

COVID-19

[Spring break class](#) for PhD and Langone students

Viral V Acharya*

NYU Stern, [Volatility and Risk Institute](#) ([VLAB](#), [VLAB-COVID19](#))

(joint work with Richard Berner, Rob Capellini, Robert Engle, Thomas Philippon and Johannes Stroebel, NYU Stern; Randy Milch, NYU; and, Sascha Steffen, Frankfurt School of Finance and Management)

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* I am grateful for inputs from Anurag Gupta, Manjiree Jog, Timothy Johnson and Raghuram G Rajan.

Outline

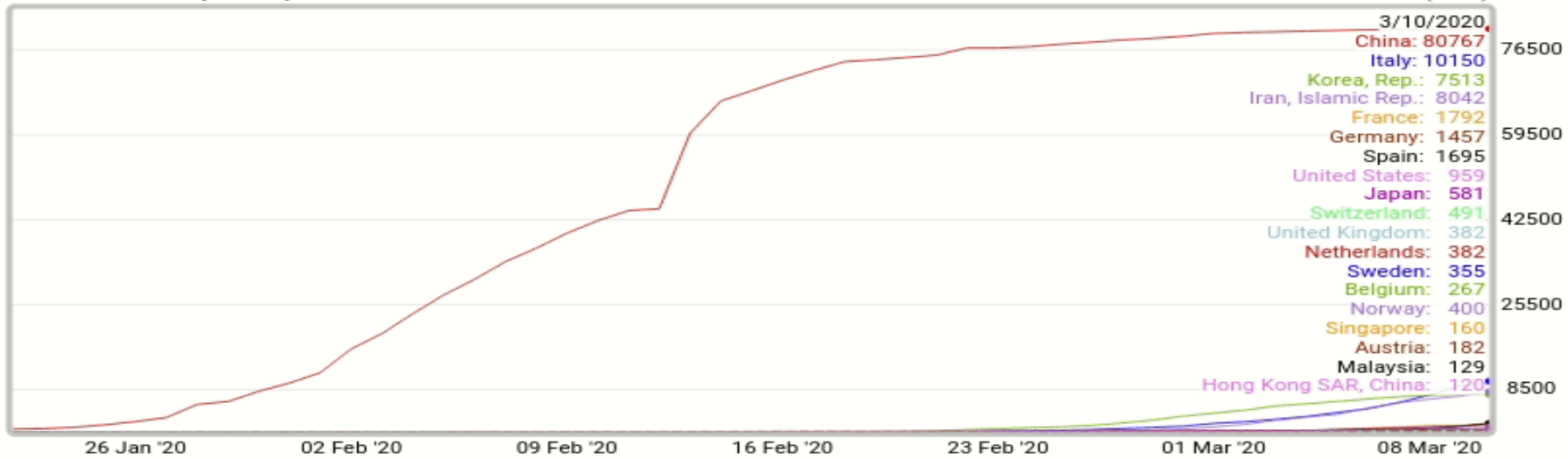
- I. Once-in-a-century pandemic
- II. Lessons from the past
- III. COVID impact on the economy
 - Paradox of the Pandemic Response
- IV. Like any other financial crisis?
- V. How has COVID played out financially?
- VI. Policy responses and challenges
- VII. Lessons for the future
- VIII. Q & A

I. Once-in-a-century pandemic

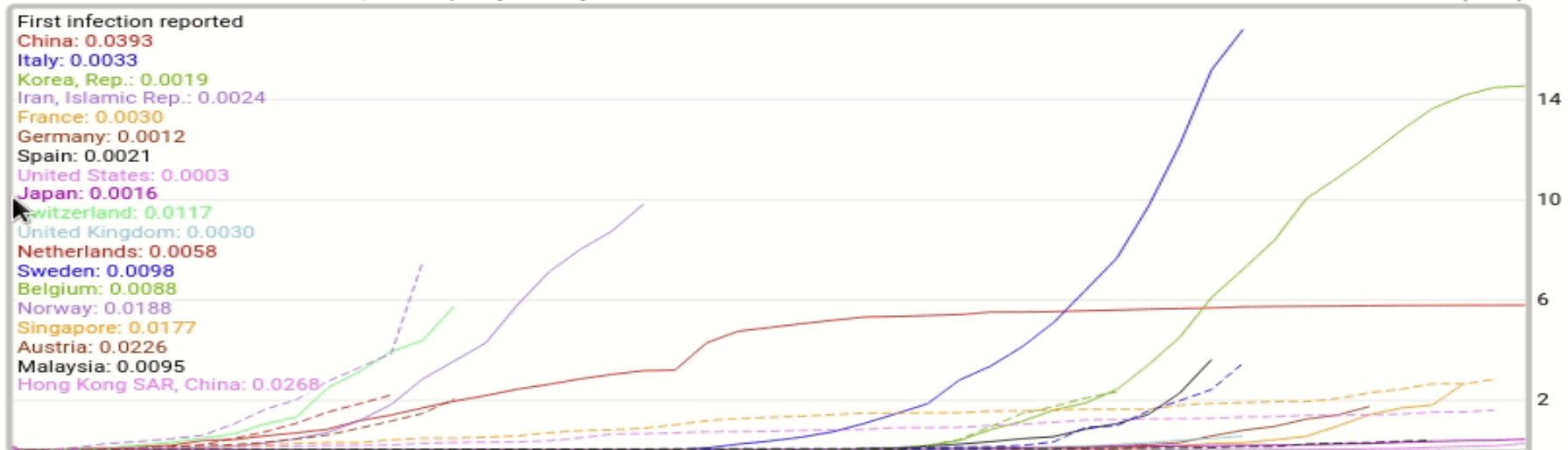
Once-in-a-century pandemic has manifested

- COVID-19 breakout from Wuhan (China) has engulfed most of globe
 - First wave: S. Korea, Japan, Singapore, Hong Kong
 - Second wave: Italy, Iran, other parts of SE Asia
 - Third wave: US, UK, Spain, most of Europe
- Some countries appear to have arrested the exponential growth better than others (Hong Kong, Singapore, S Korea, Japan)
 - Strong universal health care, state capacity, Test-test-test, ...
- Will it end in few quarters? Will there be recurring waves? Seasonality? Will it be intermittent for few years?

Confirmed Cases by Country

Source: [Johns Hopkins Center for Systems Science and Engineering \(GitHub\)](#).☐ Normalize by population

Diffusion of Confirmed Cases / 100,000 People by Country



Globally, approximately 170,000 confirmed cases of coronavirus disease 2019 (COVID-19) caused by the 2019 novel coronavirus (SARS-CoV-2) have been reported, including an estimated 7,000 deaths in approximately 150 countries

Source: Severe Outcomes Among Patients with Coronavirus Disease 2019 (COVID-19) — United States, February 12–March 16, 2020. MMWR Morb Mortal Wkly Rep. ePub: 18 March 2020. DOI: <http://dx.doi.org/10.15585/mmwr.mm6912e2>

II. Lessons from the past

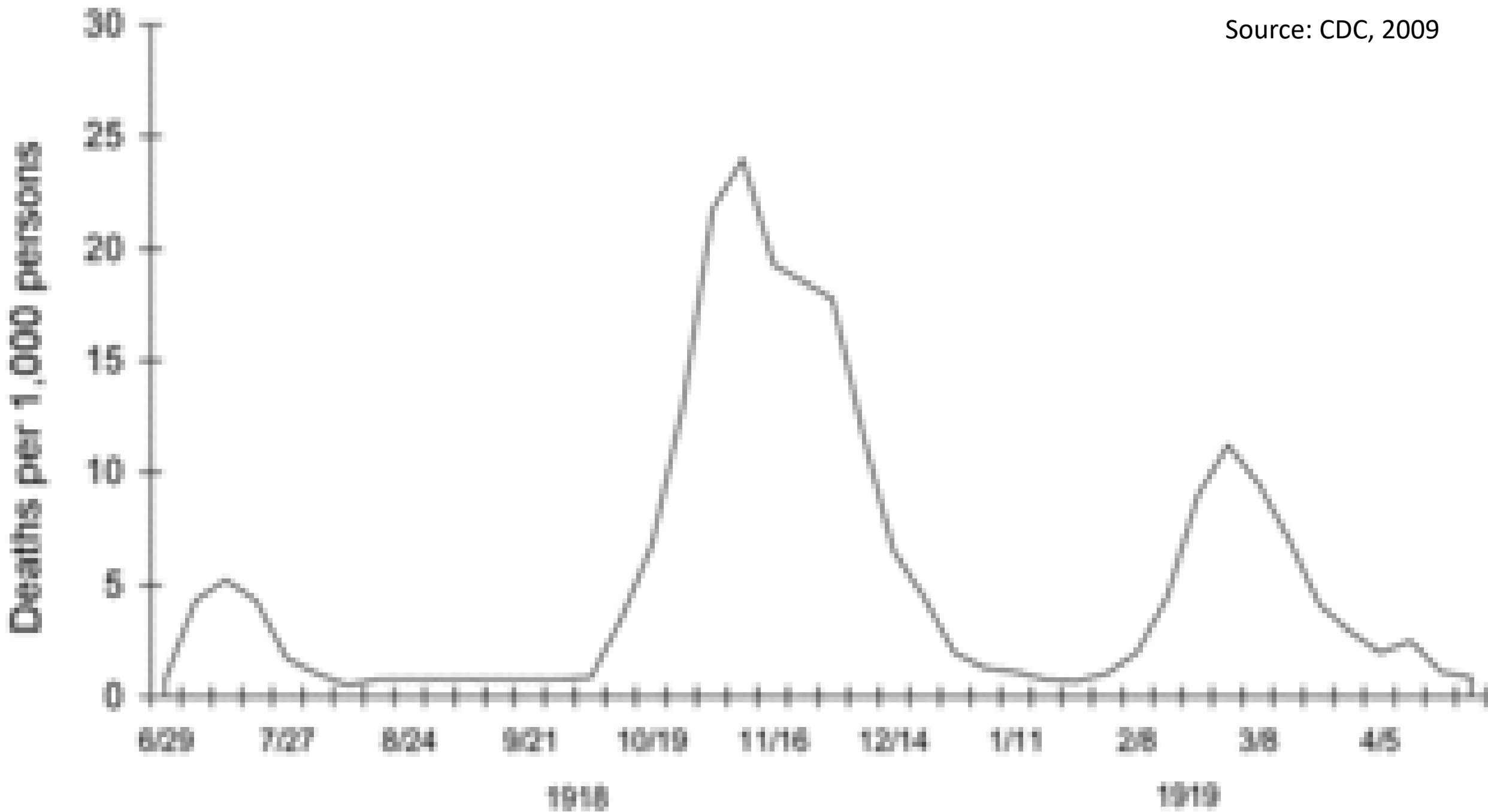
“The farther back you can look, the farther forward you are likely to see.”

— **Winston Churchill**

The Spanish flu of 1918

- On the back of World War I: January 1918 to December 2020
- Occurred over three waves
- High infection rate (25-33% of world population)
- High fatality rate (10% of infected cases)
- No pharmacological options
- Focus in containment was on social distancing efforts
- Seems not too different from COVID-19 (so far)!

Source: CDC, 2009



What worked then?

Richard J. Hatchett, Carter E. Mecher and Marc Lipsitch, "Public Health Interventions and Epidemic Intensity during the 1918 Influenza Pandemic," *Proceedings of the National Academy of Sciences*, June 2007:

"[C]ities in which multiple interventions were implemented at an early phase of the epidemic had peak death rates $\approx 50\%$ lower than those that did not and had less-steep epidemic curves. Cities in which multiple interventions were implemented at an early phase of the epidemic also showed a trend toward lower cumulative excess mortality, but the difference was smaller ($\approx 20\%$) and less statistically significant than that for peak death rates. This finding was not unexpected, given that few cities maintained NPIs (non-pharmaceutical interventions) longer than 6 weeks in 1918. Early implementation of certain interventions, including closure of schools, churches, and theaters, was associated with lower peak death rates, but no single intervention showed an association with improved aggregate outcomes for the 1918 phase of the pandemic."

