ZCP)

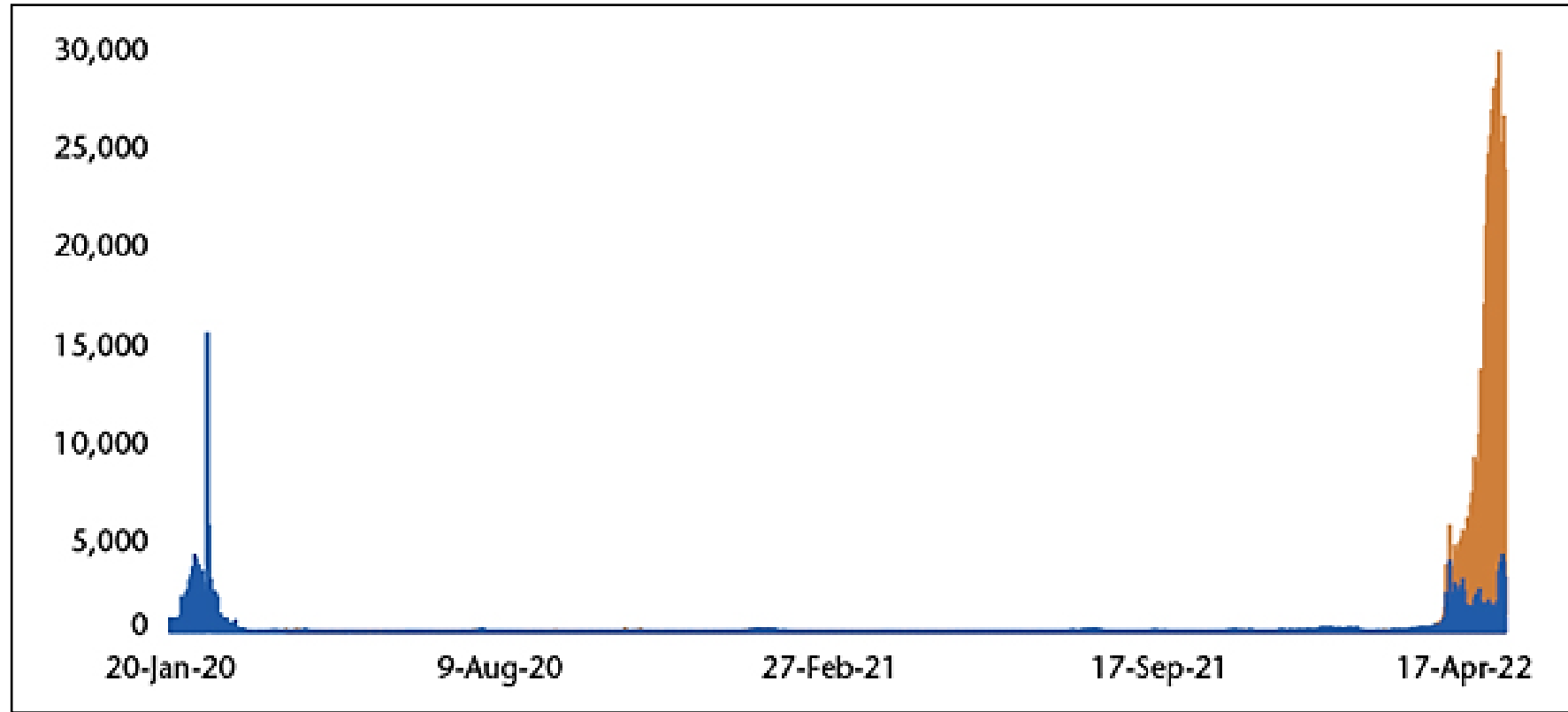
Longer term

Transition to Common Prosperity

* As of April 29, 2022

Omicron Challenges China's Zero-Covid Policy

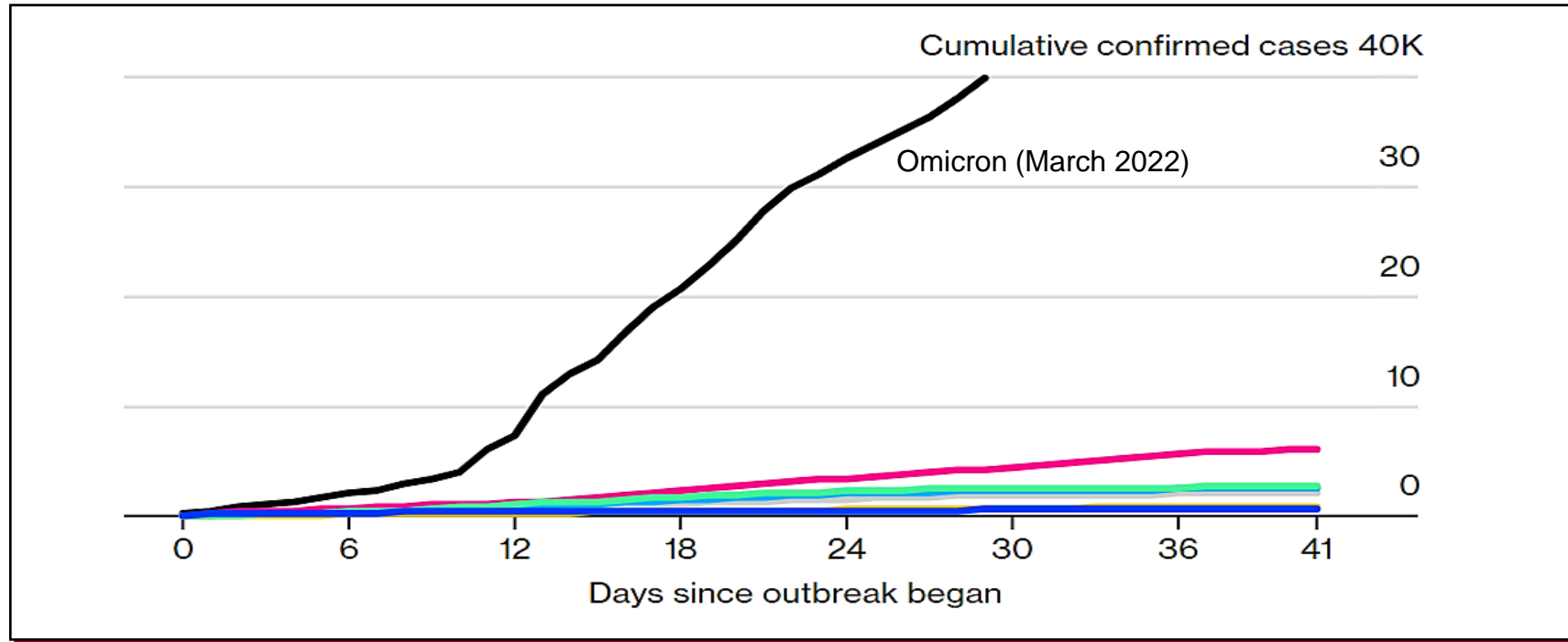
China's Covid Cases Number of official cases



This is China's first "real" Covid-19 mass outbreak experience

Covid-19 Cases by Outbreak

- Omicron (March 2022)
- Xi'an (Dec. 2021)
- Inner Mongolia (Oct. 2021)
- Nanjing (July 2021)
- Guangzhou (May 2021)
- Shijiazhuang-Jilin (Jan. 2021)
- Beijing (June 2020)



China is in the midst of its worst outbreak since the start of the pandemic

Source: Bloomberg

Shanghai (April-May 2022)

- 25 million city population
- Strict full-city lockdown since 4/1, with no official announcement on end date (some residential areas in SH have been under lockdown for nearly two months)
- Daily new cases peaked around 25K in mid-April and declined to 4-5K in early May
- Nearly 600K cases and 504 death tolls in total reported. 90%+ of reported cases are asymptomatic
- SH residents also suffered from shortage of food and medical supply due to poor city management

Committed to “Dynamic” Zero-Covid Policy (ZCP)

“Dynamic Covid-Zero doesn't mean pursuing zero infections, but rather stamping out any outbreak within a short period of time.