Lessons from past epidemics and pandemics

- Modeling by the [Imperial College, UK scientists](#) confirms that
 - “suppression” measures (isolation, quarantine, etc.) will be necessary to contain spread and buy time so as not to run out of hospital beds
 - “mitigation” measures that allow spread but contain it, hoping for building of “herd immunity”, will immediately cause over-capacity problems
- Likely measures undertaken will entail economic disruption on a global scale, (only) some of which are already being witnessed

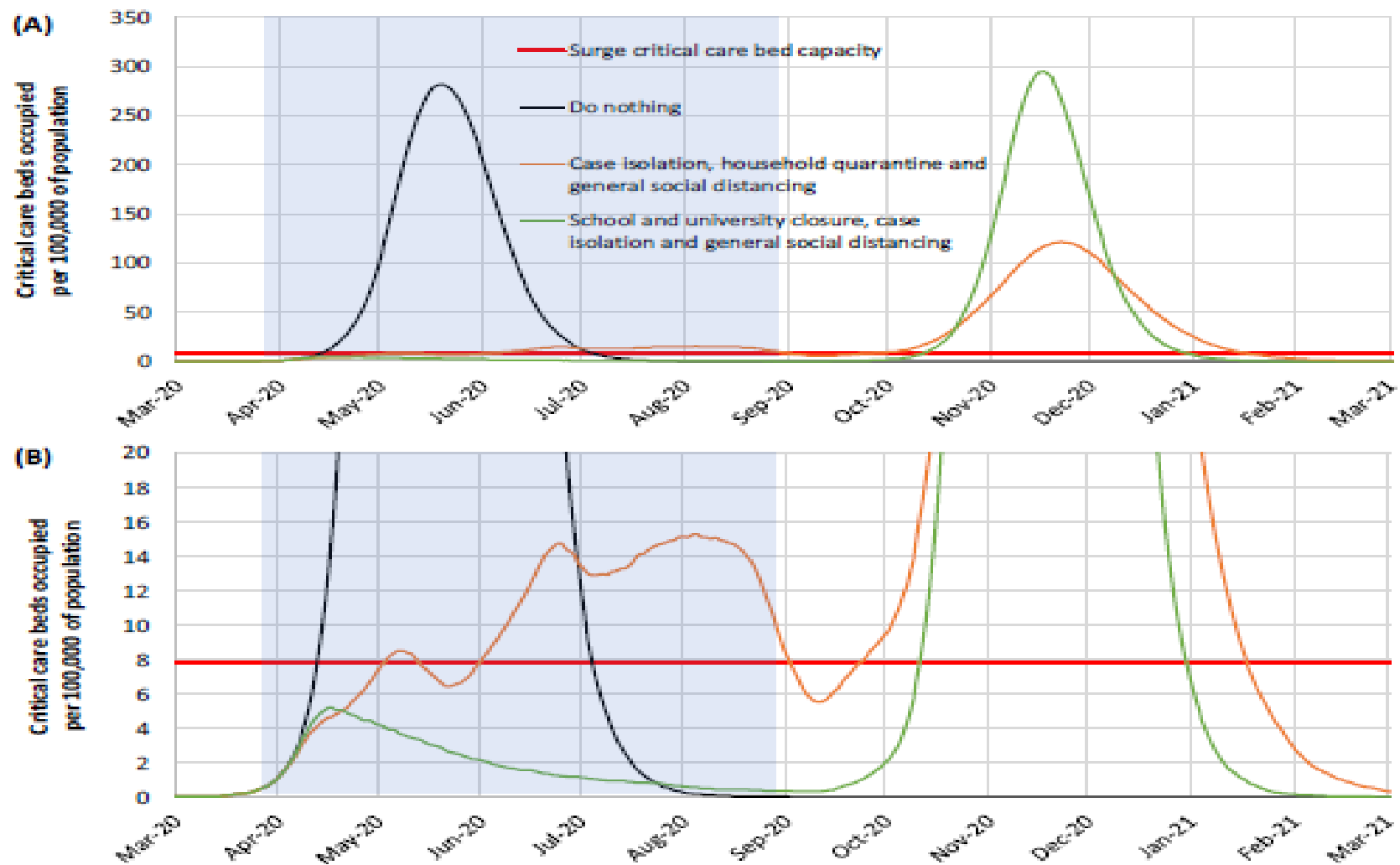


Figure 3: Suppression strategy scenarios for GB showing ICU bed requirements. The black line shows the unmitigated epidemic. Green shows a suppression strategy incorporating closure of schools and universities, case isolation and population-wide social distancing beginning in late March 2020. The orange line shows a containment strategy incorporating case isolation, household quarantine and population-wide social distancing. The red line is the estimated surge ICU bed capacity in GB. The blue shading shows the 5-month period in which these interventions are assumed to remain in place. (B) shows the same data as in panel (A) but zoomed in on the lower levels of the graph. An equivalent figure for the US is shown in the Appendix.

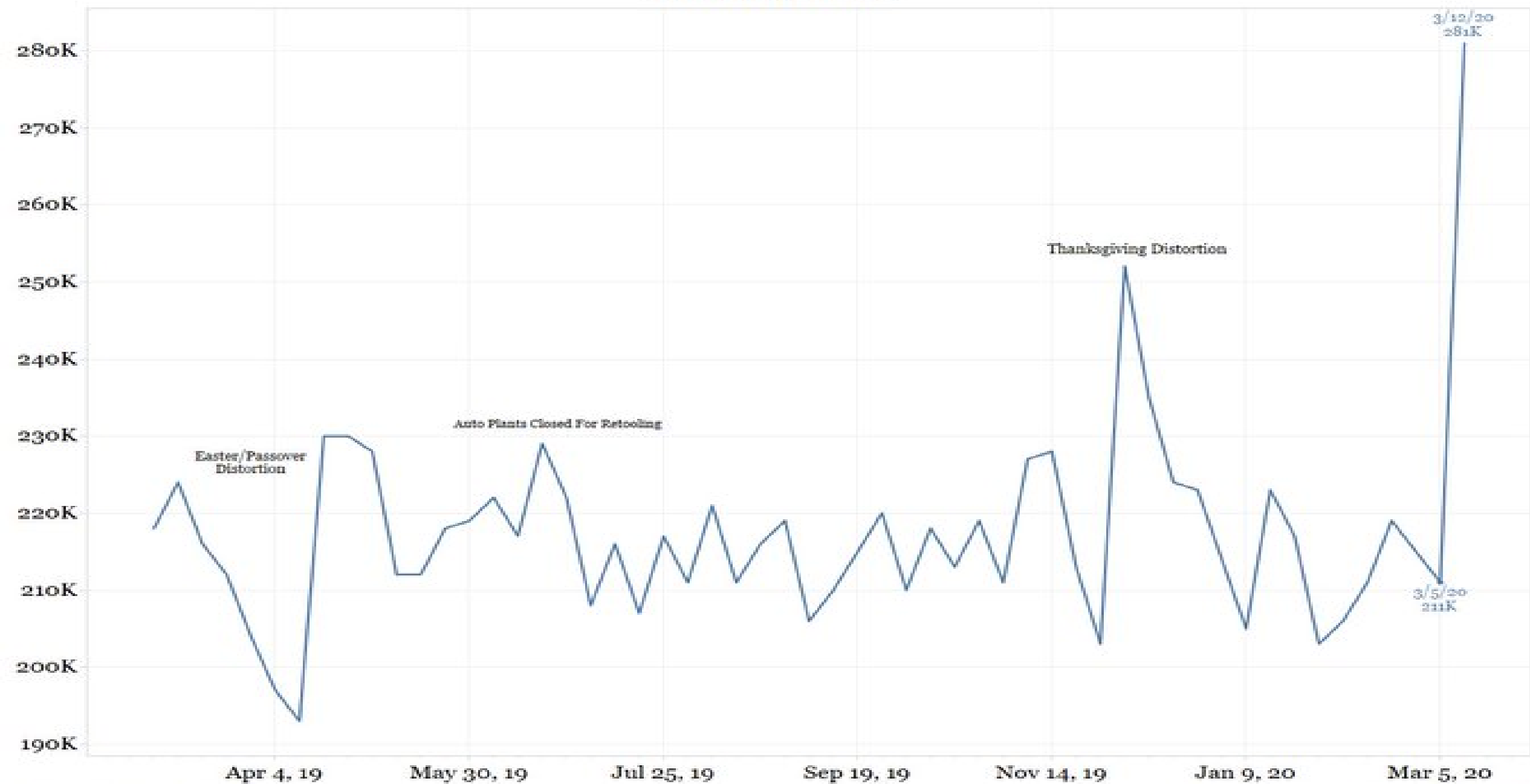
III. COVID impact on the economy

Paradox of the Pandemic Response: Better the response, the harder the economic hit

How will COVID-19 play out? – Real side

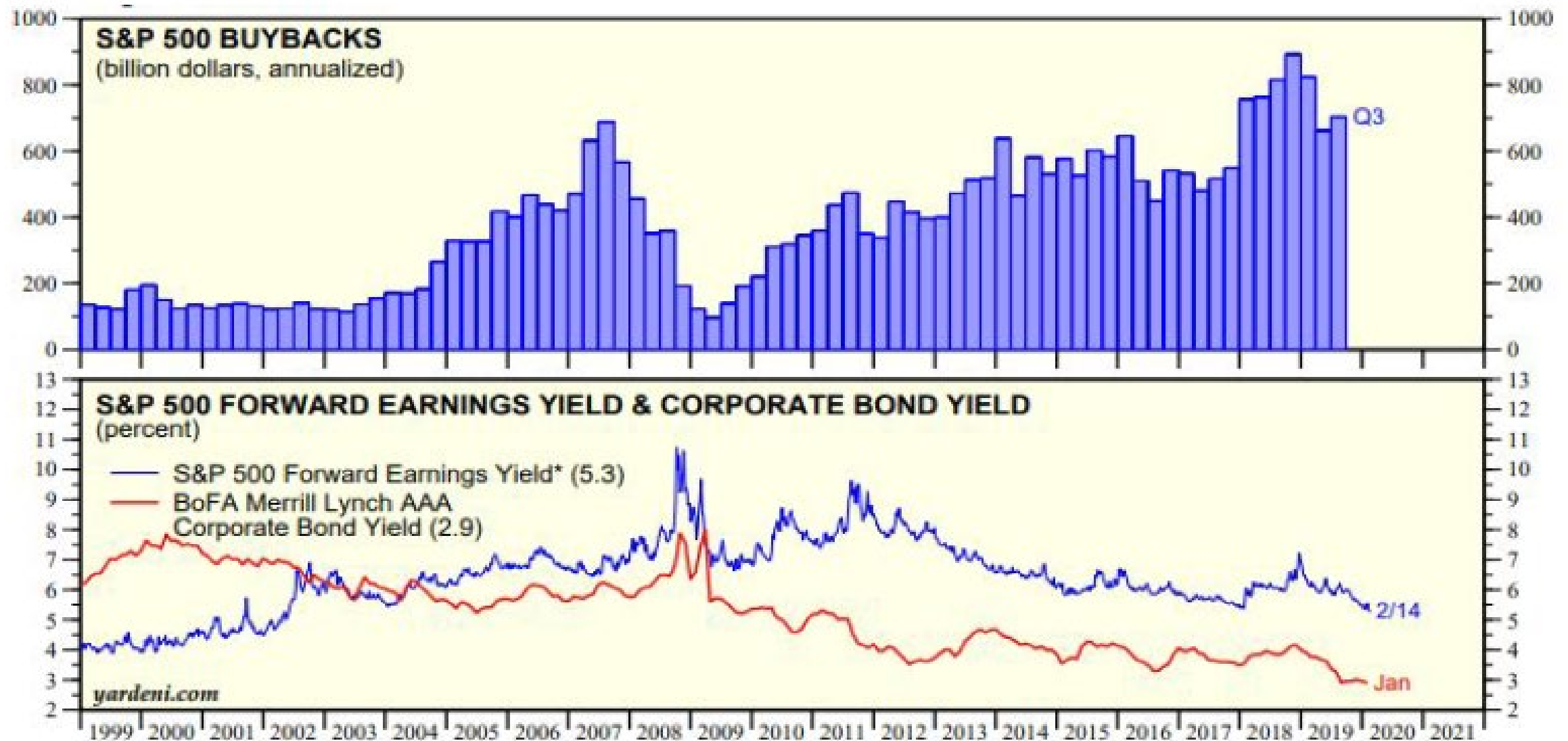
- Supply-chain disruptions to complete production halts
- Demand-side collapse due to isolation and social-distancing measures
- Amplification mechanisms such as “oil price war” (some countries/sectors)
- The real shock to output and employment is global to begin with, so no country/region can serve the role of being a global stimulator of last resort
- Impact likely to be the highest on
 - Certain services (leisure, entertainment, transport, energy, etc.)
 - Micro-, small- and medium-sized enterprises with weak financial buffers
 - Individuals with access to weak or no safety nets
 - Countries exposed to oil crash, limited policy space, weak health systems/safety nets

Initial Claims



How will COVID-19 play out? – Financial side

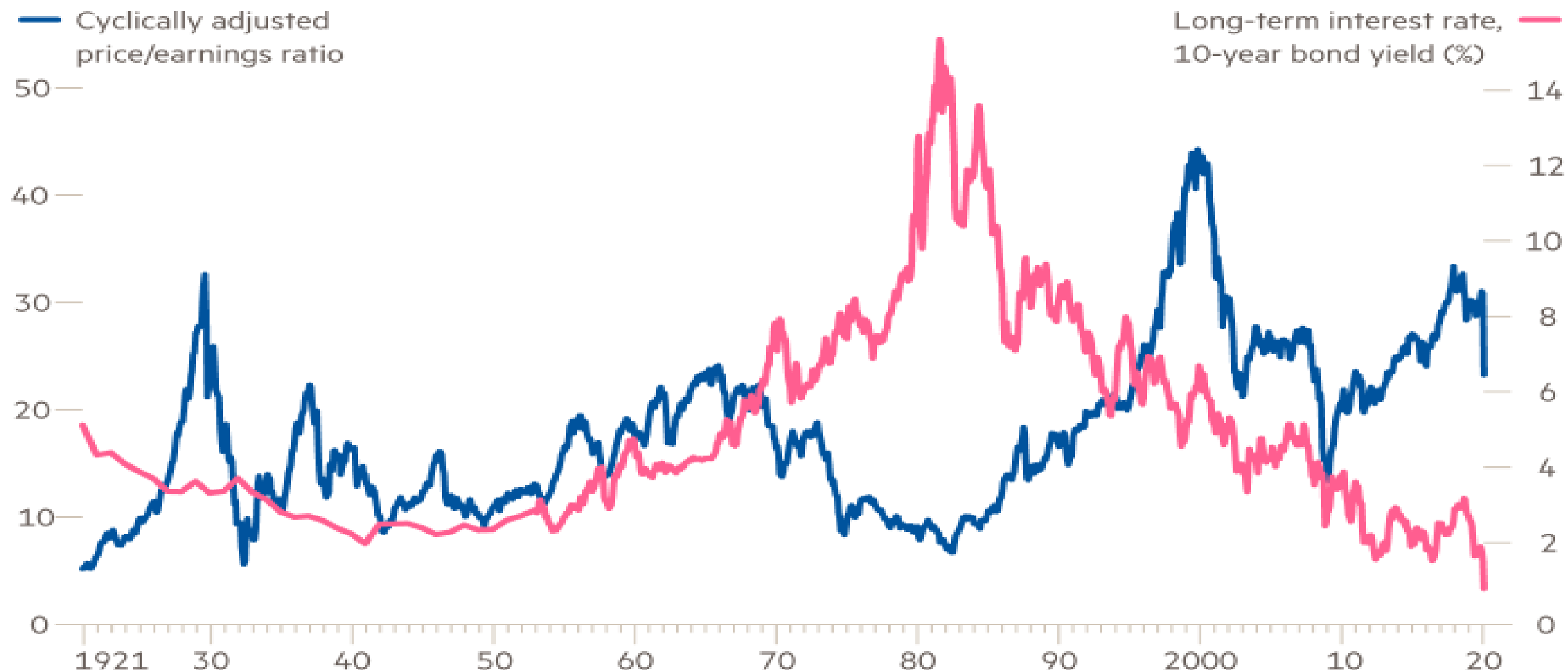
- COVID-19 outbreak has occurred in less benign circumstances, but...
 - The world is more heavily inter-connected and inter-dependent than it was in 1918
 - Financial system “frothy” in several parts (junk bonds, EM corporate and sovereign debt, equity market valuations and leveraged buybacks – all “search for yield”)
 - Global growth already weakening in the face of trade war and other risks
 - Central bank policy space limited due to accommodation of past decade+ (negative rates and ongoing large-scale asset purchases by many AE central banks)
 - Good news: Banking sector far better-capitalized and more liquid due to reform measures of the past decade



* Forward earnings (time-weighted average of consensus operating earnings estimates for current and next year) divided by S&P 500 stock price index.
Source: Thomson Reuters I/B/E/S, Standard & Poor's and Bank of America Merrill Lynch.