Many said dynamic zero would affect the economy, but actually only dynamic zero can safely guard the economic development to the greatest extent”

– *Zunyou Wu, Chief Epidemiologist, Chinese Center for Disease Control and Prevention*

Shenzhen (March 2022)

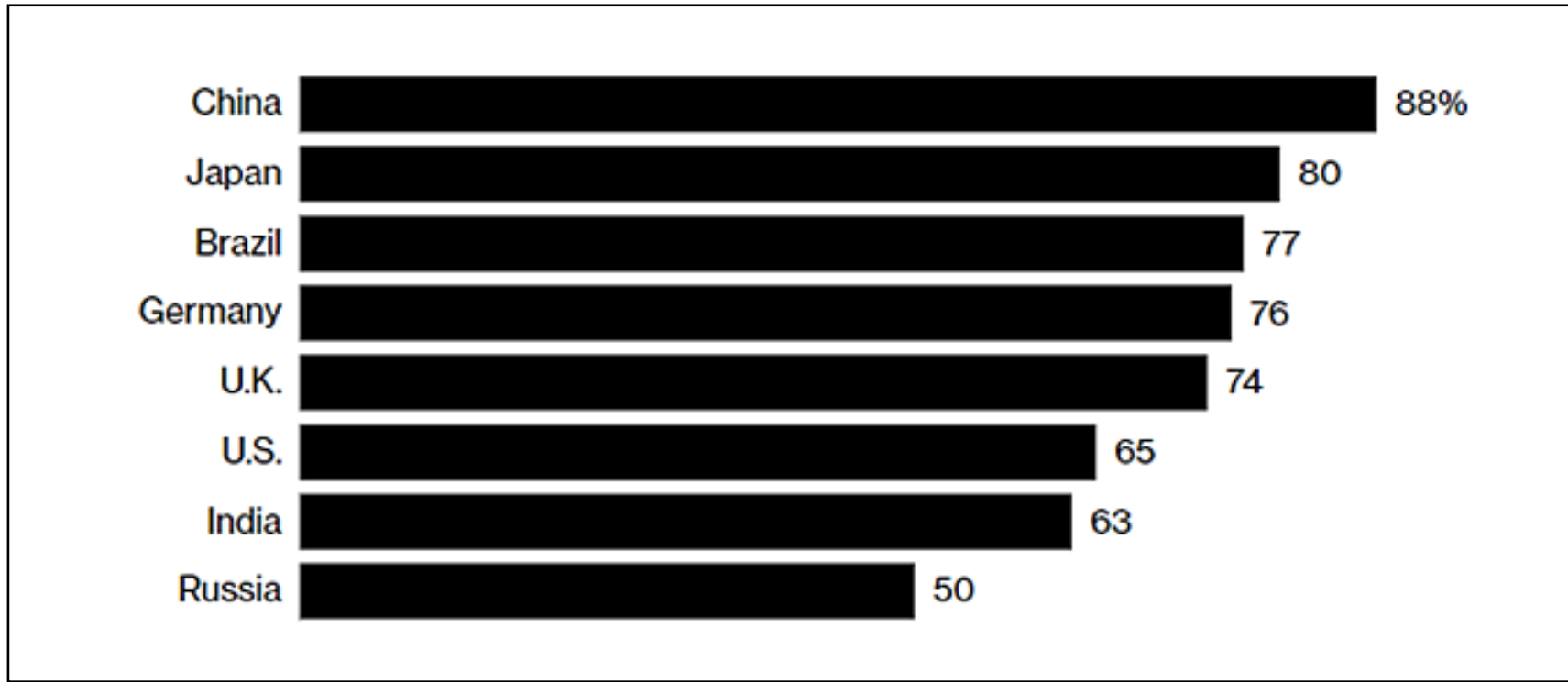
- 17 million city population
- One-week full-city lockdown at early outbreak (3/14-20)
- Daily new cases peaked around 100
- Managed to achieve zero COVID within one month

Beijing (April-May 2022)

- 22 million city population
- No full-city lockdown yet
- Aim to control COVID at early stage through measures, like mass testing, strict quarantine in some districts, etc.
- Daily new cases have been kept under 100

~90% of China's population is fully vaccinated ...

Share of population fully vaccinated against Covid-19
Percent as of April 24, 2022



China has one of the highest vaccination rates (two jabs) globally

Source: Bloomberg

Current Vaccine Status

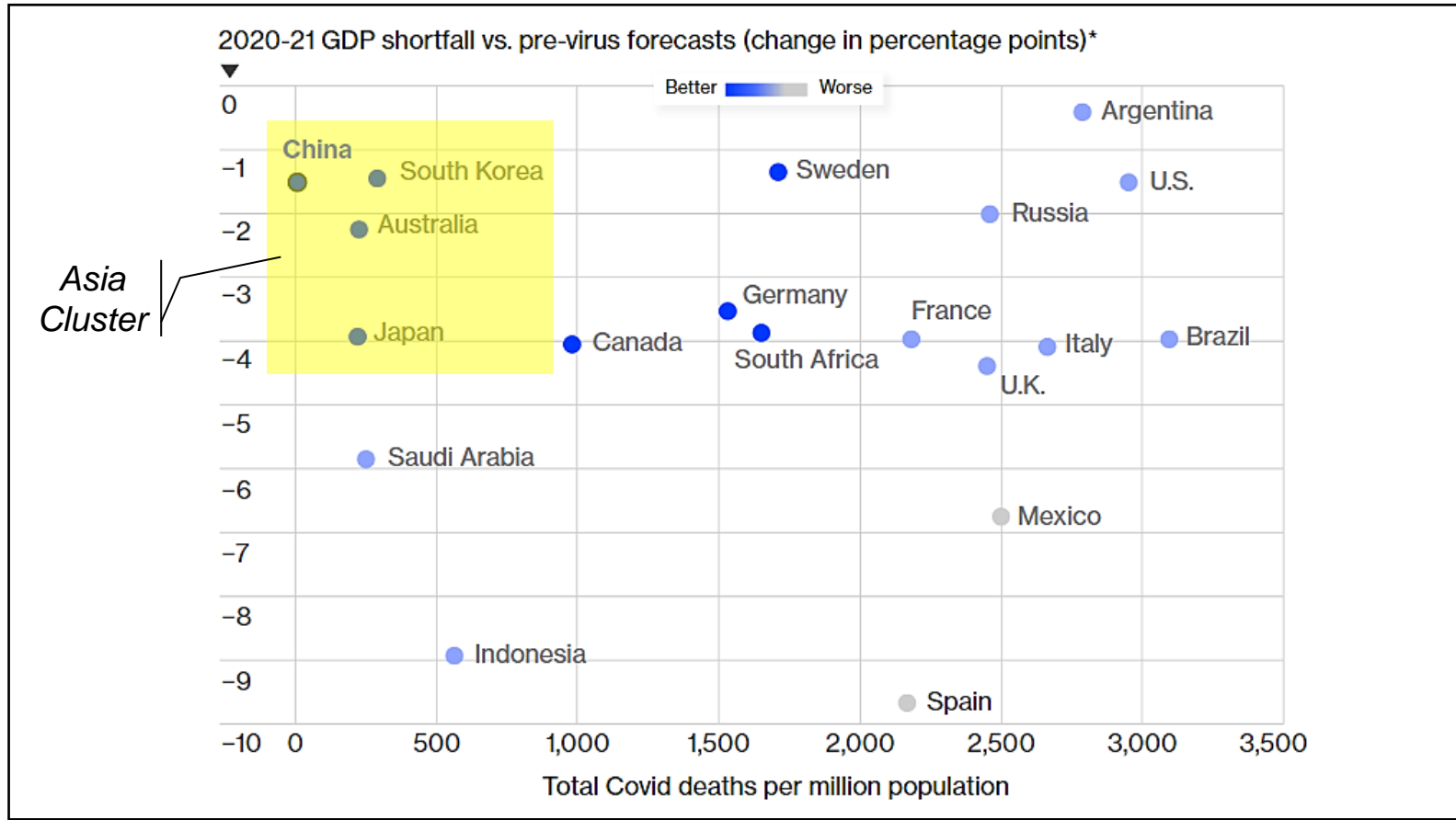
- **China has one of the highest vaccination rates globally, yet vaccination rate among the elderly is low**
 - ~88% of Chinese population received two doses of domestic vaccines; while among people aged 80 and over, only 51% received two jabs
 - Booster (three jabs) rate for the elderly: China 20%, Japan 88%, S. Korea 83%, France 80%, Taiwan 72%, US 70%
- **Most widely used vaccines in China are domestic inactivated vaccines, which have low efficacy** – For people over 60, two jabs of CoronaVac vaccine is only 77% effective in preventing death vs. 92% for two jabs of the Pfizer vaccine (University of HK study)
- **China hasn't approved any domestic or foreign mRNA vaccine yet, partly due to political reasons**
 - Domestic mRNA vaccines can't adapt to variants as well as the Pfizer-BioNTech / Moderna ones
 - In Dec 2020, BioNTech and Shanghai Fosun announced an agreement to provide China with 100 million doses of the mRNA vaccine, but it's still "subject to regulatory approval"