Figure 1: Aggregate trend in buybacks for S&P500 firms . Source: Edward Yardeni www.yardeni.com.

US stocks are still not all that cheap



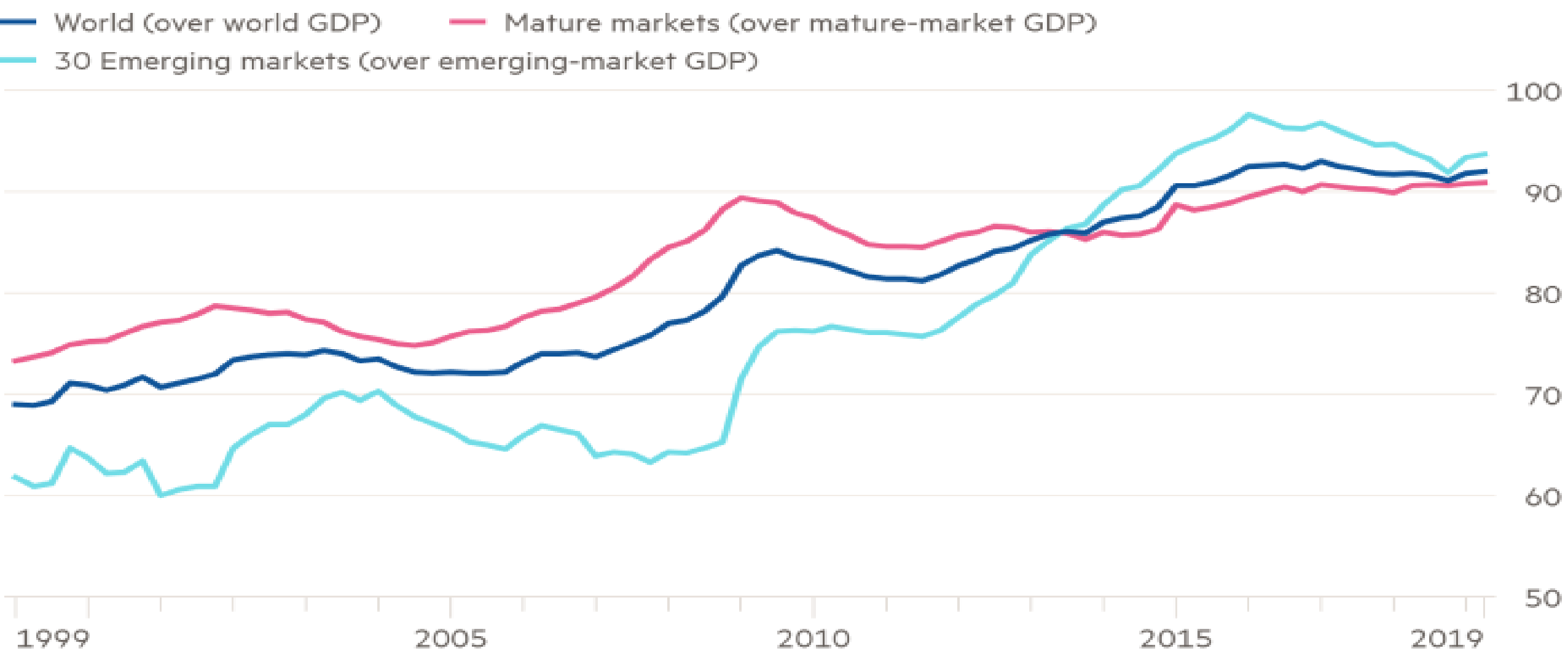
Source: Robert J. Shiller

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The virus is an economic emergency too, Martin Wolf, Financial Times, 17 March 2020

Global non-financial corporate debt has soared

Non-financial corporate debt as a % of GDP



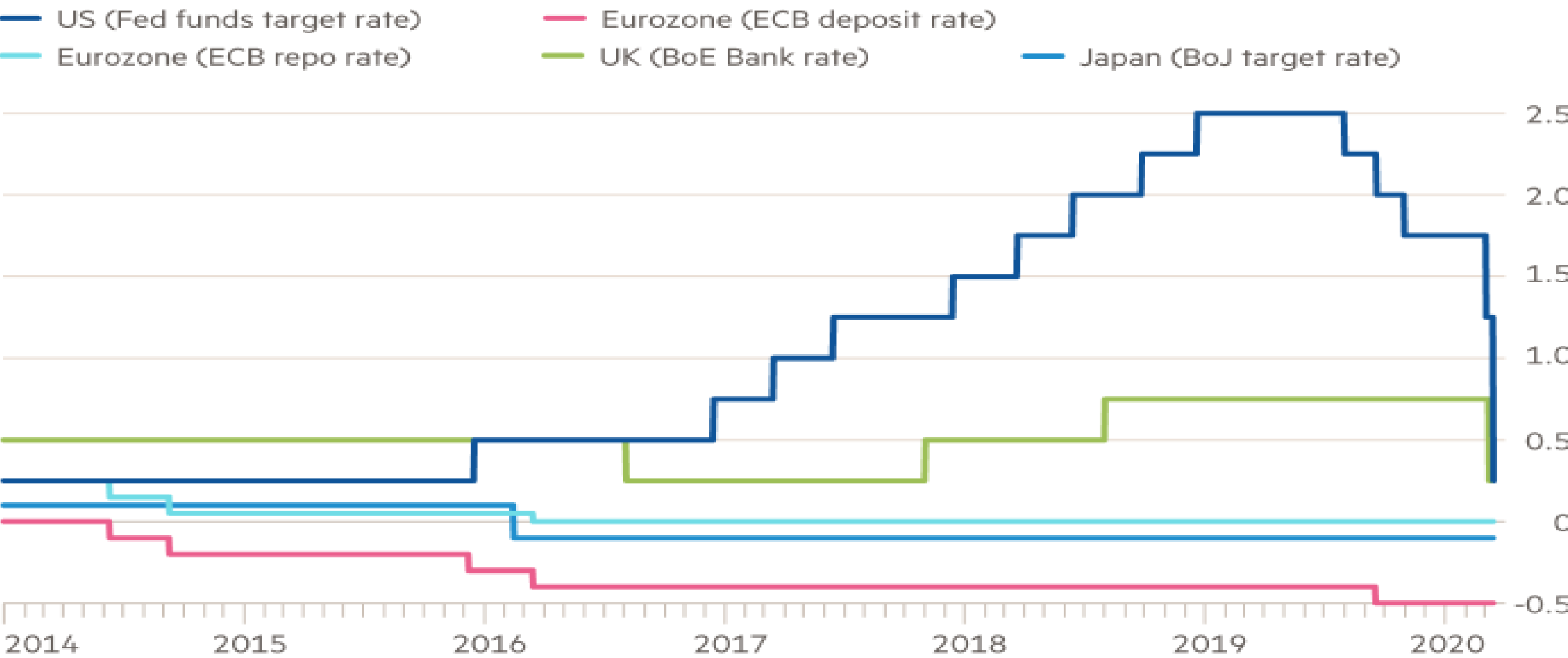
Source: Institute for International Finance

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The virus is an economic emergency too, Martin Wolf, Financial Times, 17 March 2020

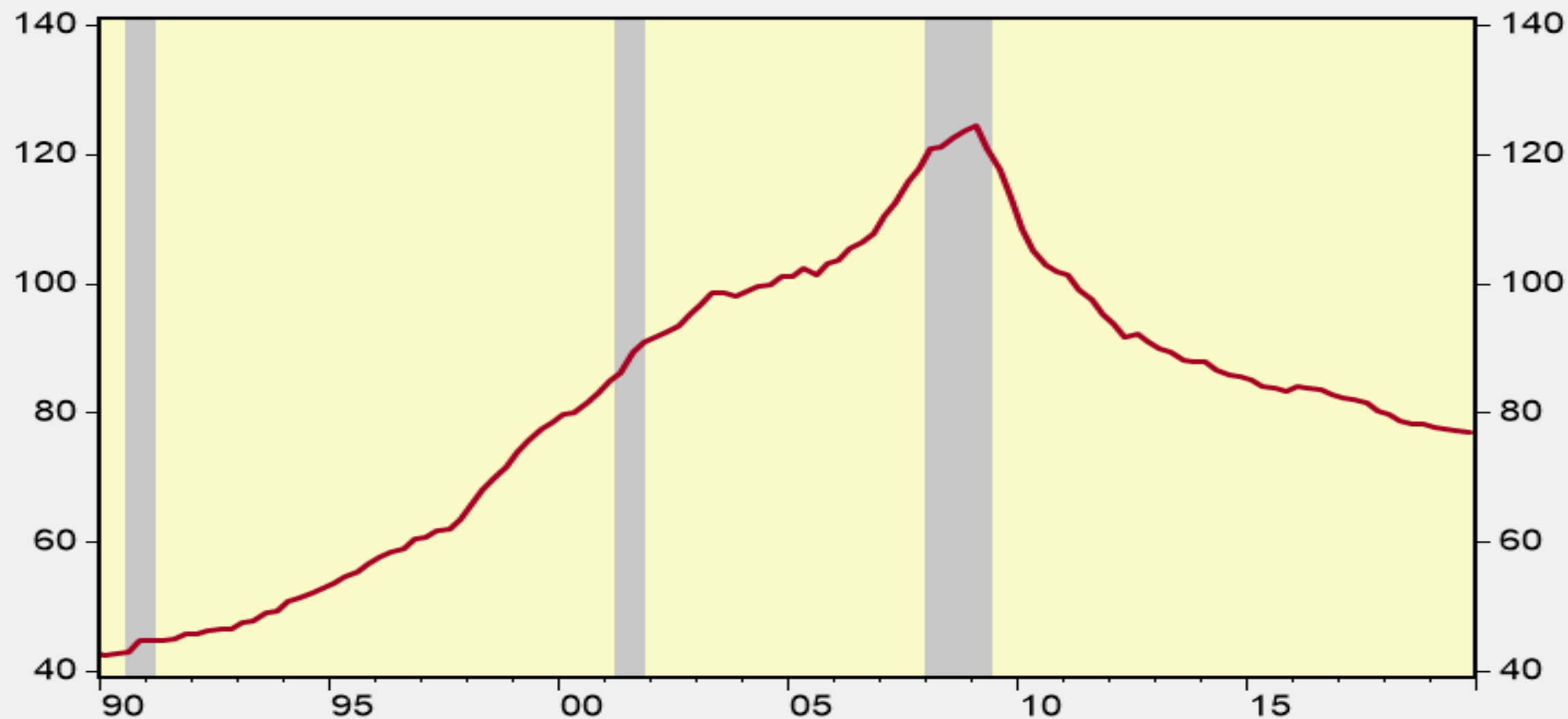
Central banks throw almost everything at the crisis

Central bank policy rates (%)



US: Financial Institutions Debt Outstanding as a % of SAAR GDP

%



Source: Federal Reserve Board/Haver Analytics

Paradox of the Pandemic Response

- In many stress episodes, dealing well with the root cause of the problem helps dealing with the financial sector fallout
- In case of pandemic, suppression measures – the desired response – will hit economic activity, and in turn, the financial sector, hard
 - Many economists predict a deep recession for few quarters; some even a depression
 - China: 1Q20 GDP –40% q/q saar (J P Morgan); evidence of rebound in 2Q – Robust?
- Can the financial sector fallout / crisis and attendant downward spiral on real activity be contained or managed well?
- ... While simultaneously ensuring adequate attention and resources are being devoted to the underlying medical needs (extensive testing, hospital beds, critical care provisions, search for vaccine) to deal with the outbreak?

IV. Like any other financial crisis?

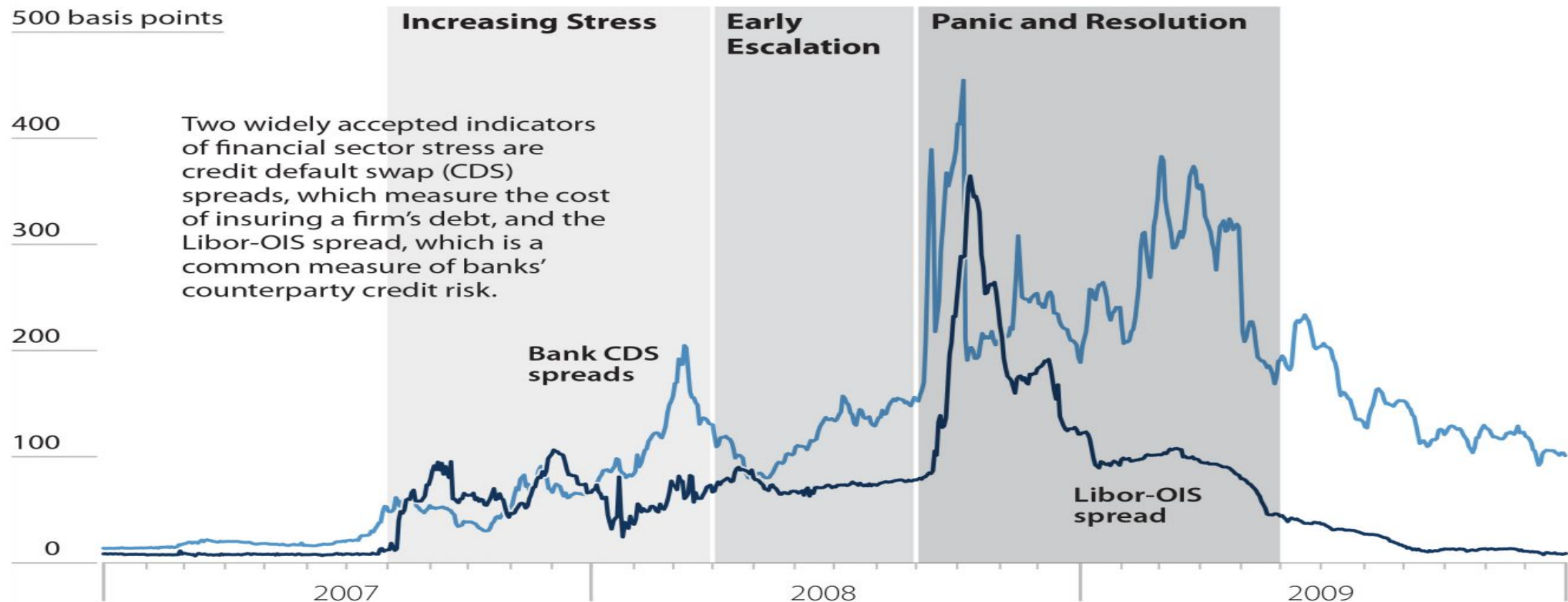
Typical financial crisis development

- Initial shock or ignition point
- Amplification mechanisms:
 - Leveraged positions, entities, sectors
 - Short-term debt rollover problems
 - Fire-sales and pecuniary externalities
 - Increase in financing costs to the real economy, credit crunch for many
- Uncertainty
 - Market volatility
 - Unpredictable policy responses
 - Ambiguity aversion / Knightian uncertainty (“model risk”)
- Extreme market failures: simplest parity relationships (covered interest-rate parity, CDS-bond basis, cross-market correlation structures) fail

Another lookback: Global financial crisis (GFC)

- COVID-19 is similar in some ways to the GFC
 - High leverage in certain sectors of the economy
 - Global spillovers through the financial sector
- Yet, it is different in many other ways
 - Better state of household and banking-sector balance-sheets
 - Global spillovers directly to the real economy rather than first to the financial sector
 - “Sudden stop” to real activity rather than via financial amplifiers
 - Financial market fallout at the very outset comparable to peak levels during GFC
- Differences may be key to choice of different policy-mix?
 - Need to support directly the most-affected sectors, households, and even countries
 - Financial backstops to dysfunctional markets, especially credit, may still be needed (are being provided at a break-neck pace by the AE central banks)

Phases of the 2007–2009 Global Financial Crisis as Reflected in Bank Credit Default Swap Spreads and Libor-OIS Spread



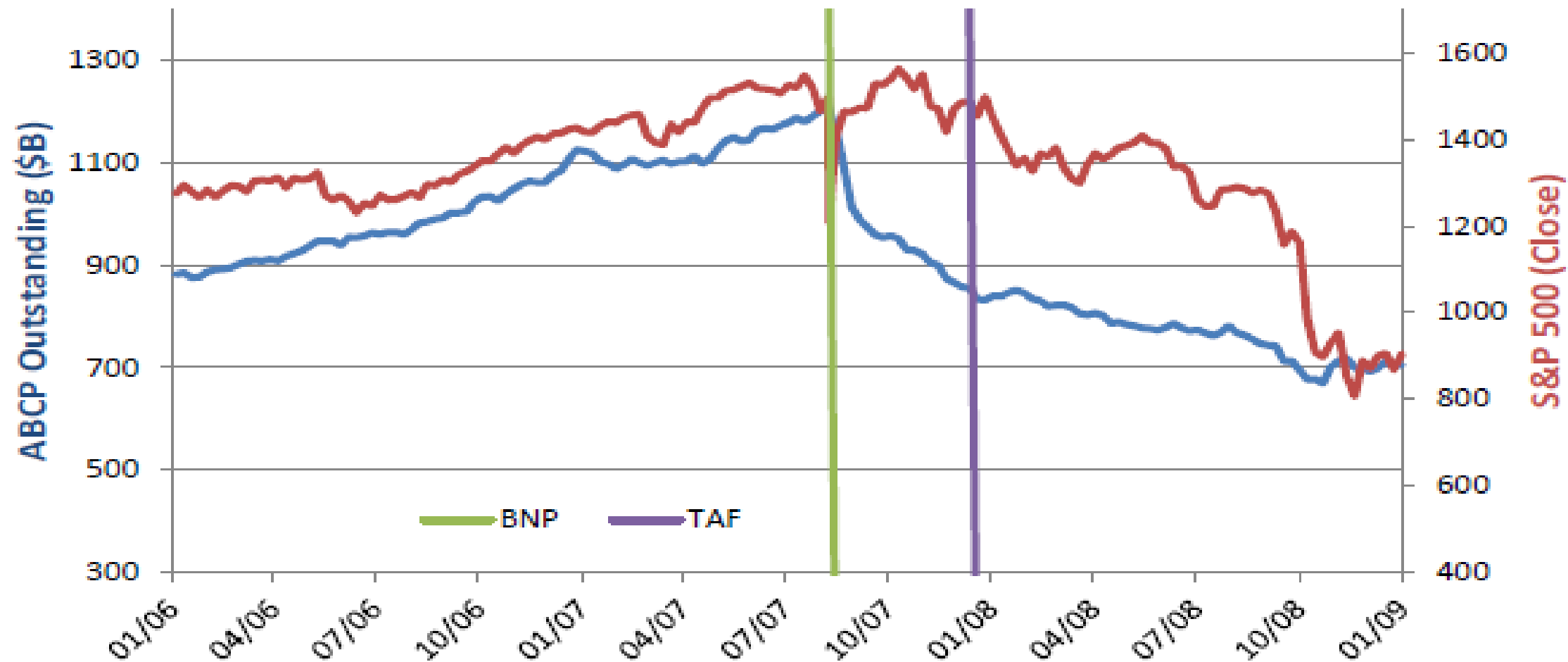
Notes: Credit default swap spreads are equal-weighted averages of JPMorgan Chase, Citigroup, Wells Fargo, Bank of America, Morgan Stanley, and Goldman Sachs. Libor-OIS spread shown is the spread between the 3-month London Interbank Offered Rate and the 3-month USD Overnight Indexed Swap rate.

Sources: Libor-OIS: Bloomberg Finance L.P.; bank CDS spreads: Bloomberg Finance L.P., IHS Markit

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Source: The [Yale Program on Financial Stability](#) (YPFS) and the [Hutchins Center on Fiscal and Monetary Policy at the Brookings Institution](#) are pleased to reveal a new [Financial Crisis Chart Archive](#)

ABCP Falls in mid-2007



Adapted from Acharya, Schnabl, and Suarez (2013). The red line is the level of the S&P 500 at close; the blue line is the total amount of ABCP outstanding in billions USD; the green line indicates August 9, 2007, when BNP Paribas suspended withdrawals from 3 subprime mortgage backed funds; the purple line indicates December 12, 2007, when the Federal Reserve announced the TAF to alleviate pressure in short-term funding markets.

V. How has COVID played out financially (so far)?

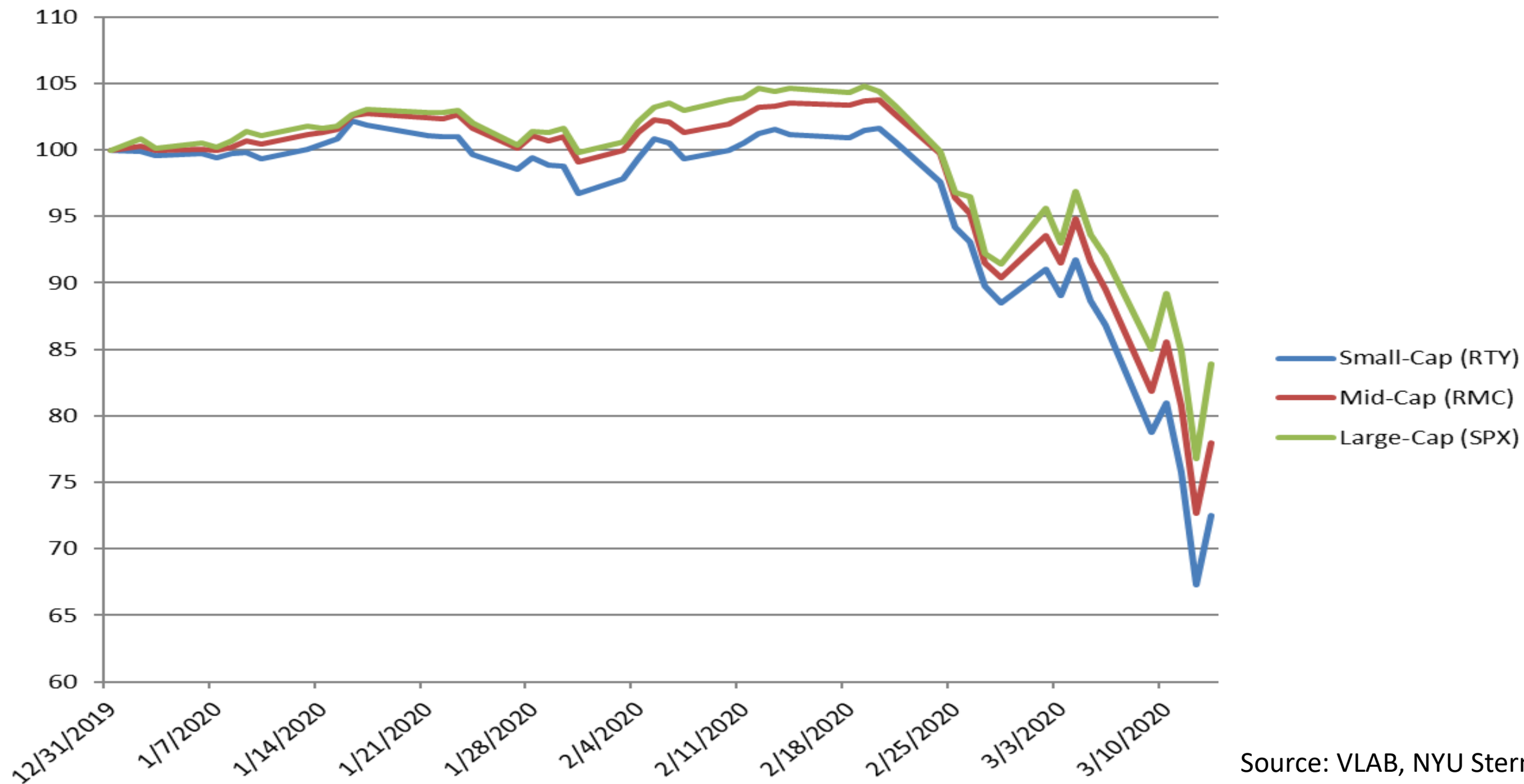
How has COVID-19 played out financially?