What China needs to do to exit ZCP

- **Accelerate vaccination and booster shot rate in the elderly**
- **Approve mRNA vaccine**
- **Expand covid toolkit (e.g. testing, covid pills, etc.)**
- **Perform pilot schemes in cities to test out a more flexible containment strategy (e.g. shortening quarantine and hospitalization period)**
- **Move to more 'dynamic' ZCP, then to "live with covid policy"**

Zero-Covid Policy has been very good for China so far

Global Comparison of GDP Shortfall vs. Covid-19 Deaths



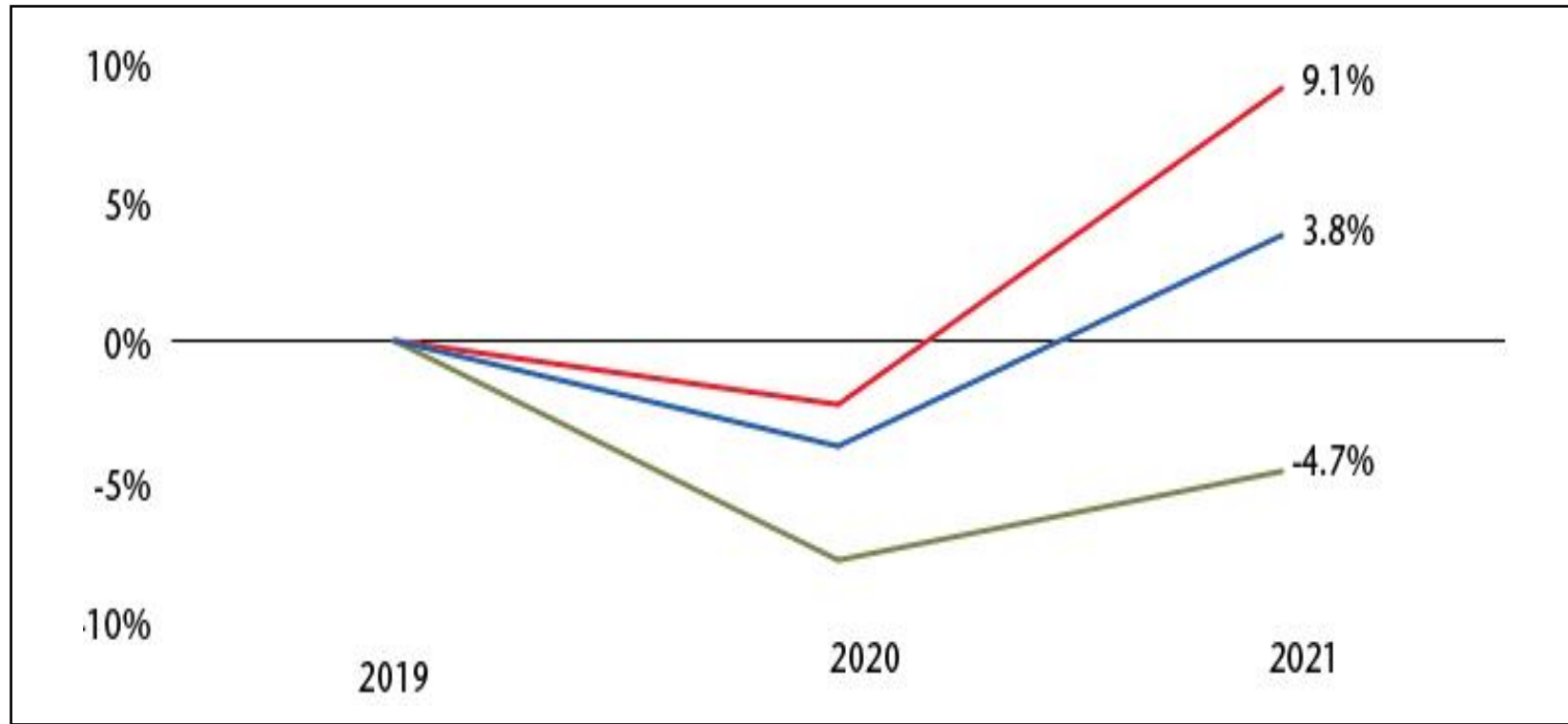
On health and growth, China's performance in the Pandemic has been better than most other countries

*Cumulative annual GDP growth in 2020 and 2021 compared with December 31, 2019
Source: Bloomberg