1. Stocks
2. Stock market volatility
3. Corporate bonds
4. Drawdown risk on bank lines of credit
 - Commercial paper market
 - Loan sales
5. Systemic risk of the financial sector
6. Government bonds
7. Cross-market correlations
8. Failures of parity relationships

1. Stocks

Pervasive and precipitous collapse; even harder for exposed sectors, financial firms

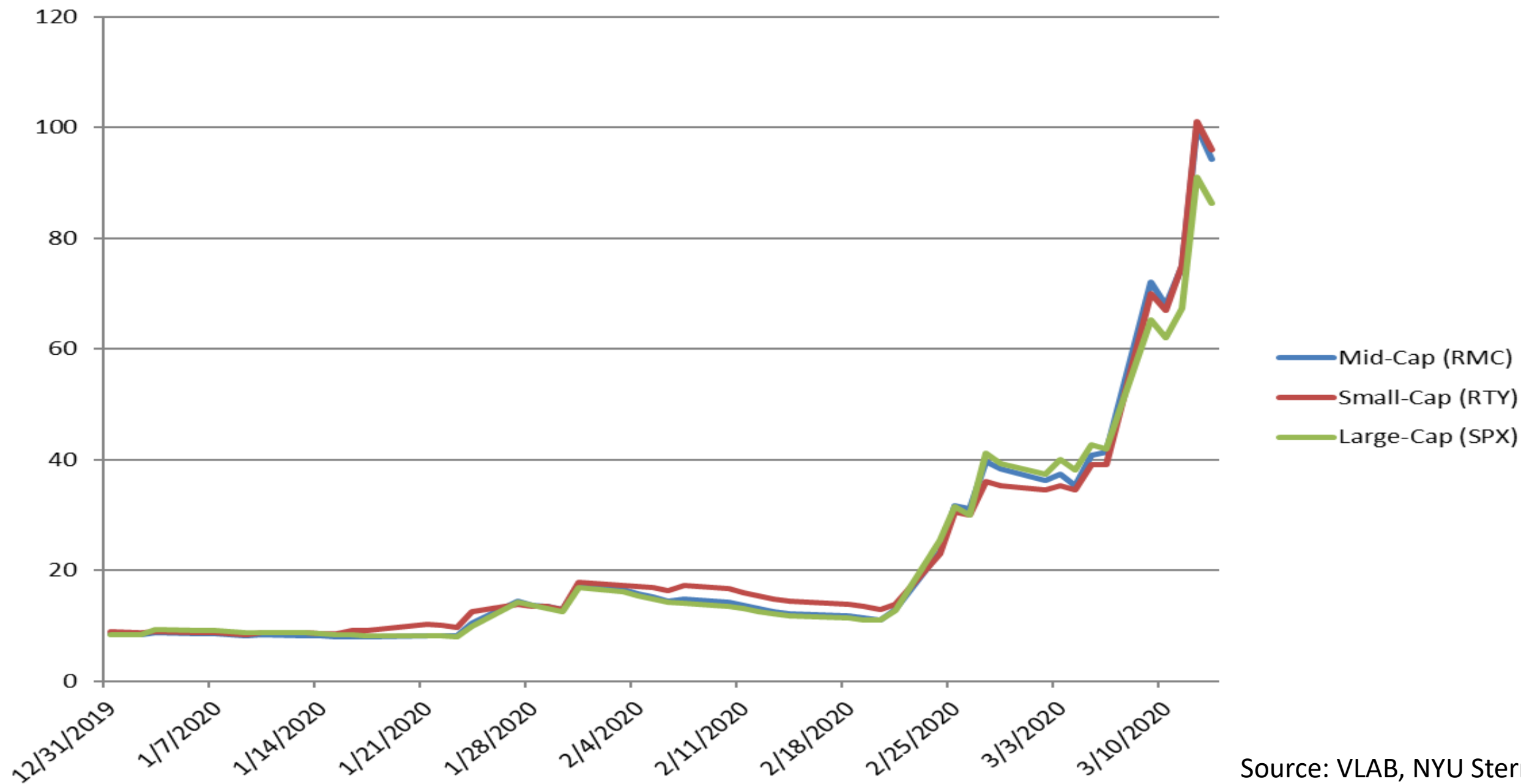
US Market Cap YTD Performance



2. Volatility (see NYU-Stern [VLAB](#))

Pervasive rise beyond GFC levels; Ignition globally once the pandemic spread

US Market Cap YTD Volatility (GJR-GARCH)

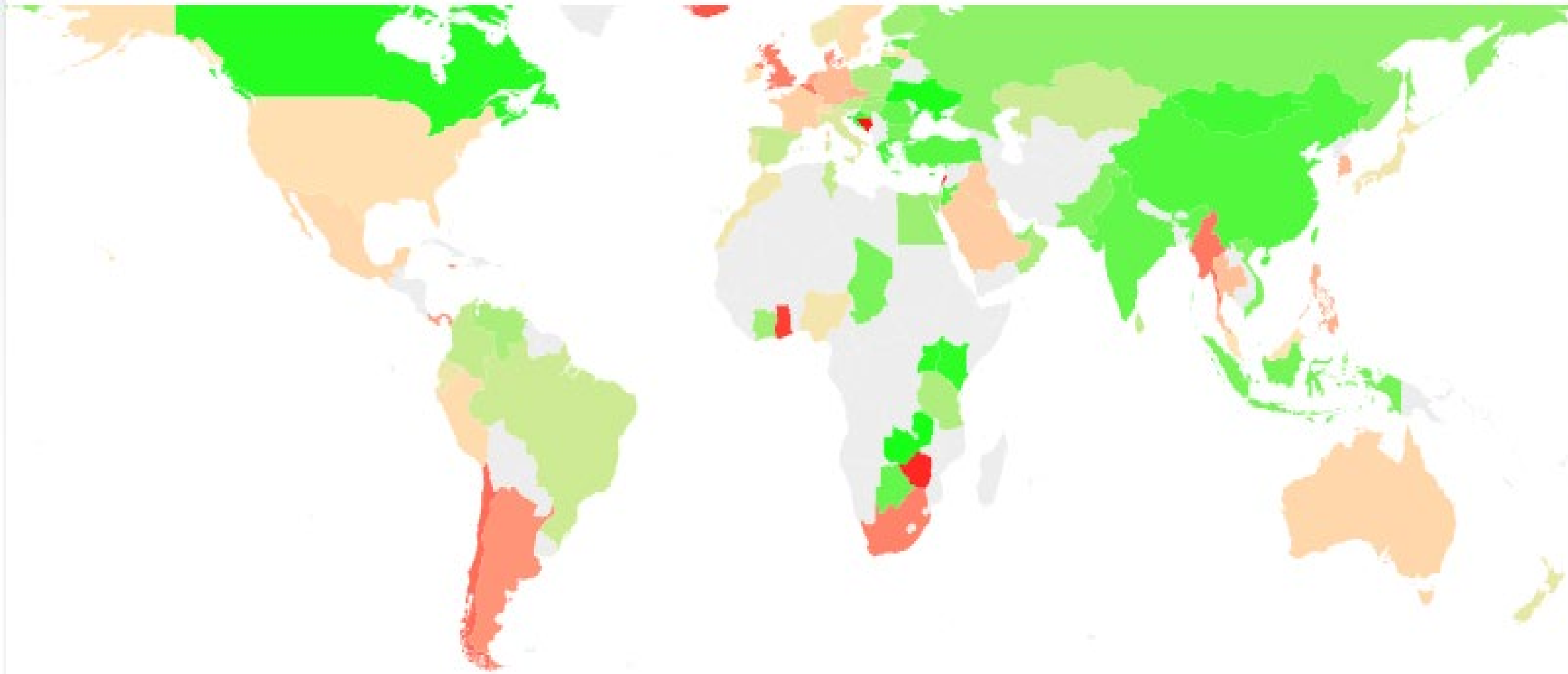


Source: VLAB, NYU Stern

Region:

World

30 days ago

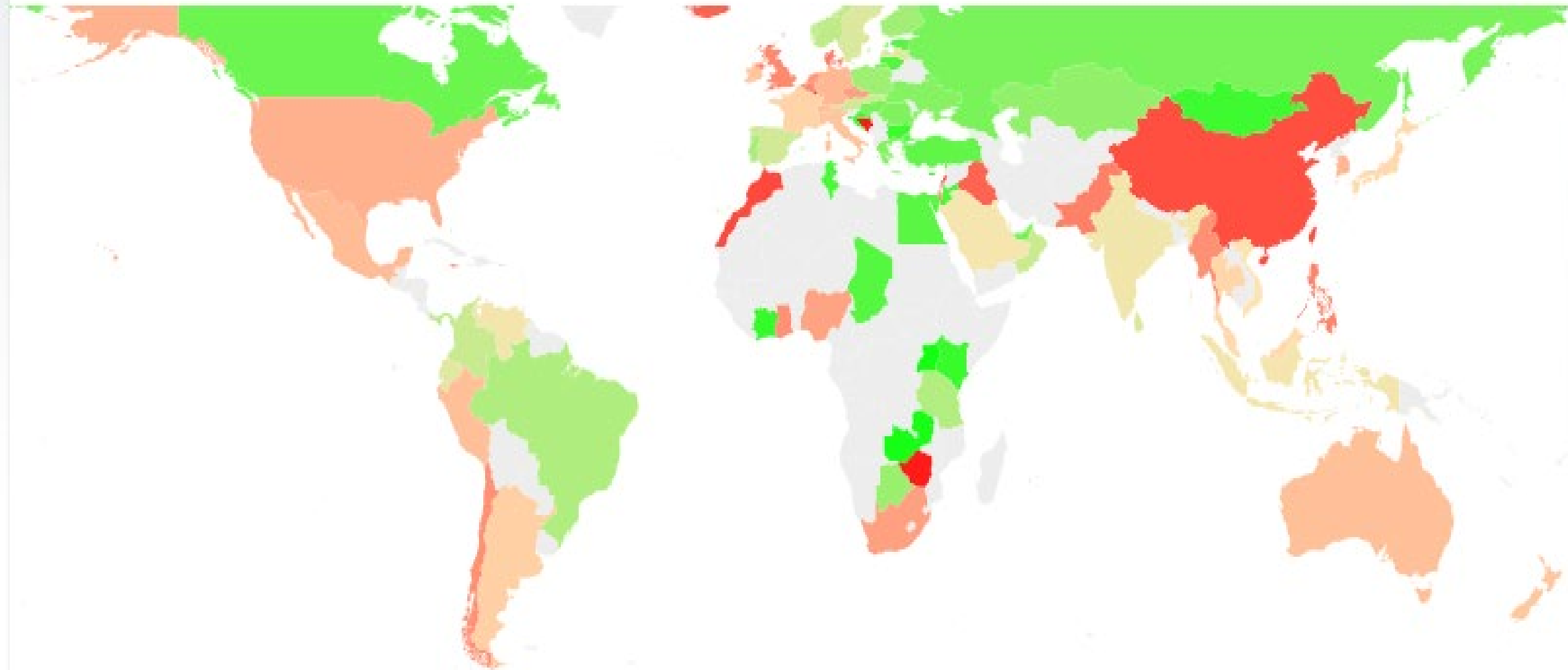


Source: VLAB, NYU Stern

Region:

World

25 days ago

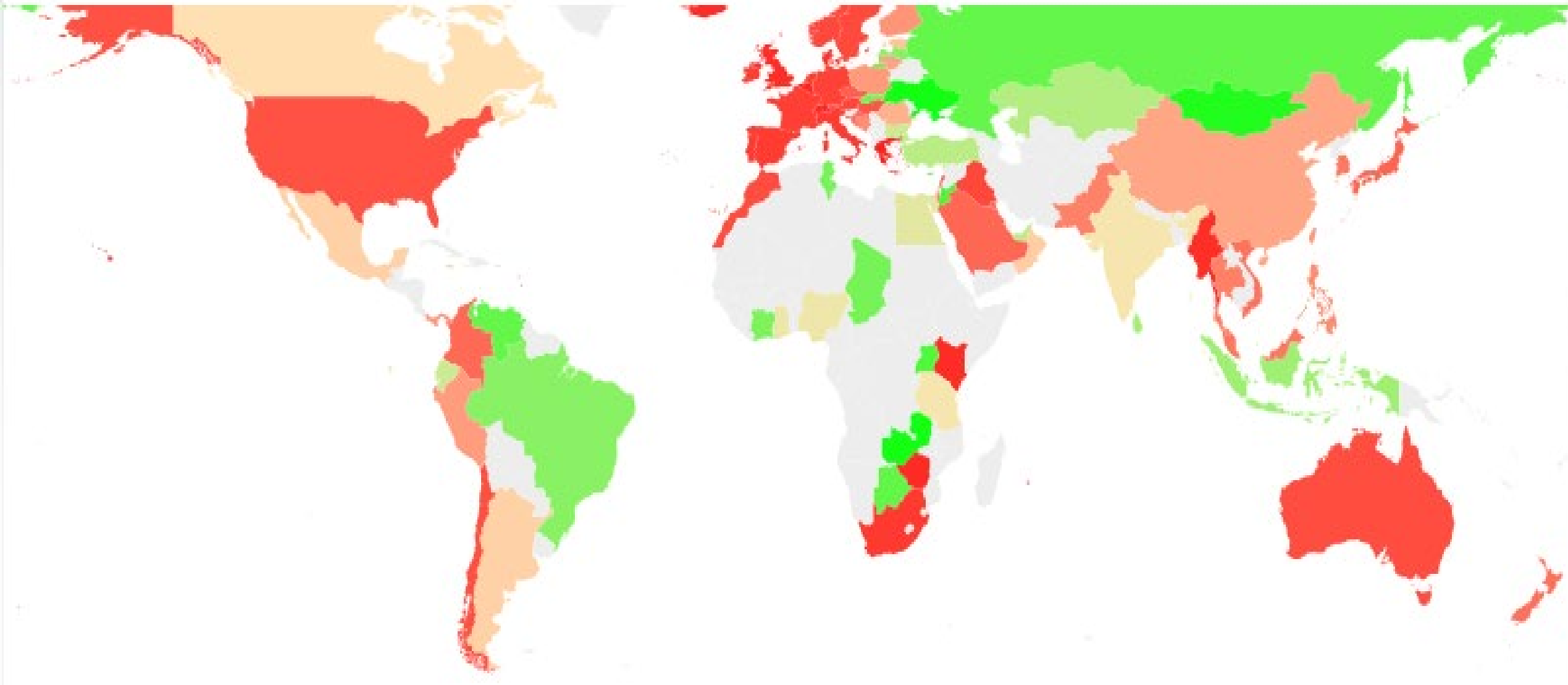


Source: VLAB, NYU Stern

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11 days ago

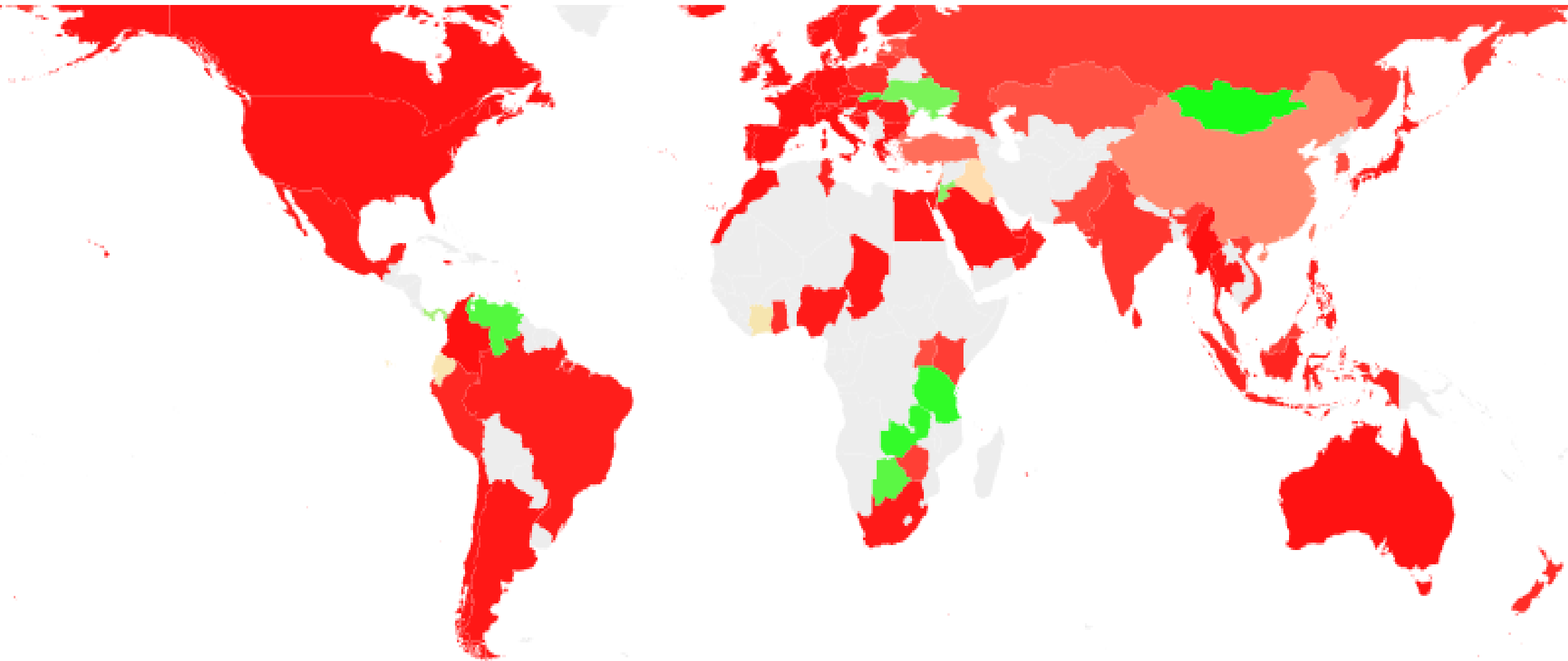


Source: VLAB, NYU Stern

Region:

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Now

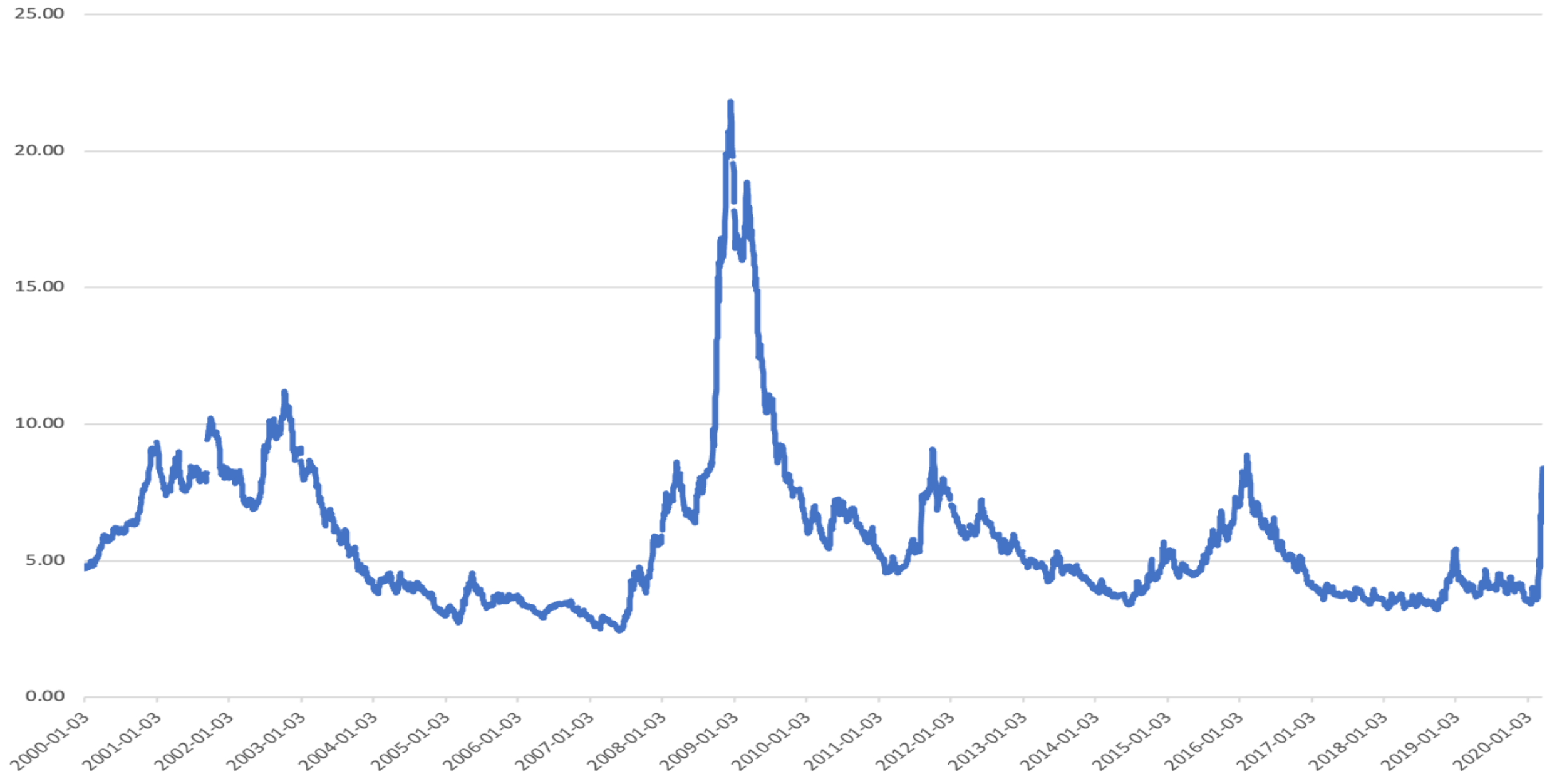


Source: VLAB, NYU Stern

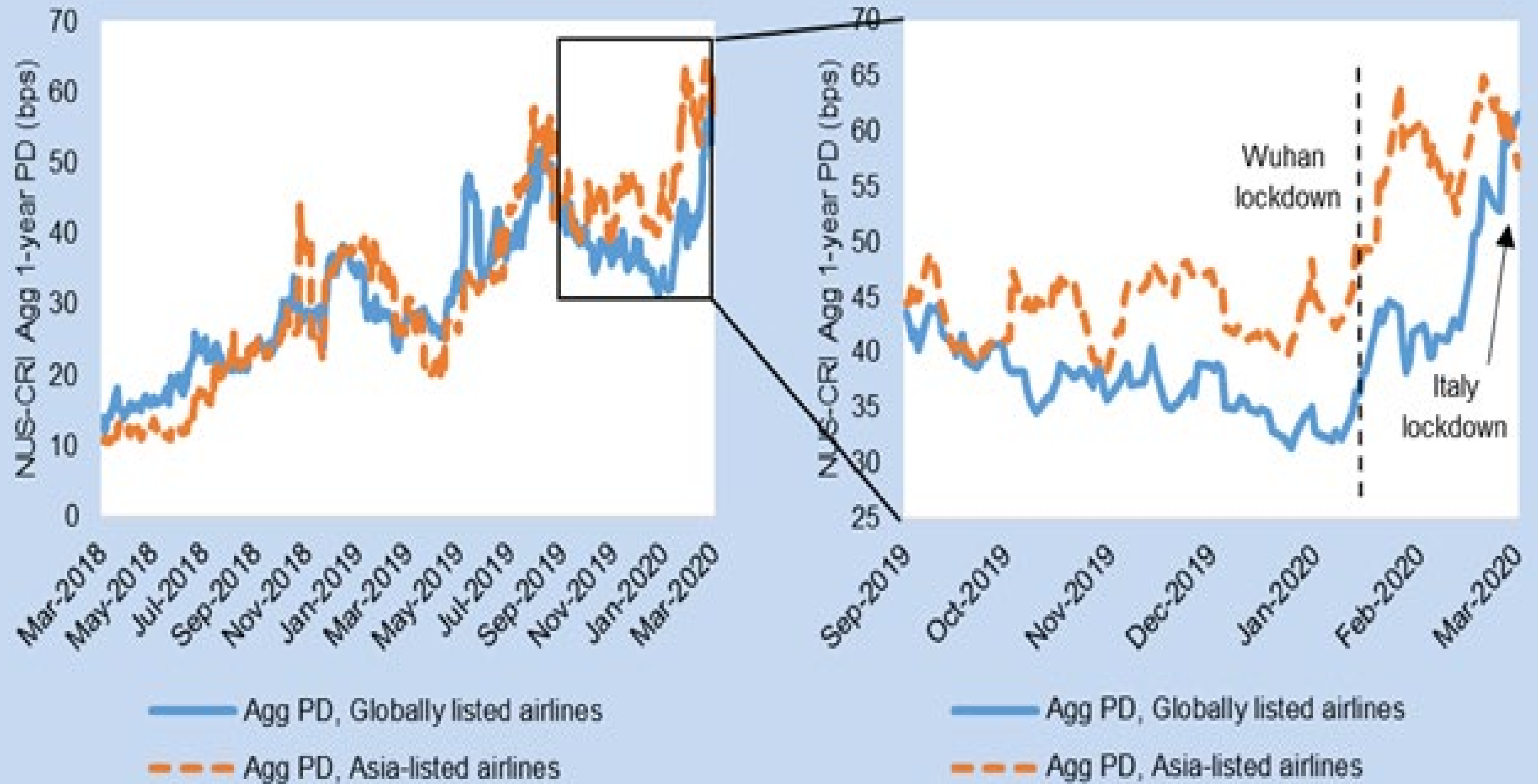
3. Corporate bonds

Junk bond stress in markets has “taken off” + Case study of the airline industry

BofA US High Yield Index OAS



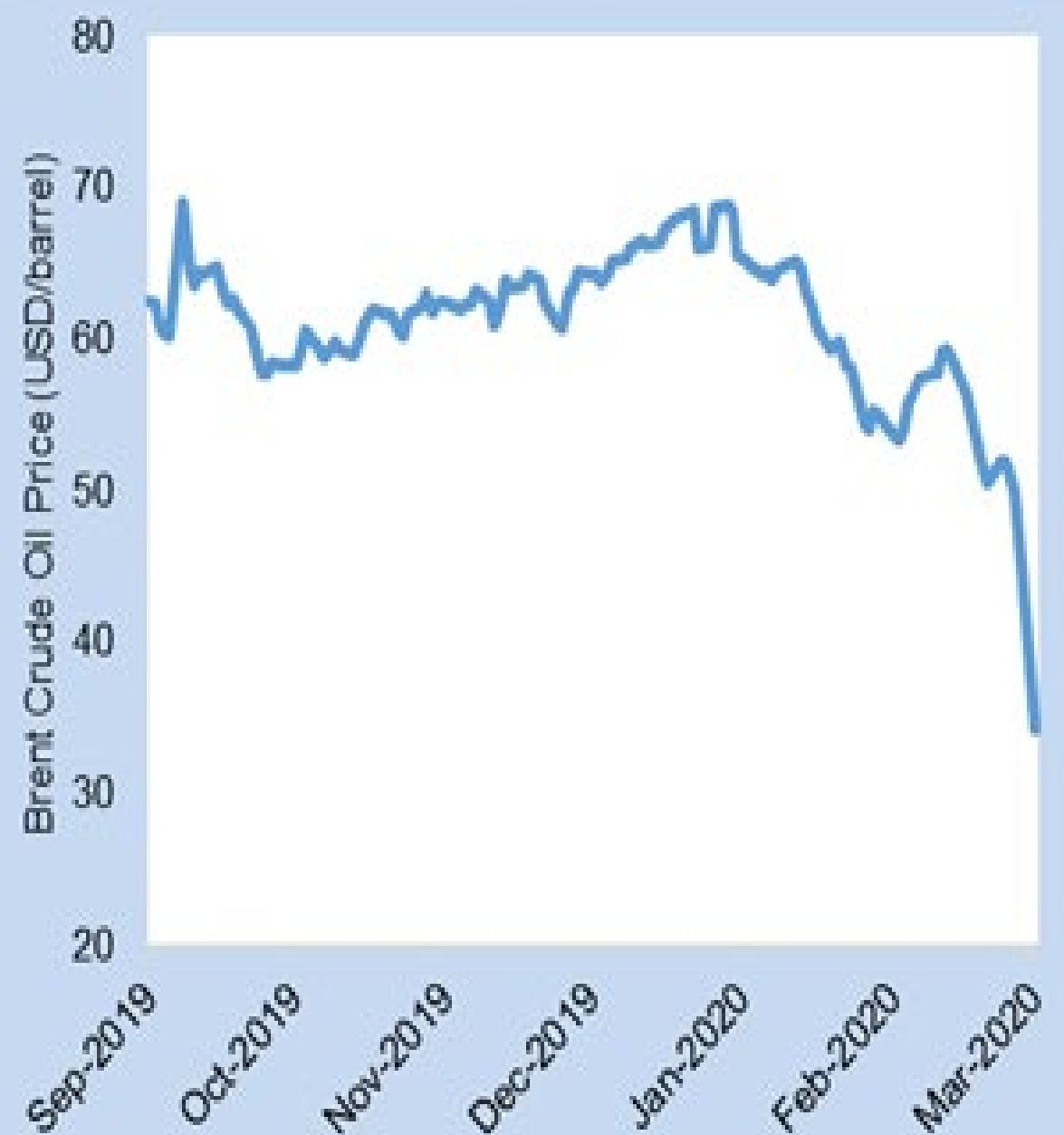
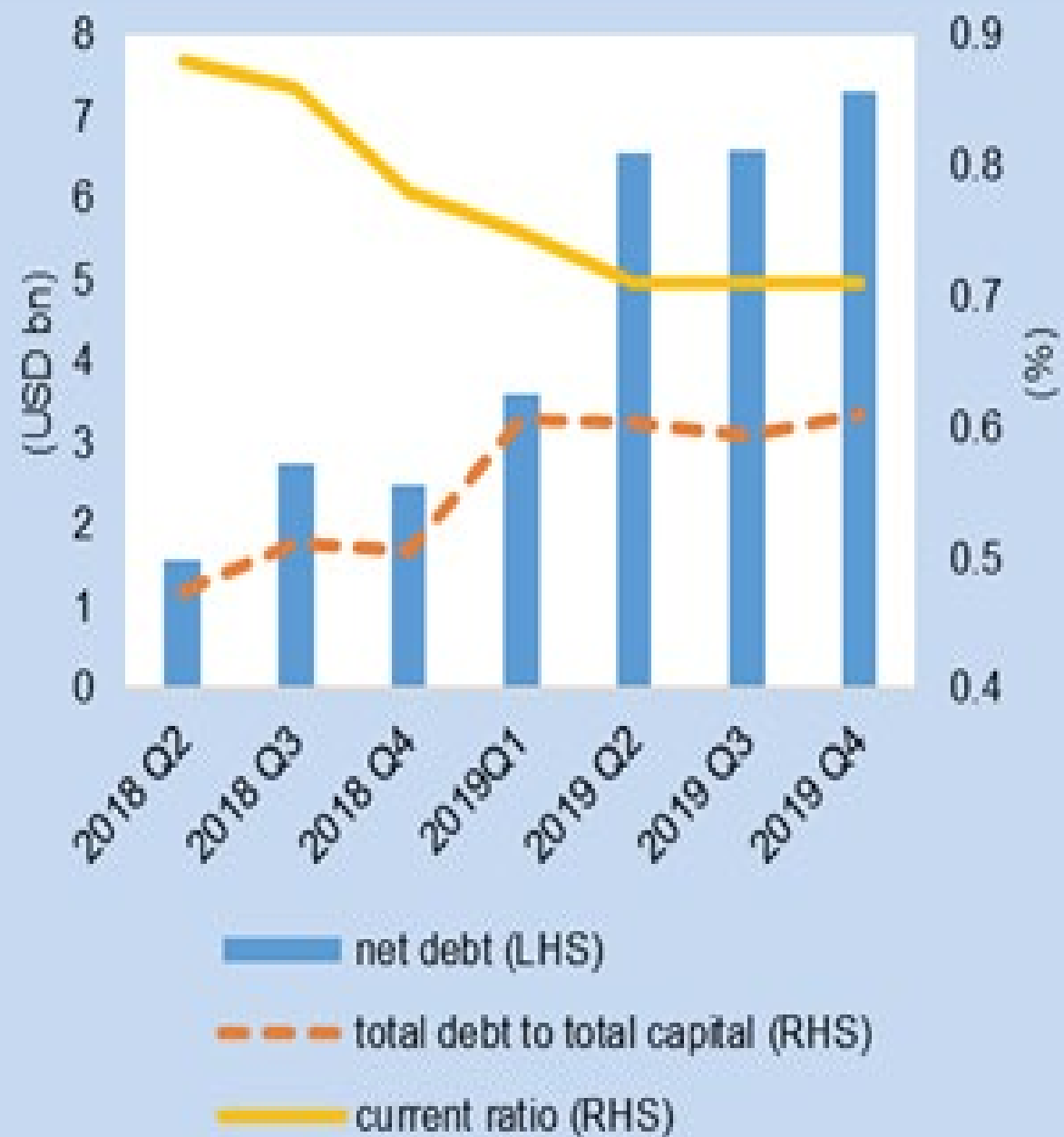
Source: <https://fred.stlouisfed.org/series/BAMLH0A0HYM2>



NUS-CRI Agg 1-year PD for globally listed airlines and Asia-listed airlines. *Source: NUS-CRI*



NUS-CRI Agg Forward 1-year PD for globally listed airlines based on information available in Mar 2020 and Dec 2019. *Source: NUS-CRI*



Financial analysis for globally listed airlines; Figure 2b: Brent Crude Price. *Source: Bloomberg*

S&P 500 Airlines + Jetblue	Free Cash Flow	Stock buybacks	Buybacks/FCF
	past 10yrs in mln		
Southwest Airlines	\$15,103	\$10,650	71%
Alaska Air Group	\$4,948	\$1,590	32%
Delta Air Lines	\$23,186	\$11,430	49%
United Airlines Holdings	\$11,526	\$8,883	77%
American Airlines Group	-\$7,935	\$12,957	N/A
JetBlue Airways	\$2,347	\$1,771	75%
Totals	\$49,175	\$47,281	96%
			Source: FactSet

4. Drawdowns of bank credit lines

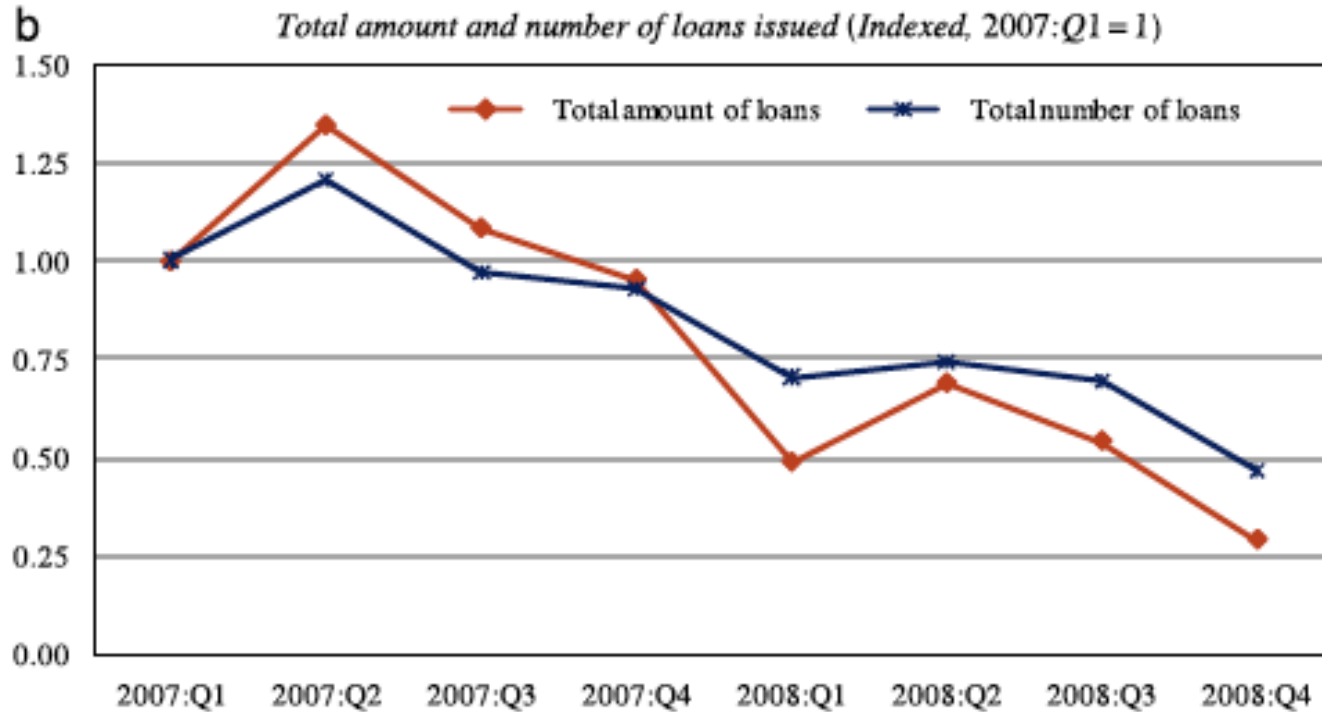
Drawdowns largest for weakest firms in times of weak equity market performance;
Liquidity stress similar to worst decline of past 20 years manageable for banks;
Greater equity market declines being witnessed warrant careful advance planning

Borrowers are drawing down heavily on bank lines of credit anticipating that market sources of funding may dry up or get costlier, especially short-term commercial paper, creating stress on bank balance-sheets and liquidity conditions and contagion that could aggravate if stress worsens

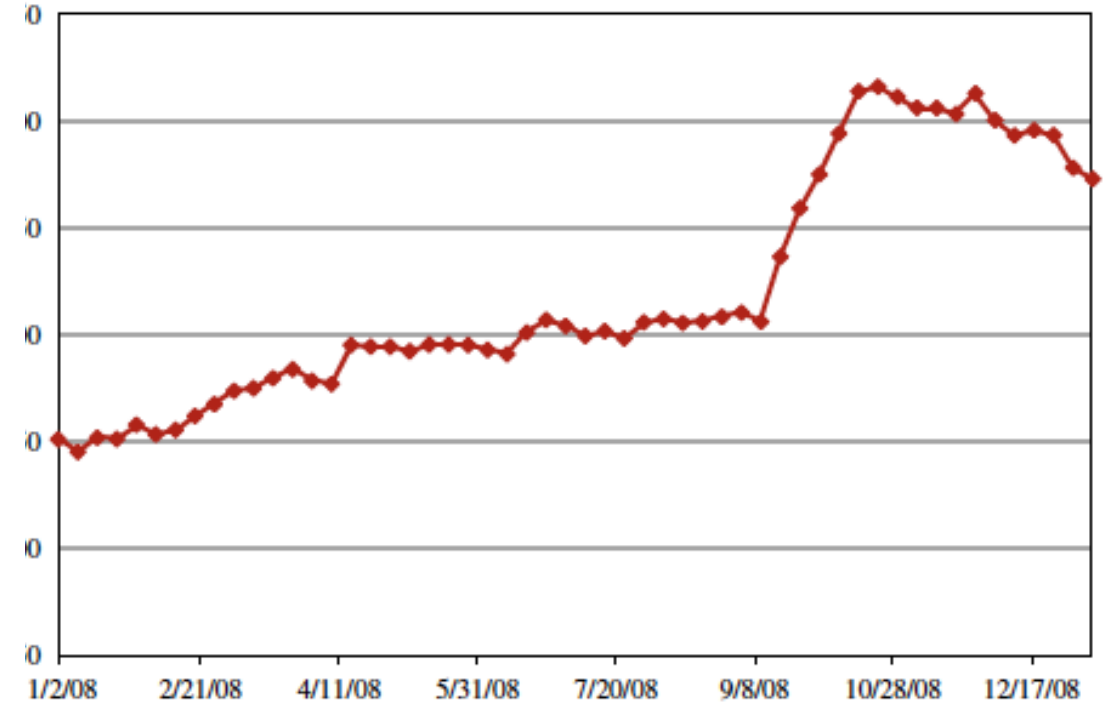
(<https://www.bloomberg.com/news/articles/2020-03-12/dash-for-cash-is-on-as-corporate-titans-draw-down-credit-lines>):

“Companies are maxing out unused credit lines for extra liquidity. U.S. banks had a total of \$2.5 trillion of credit commitments to companies that weren’t used at the end of 2019, with two-thirds of provided by JPMorgan, BofA, Citi & Wells Fargo.”