Strong Consumption in China during Pandemic

Real private consumption growth
In % of 2019 level

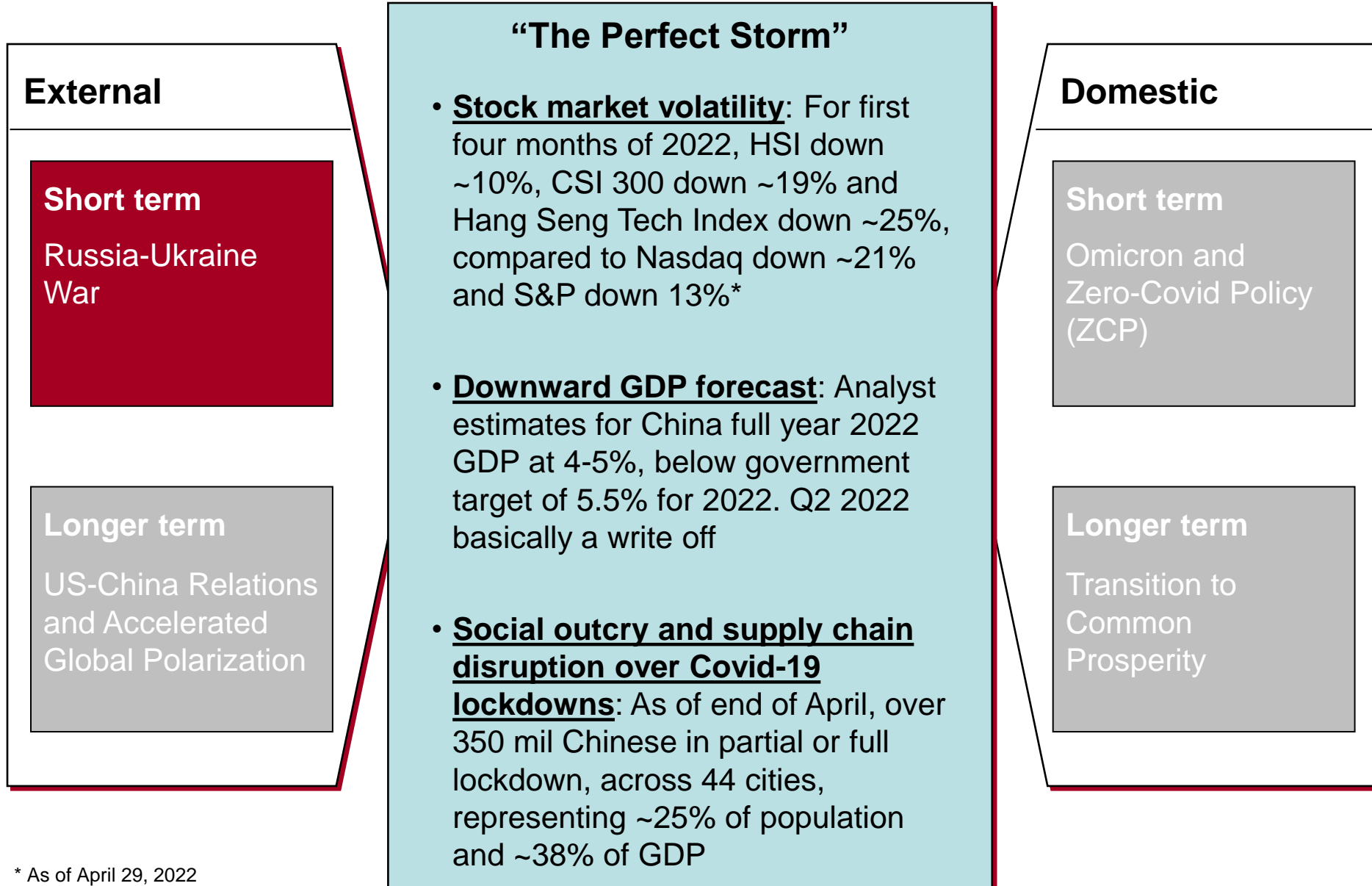
— US
— Euro Area
— China



Prior to lockdowns, strong consumption recovery in China

Scenario	Details	Direct Health Cost (deaths/million population /day)	GDP Growth (2022, YoY%)****
Dynamic Clearing	Testing and local lockdowns to keep infections near zero	~0*	5.0%
Gradual Opening	Advanced vaccines, boosters, and treatment to minimize serious cases	~0.75 - 5.2**	5.0%
National Lockdown	Widespread outbreak requires national lockdown to maintain zero-Covid	~0*	1.6%
Out of Control Virus	Virus eludes even national lockdown and runs out of control	~37.4***	3%

*Not captured in the numbers – a cost in missed treatments for other diseases and deteriorating mental health
 **Range for deaths per million population per day for countries with effective vaccines suffering an omicron wave
 ***Based on the experience in Hong Kong
 ****Bloomberg Economics' estimates
 Source: Bloomberg



* As of April 29, 2022

China's Stance on Russia/Ukraine*

- China had no prior knowledge of Russia's military action nor provided military assistance to Russia
- China does not benefit from the conflict given its trade interests in the region and its status as the largest oil and natural gas importer globally
- China is fully supportive of a "peaceful settlement", and its position is "objective and impartial." "The priority now is to achieve a cease-fire to protect civilians."

Jake Sullivan (US National Security Advisor) "indicated that so far he had seen no evidence that China was stepping in to help Mr. Putin with either military or financial aid." (*New York Times*, April 14, 2022)

How long and how far can China maintain neutrality?

Foreign Minister Wang Yi said "China is not a party to the crisis, nor does it want the sanctions to affect China." (*Bloomberg*, 3/15/21)

Foreign Minister Wang Yi said "China always opposes the use of sanctions to solve problems, and even more opposes unilateral sanctions that have no basis in international law, which will undermine international rules and bring harm to the people's livelihood of all countries." (*Bloomberg*, 3/15/21)

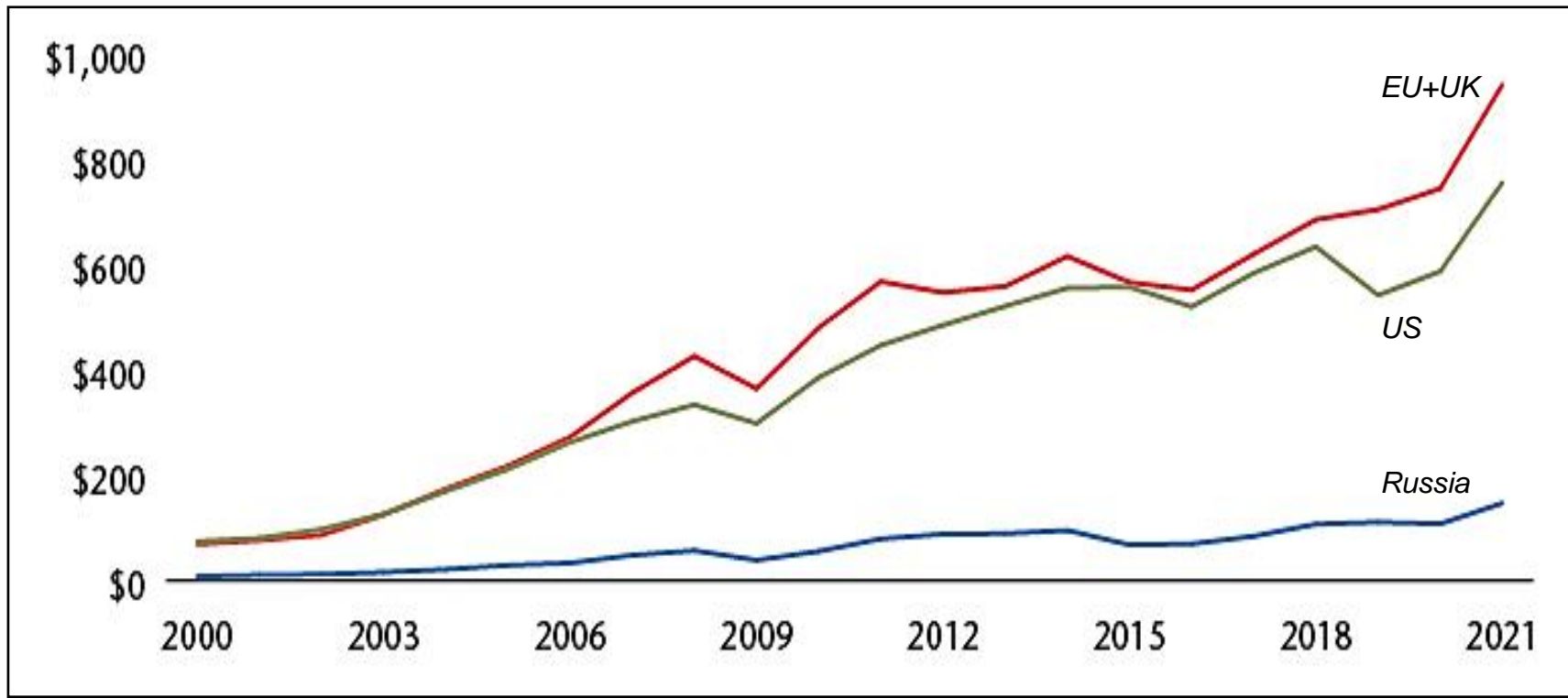
"An important takeaway from the success of China-Russia relations is that the two sides rise above the model of military and political alliance in the Cold War era," Foreign Ministry spokesman Zhao Lijian said, adding that they "commit themselves to developing a new model of international relations." That model involved not causing confrontations or targeting other nations, (*Bloomberg*, 3/29/22)

*Washington Post, March 15, 2022, from China's Ambassador to US

China's Trade Much More Dependent on US, EU, UK

China's trade with the US, Russia, and EU+UK
\$ billion

- China's trade with Russia
- China's trade with the US
- China's trade with EU+UK

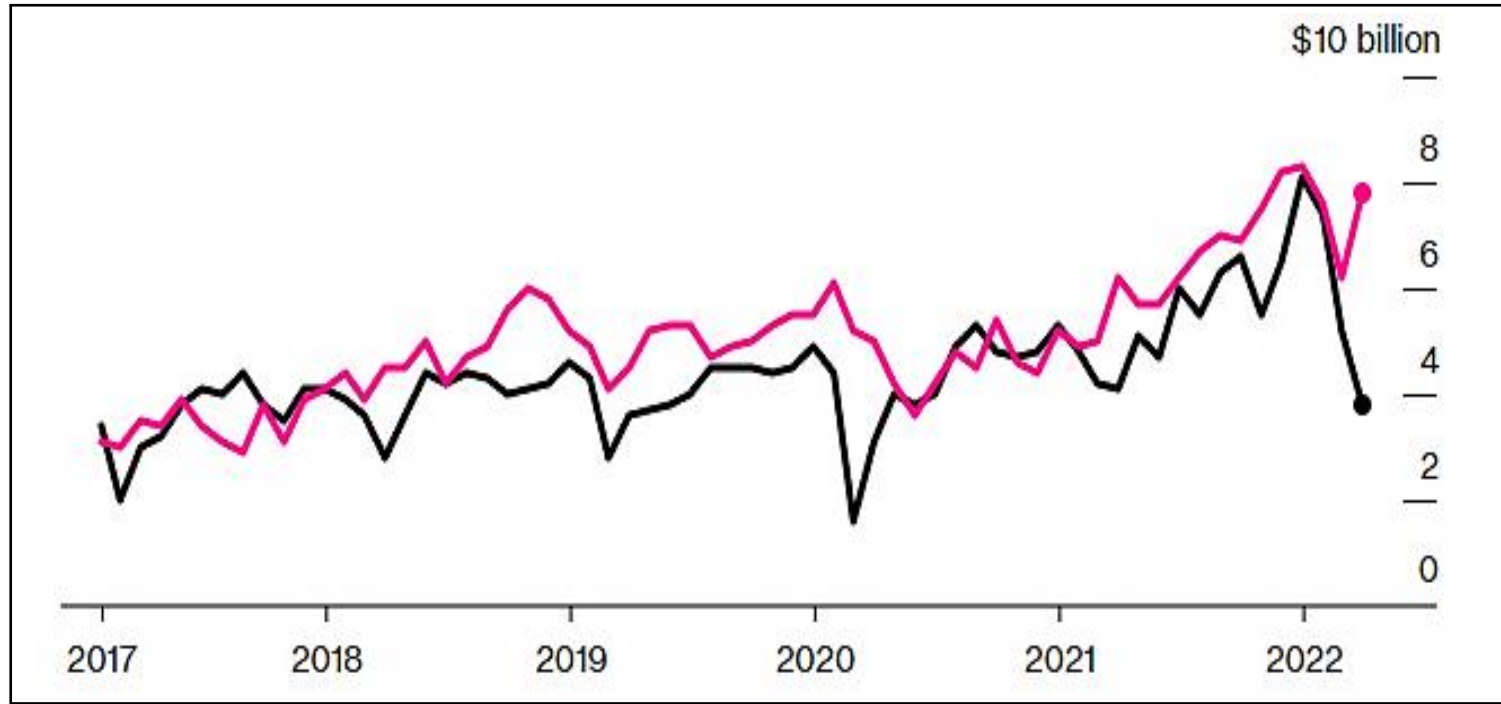


China's trade with Russia is immaterial compared to that with the EU, UK and US

China exports to Russia sharply decline

China-Russia Exports
\$ billion

— Chinese exports to Russia
— Chinese imports from Russia



Chinese exports to Russia drop to lowest since mid-2020 after invasion.

Commerce Secretary Gina Raimondo said there was no evidence that any Chinese companies have or were planning to help Moscow get around American restrictions

External

Short term

Russia-Ukraine War

Longer term

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Domestic

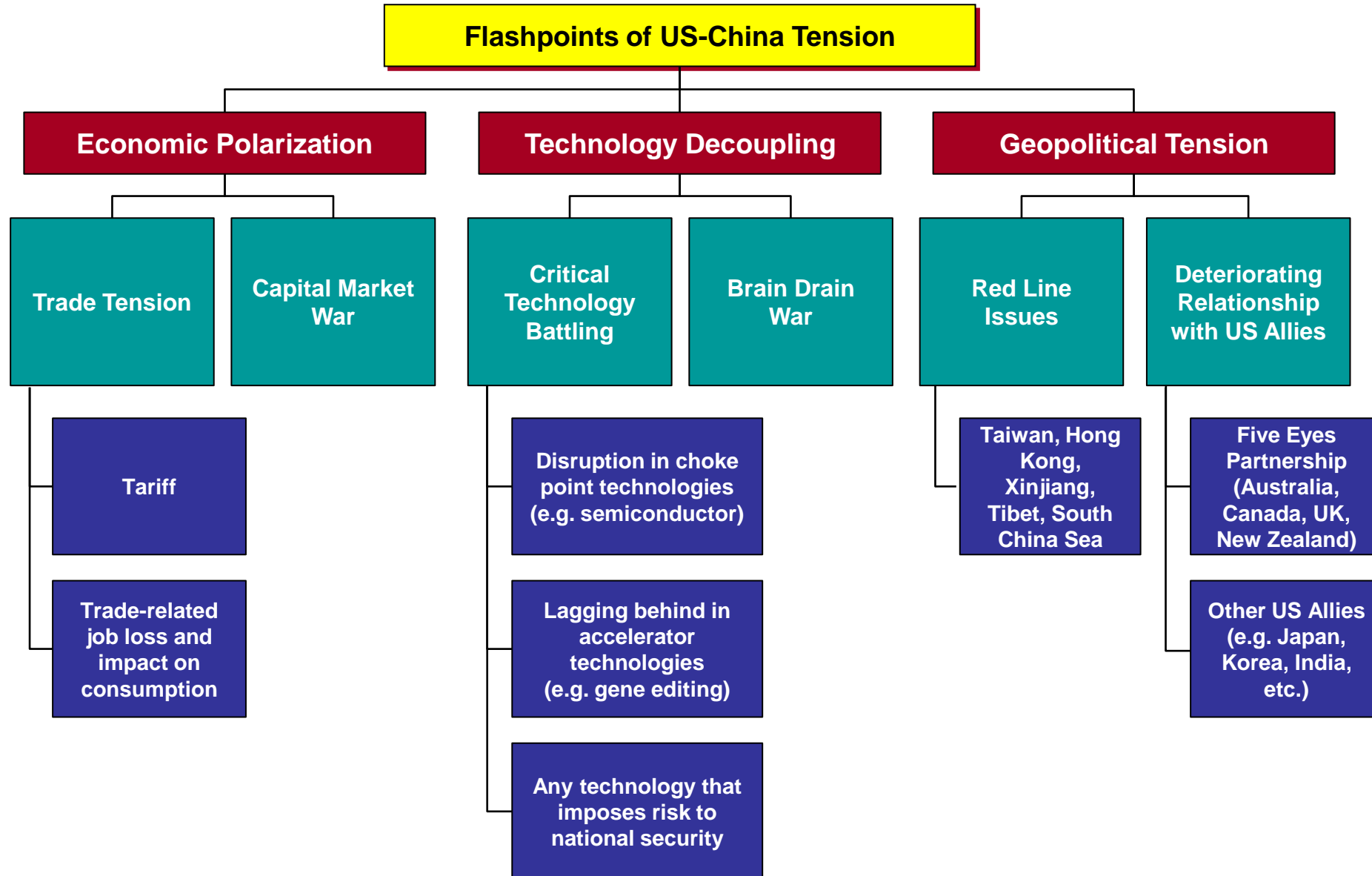
Short term

Omicron and Zero-Covid Policy (ZCP)

Longer term

Transition to Common Prosperity

* As of April 29, 2022



Holding Foreign Companies Accountable Act (HFCAA) (December 2020)

- HFCAA was signed into law by former US President Trump in December 2020
- HFCAA requires the US SEC to prohibit the trading of foreign securities from the US exchanges if the Public Company Accounting Oversight Board (PCAOB) is unable to inspect such companies' public accounting firms for three consecutive years
- HFCAA also requires such companies to make certain disclosures about their ownership by governmental entities and their relationships with the ruling political party in China

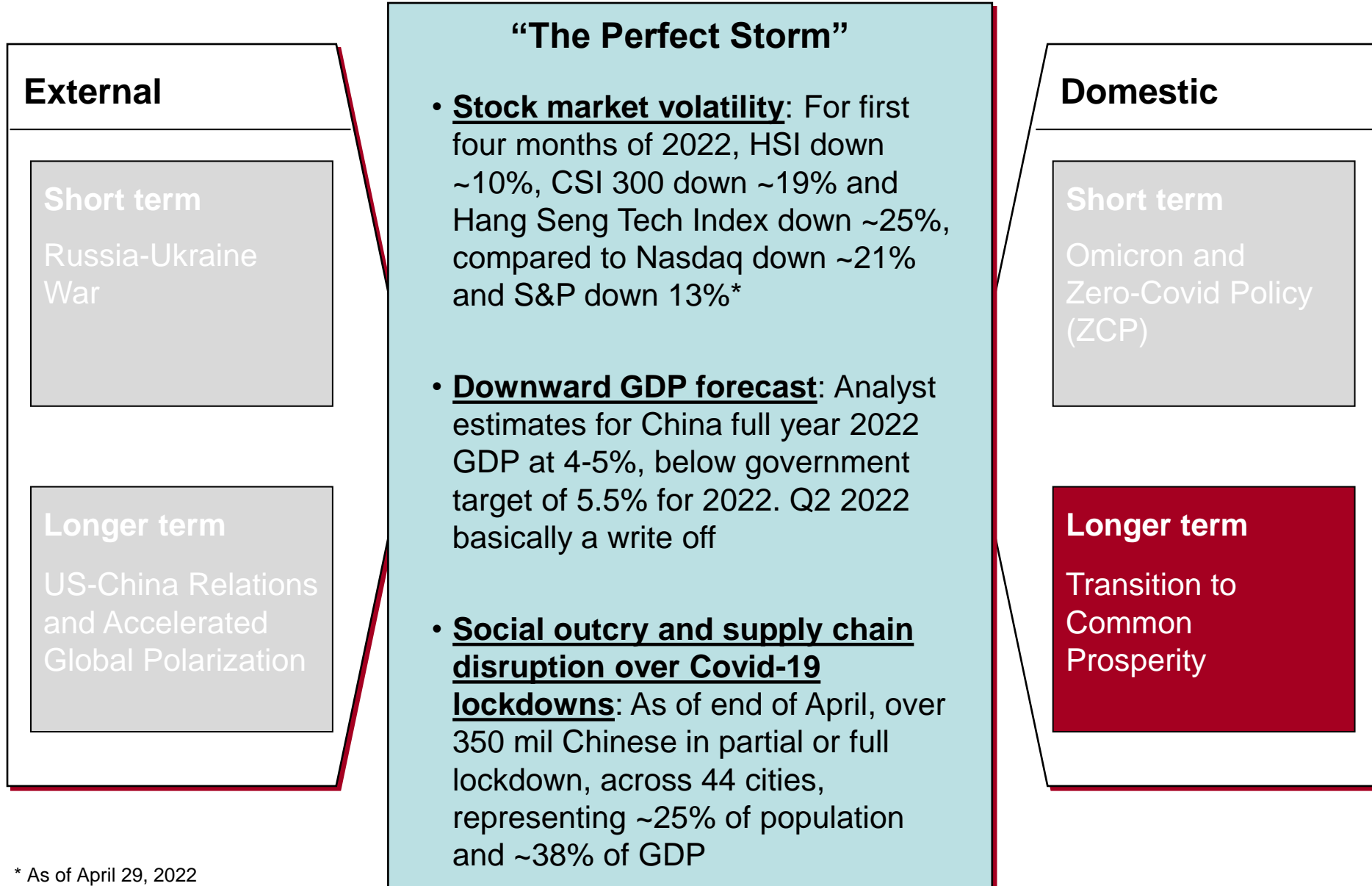
Current Status

- As of May 4, 2022, 23 Chinese companies were identified by US SEC on the Conclusive List* of potential delisting and another 105 were on the Provisional List* under the HFCAA
- Beijing has recently signaled willingness to accept the same PCAOB inspection process that has been in place in 25 other countries
- Beijing has been in discussion with the US regulators the logistics of allowing on-site audit inspections of US-listed Chinese companies. On-site inspections would kick off the process of allowing US inspectors to get the full access to audit papers required by HFCAA

China's willingness to compromise shows evidence of embracing pragmatism to keep the US market open to its issuers

*The US SEC will first identify a non-compliant company on the Provisional List. Such company will not be a Commission-Identified Issuer until it is put on the Conclusive List by the SEC. An initial trading prohibition will not be imposed until an issuer has been a Commission-Identifier Issuer for three consecutive years

Source: US SEC, Bloomberg, DavisPolk



* As of April 29, 2022

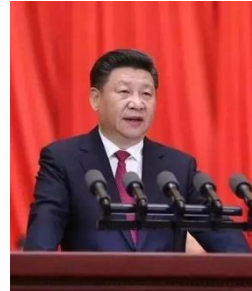
China's Historical Turning Point: from "Partial Prosperity" to "Common Prosperity"

China has pursued a progressive policy direction towards "Common Prosperity"



"Let some people in some areas get rich first, lead and help other regions and people, and gradually achieve common prosperity"

Oct 1983



President Xi mentioned the theme of "taking the road of common prosperity" in his inauguration speech

Nov 2012
18th Party Congress

Emphasized that China's socialism has entered "a new era of realizing common prosperity for all the Chinese", signifying the goal to significantly increase the proportion of middle class by 2035 and achieve "common prosperity" by 2050

Oct 2017
19th Party Congress

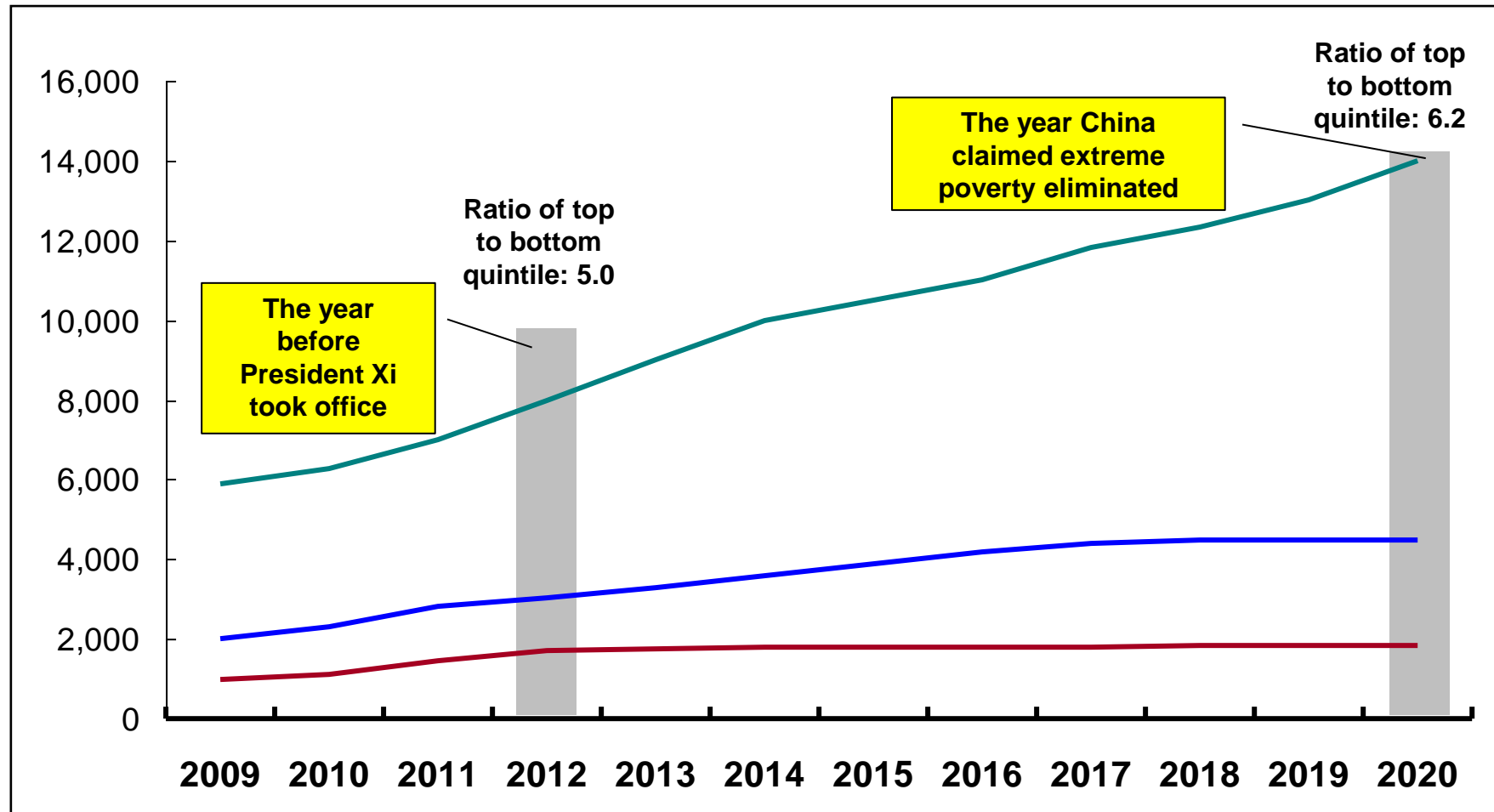
President Xi mentioned "achieving well-rounded human development and common prosperity for all" in his speech

Jul 2021
CCP 100th Anniversary

“Common Prosperity” becomes a priority due to widening income gap

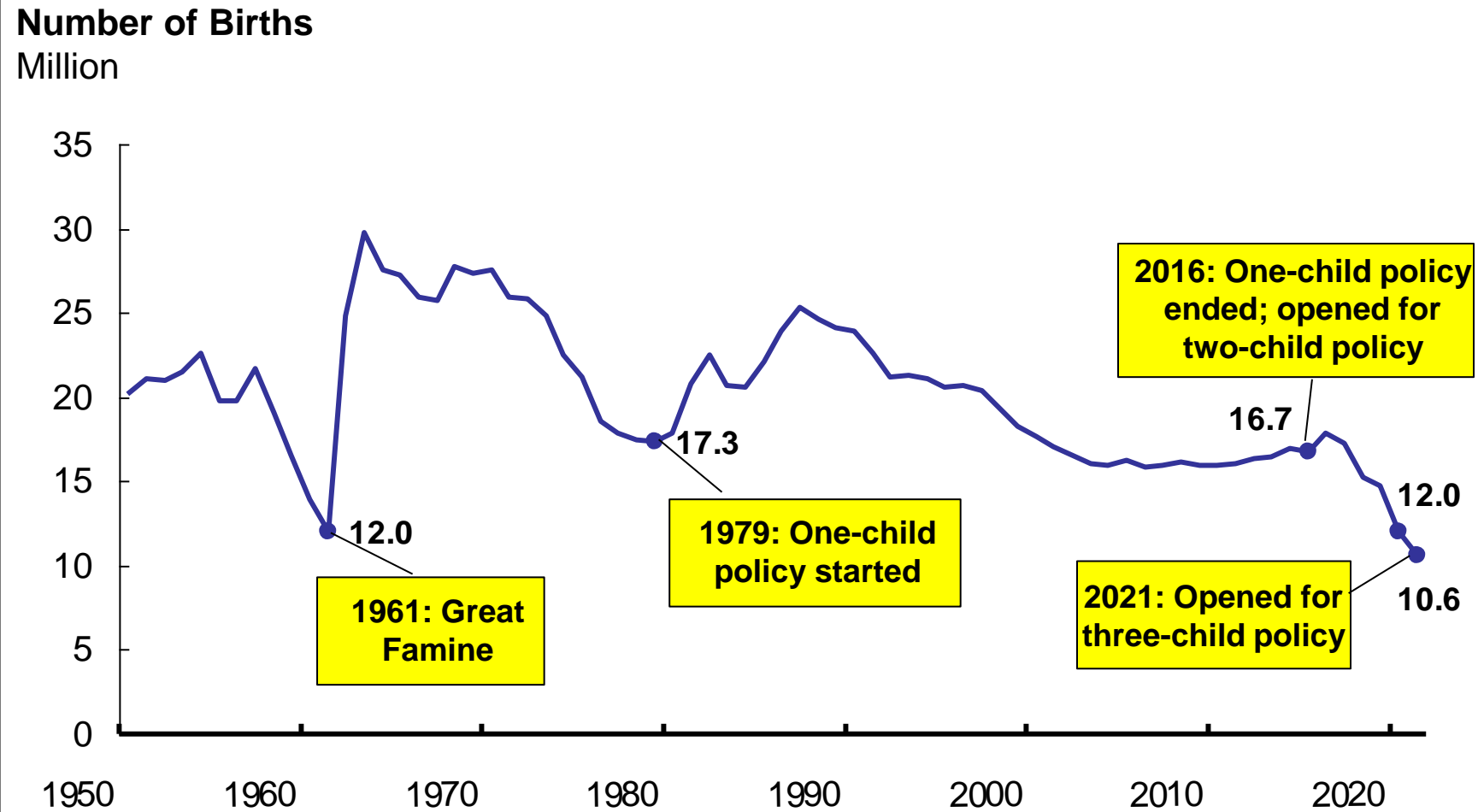
Urban Disposable Income \$

— Top Quintile
— Middle Quintile
— Bottom Quintile



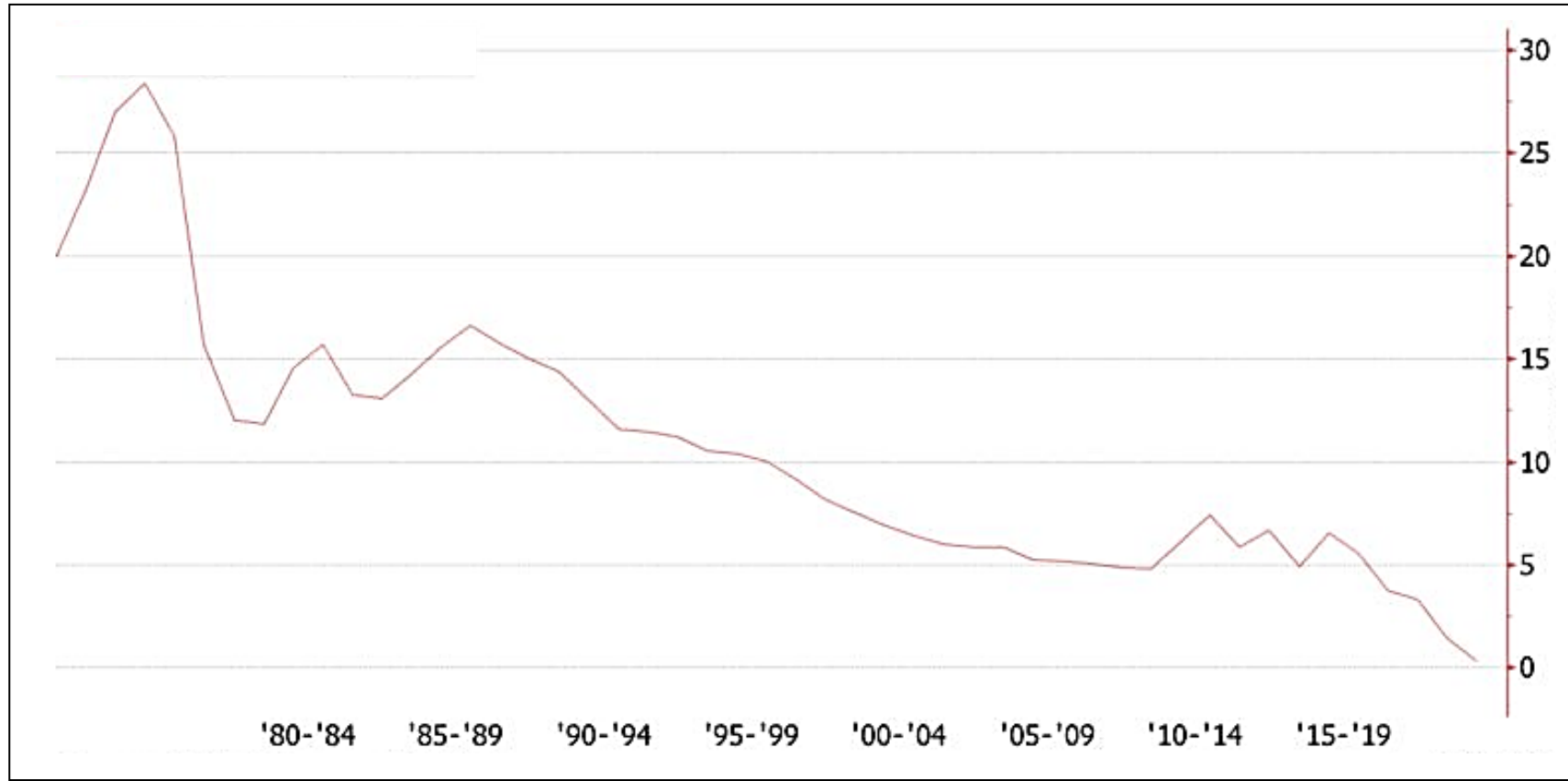
“Common Prosperity” becomes a priority due to declining birth rate

Number of births in China in 2021 fell to the lowest since the founding of PRC



China's Demographic Challenge

Population growth rate (per 1000)



China has effectively stopped growing its population

Xi called for “Dual Circulation” to drive long-term growth

The “Dual Circulation” growth model relies on “Domestic Circulation” (boosting domestic output), while “External Circulation” (foreign direct investment and stabilizing trade) is equally important. China will continue to reform and open up in the “Dual Circulation” model

Asia Alternatives’ Assessments about Xi’s Guidance

Key Points	Domestic Circulation – Boost domestic demand	Domestic Circulation – Accelerate supply-side upgrade	External Circulation – Continue reform and opening up
Key Pathways	<ul style="list-style-type: none"> Promote consumption growth/upgrade through optimizing income distribution system and increasing investment in education, employment, medical care and pensions Accelerate urbanization 2.0 development with a focus on developing super city clusters 	<ul style="list-style-type: none"> Promote “technology independence” with a focus on tackling the bottleneck in critical technologies (e.g. chips and semiconductors) Improve potential economic productivity through factor market reform (land, labor, capital, technology and data) Accelerate investment in “new infrastructure*” to promote industrial upgrade 	<ul style="list-style-type: none"> Domestically, continue market liberalization through optimizing business environment, SOE reforms, leveling the playfield for private and foreign players, strengthening IP protection Deepen international relationship with “Belt and Road”, European Union, East Asia and ASEAN countries

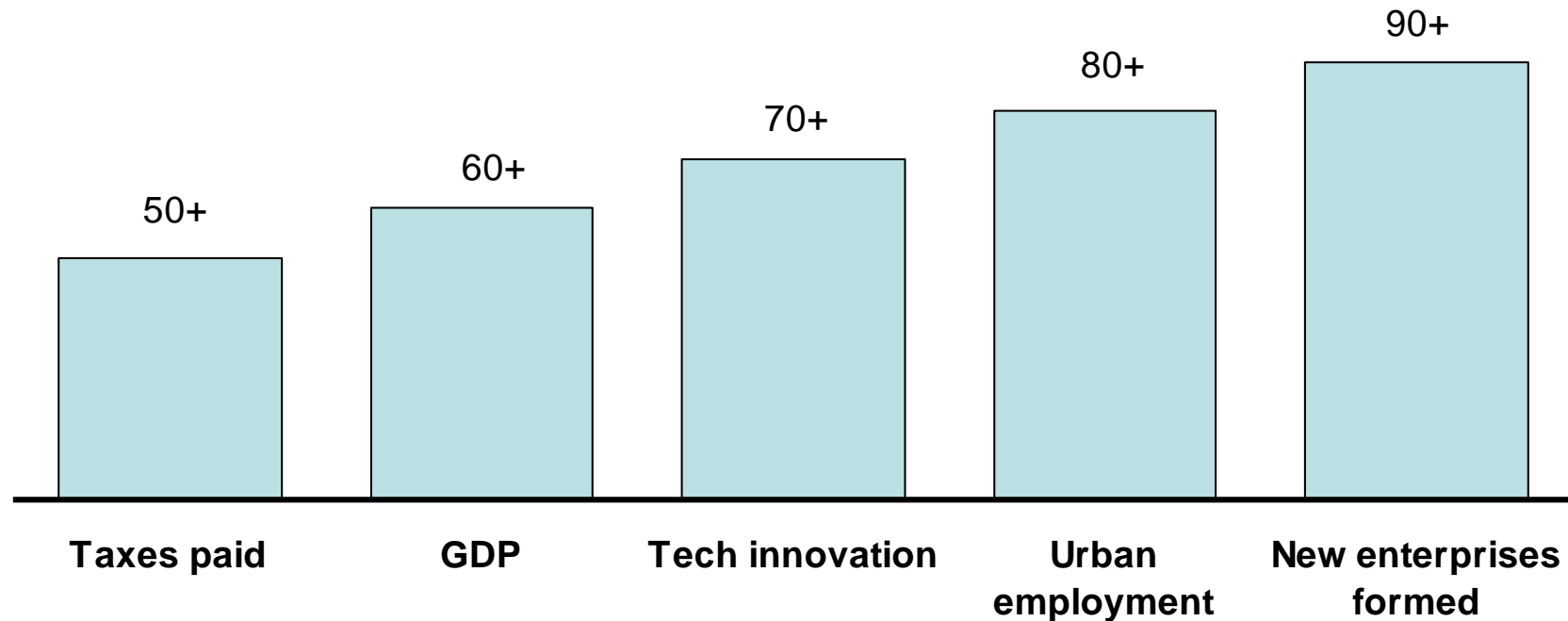
*New infrastructure includes 5G base stations, Industrial Internet of Things (IIoT), artificial intelligence and data centers, ultra high voltage, intercity high-speed railways and rail transit, and electrical vehicle charging stations

Source: Asia Alternatives analysis

China has no intention to deter private sector entrepreneurship

Liu He* announced China's private sector now represents...

**Share of Private Sector
Percent**



Liu He's speech shows that the government knows the private sector is important

*Vice Premier of the PRC
Source: Liu He's speech at China International Digital Economic Expo on September 6, 2021

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Domestic

Short term

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* As of April 29, 2022

Politburo meeting chaired by President Xi called for the most concerted efforts since 2018 to stabilize the economy

Major government policy boost for rest of 2022

Fiscal Policy

- Tax and fee cuts and pandemic fiscal relief are likely further expanded
- Beijing may bring forward the 2023 construction bond quota to this year to support infrastructure capex once they utilize the 2022 quota by 2H

Monetary

- Expect 75bps of RRR (reserve requirement ratio) cuts and 20bps of policy rate cuts for the rest of this year
- Urged banks to lower deposit rate ceiling by 10bps

Housing

- Easing in nationwide mortgage and home purchase restrictions
- Over 70 cities have easy city-specific housing purchase restrictions
- Over 100 cities lowered residential mortgage rates in March
- Expect risk management mechanism and supportive measures to smooth transition to new development model

Covid Policy

- **Near-term adherence to Covid-zero reaffirmed**
- Expect a gradual exit from ZCP to take place after the 20th Party Congress at the earliest, given political considerations and the time needed to boost elderly vaccination
- However, **State Council said for the first time that Covid-zero is a temporary solution (transitory)**, as China will take advantage of the window offered by Covid-zero to boost vaccination (particularly among the elderly), ramp up healthcare capacity and increase production/adoption of Covid treatment pills. It hinted that while a turnaround in Covid policy is difficult, pathways are forming
- Shortened quarantine time in 8 coastal cities from 14 days to 10 days from April 11
- Announced home quarantine guidance for the first time on April 13

Big Tech Regulation

- Expect Beijing to wrap up ongoing regulatory work on data security inspections and riders' social security arrangements
- Big tech companies are provided clearer support, which involves internet and financial regulators
- More supportive tone by vowing to roll out concrete measures to support the sector while wrapping up ongoing regulatory work, **implying that regulations will enter a stable phase**

Risks to China's 2022 GDP growth are becoming more symmetric and less skewed to the downside

“The world does not need China to be great – but only to be pragmatic again”

“Pragmatists value peace and prosperity as the ends and to do whatever is necessary to achieve them, even if it entails breaking ties with friends and working rivals. To be ideological means to regard opposing enemies as an end, even if fighting comes at a price of peace and prosperity”

(Yuen Yuen Ang, professor of political science at University of Michigan, Ann Arbor, *Noema* magazine)

Asia Alternatives believes China will continue to choose pragmatism over ideology and learn and adapt as they go.

Along with the intrinsic growth drives (consumption power, technology advancement, and global integration), this forms the foundation of our investment thesis



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Closing Remarks

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