Lookback at bank credit line drawdowns during the GFC



Number and amount of NEW loans issued



Amount of loans on banks' balance sheets

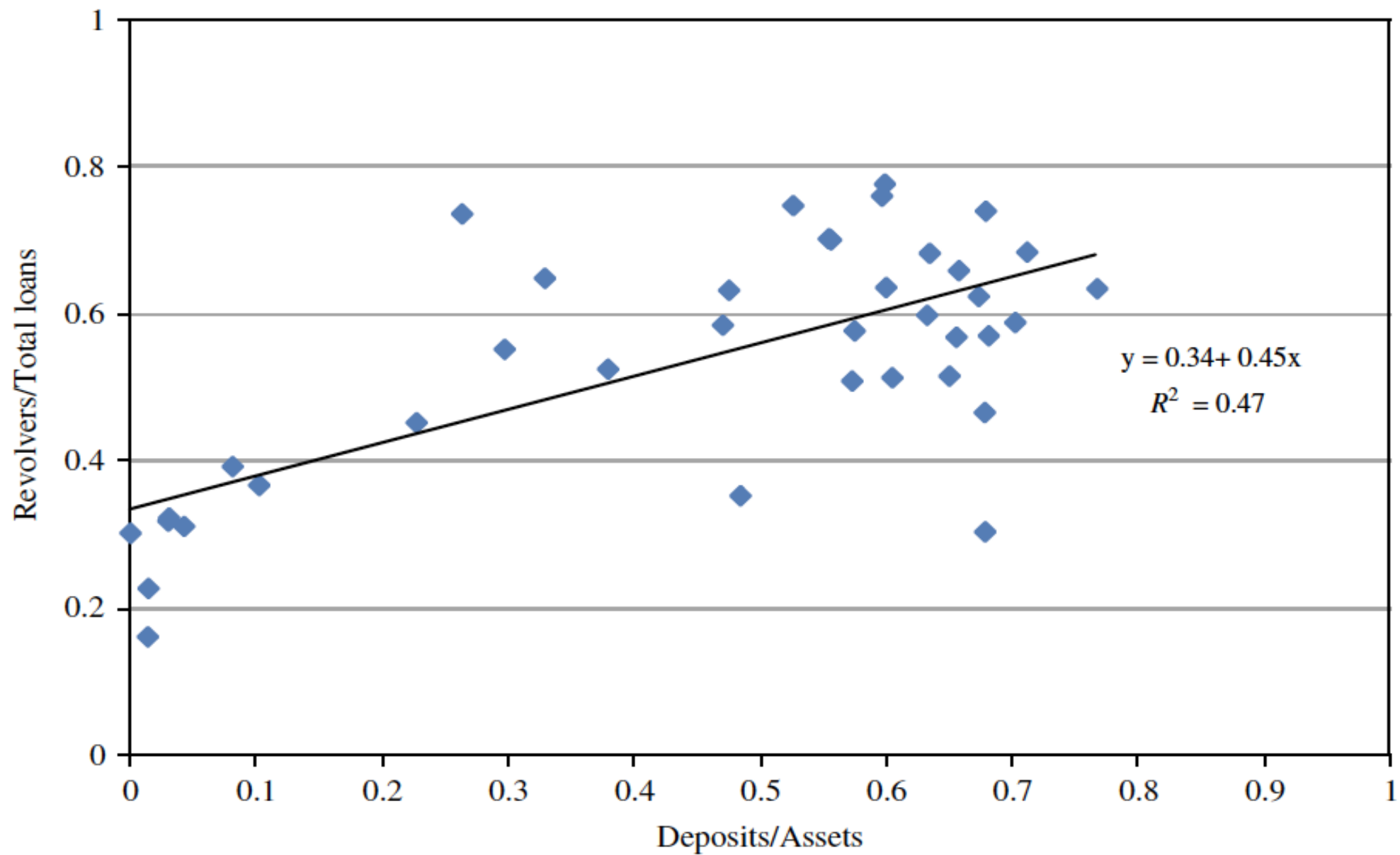


Fig. 6. Relation between Deposits/Assets and Revolvers/Total loans.

Table III: Usage of credit lines and economic performance

Panel A: Measuring economic performance via equity returns

Quintile	IG	Non-IG	Not rated	Total
1 (Highest equity return)	18.45%	29.89%	28.62%	25.23%
2	20.18%	28.57%	29.65%	25.98%
3	22.64%	24.79%	32.60%	27.19%
4	19.97%	28.35%	34.53%	27.83%
5 (Lowest equity return)	20.20%	36.04%	43.20%	33.23%
Q5 – Q1	1.75%	6.15%**	14.58%***	8.00%***
t-stat	(1.07)	(2.35)	(7.71)	(6.71)

Panel B: Measuring economic performance via changes in profitability (EBITDA/sales)

Quintile	IG	Non-IG	Not rated	Total
1 (Increasing profitability)	21.56%	32.46%	33.74%	29.63%
2	19.88%	33.10%	31.82%	28.35%
3	18.58%	28.76%	32.87%	27.48%
4	20.72%	31.75%	31.81%	28.31%
5 (Decreasing profitability)	24.27%	36.87%	39.93%	34.33%
Q5 – Q1	2.71%	4.41%*	6.18%***	4.70%***
t-stat	(1.58)	(1.88)	(3.94)	(4.39)

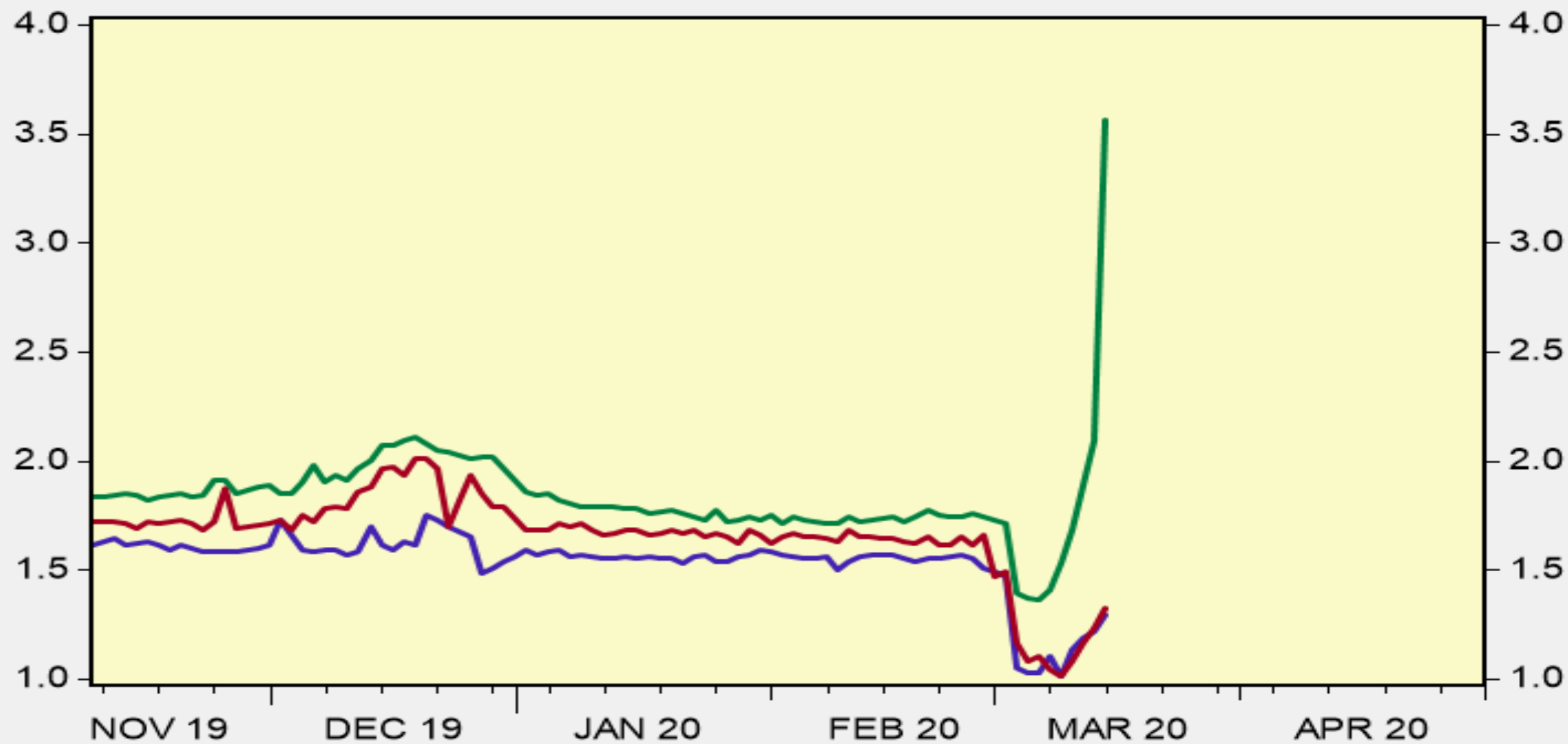
Credit line draw-downs are sensitive to stock returns

- U.S. firms are highly sensitive to their stock price performance while determining whether to use their credit lines
 - They care about the overall market performance (S&P 500) as well as their “excess return” above the market
- For example: 40% decline in S&P 500 index increases the expected usage rates by 8pp, an increase of the average usage rate by $\frac{1}{3}$
- Usage rates of European firms are less sensitive to the stock market performance (and only to the overall market performance)

Importance of the commercial paper market

- A short-term, unsecured credit market for rated non-financial firms that directly finances a wide range of economic activity
 - Short-term rating: High rating (A1/P1), lower rated firms (A2/P2)
- Credit lines work as a “backstop” if firms experience problems in refinancing their outstanding commercial paper.
 - This form of credit “enhancement” enables the commercial paper to acquire credit rating that makes it eligible for investment by money-market funds.
- Changes in the commercial paper rates can be used to gauge stress in the commercial paper market

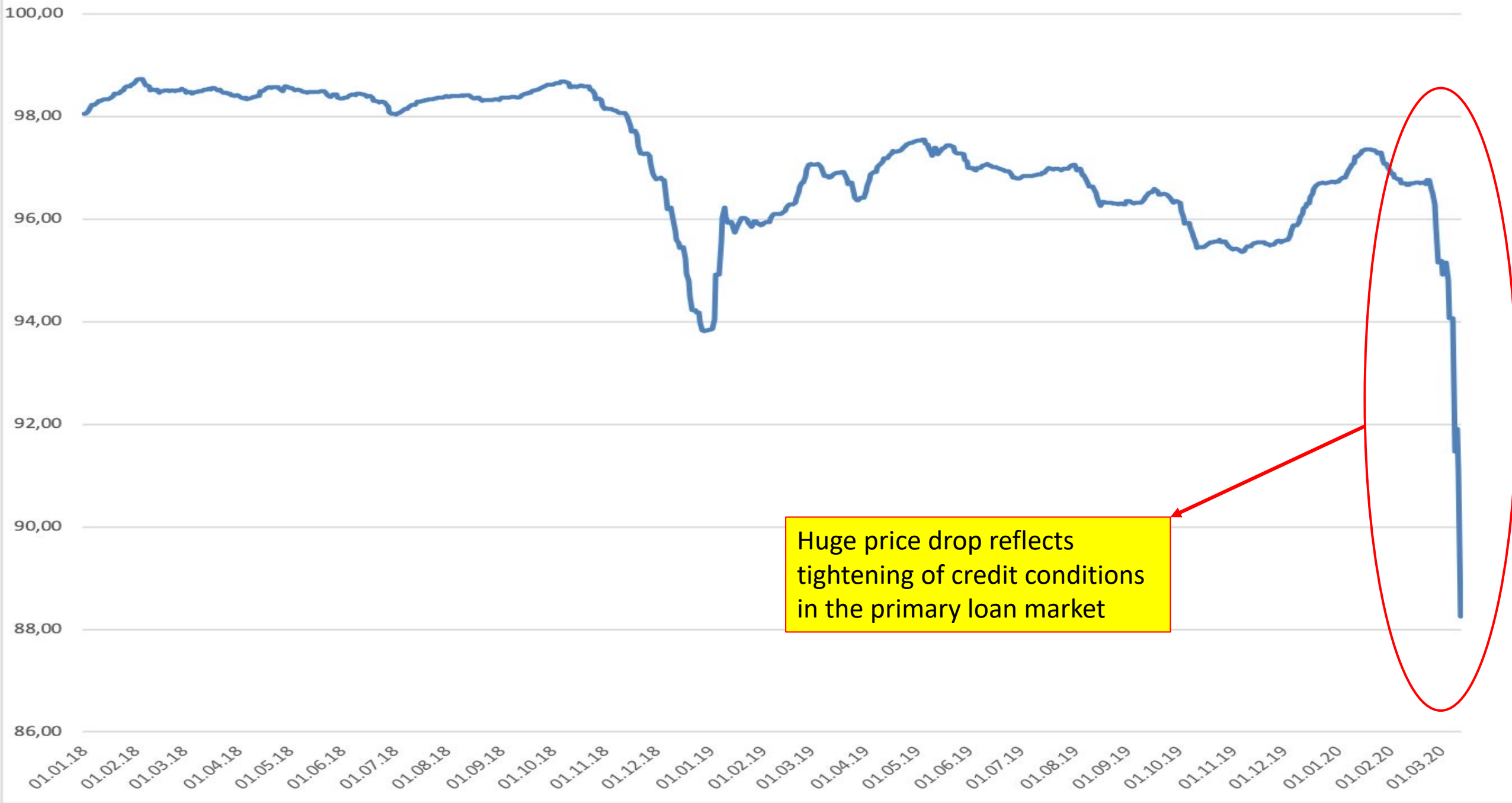
1-Month AA Asset-Backed Commercial Paper (% per annum)
1-Month AA Nonfinancial Commercial Paper (% per annum)
1-Month A2/P2/F2 Nonfinancial Commercial Paper (% per annum)



Source: Federal Reserve Board/Haver Analytics

S&P U.S. Leveraged Loans

Source: LSTA index of over \$1.3 trn loans



Liquidity stress test around undrawn LCs

- Sample
 - 2,425 U.S. non-financial firms with information on undrawn credit lines as of Q4 2019 (Source: Capital IQ)
 - Concentrated in manufacturing (54%), 95% operating in 5 industries
- Quantify liquidity insurance
 - Total undrawn credit lines: **USD 958 billion**
 - 57% provided to firms with BBB-rating or non-investment-grade rating
 - They might be more likely to draw down their credit lines when credit markets tighten
 - Commercial paper outstanding: USD 131 billion
 - Fed established a Commercial Paper Funding Facility on March 17, 2020 of USD 10 billion as protection against rollover risk

Stress Scenario 1: Firms will experience a stock performance consistent with last two preceding recession periods.

Rating	Credit Line	%	Draw-down rate	Expected draw-down
Unrated	\$146,807	15.3%	43.2%	\$63,421
AAA/AA/A	\$257,444	26.9%	20.2%	\$52,004
BBB	\$323,255	33.7%	20.2%	\$65,298
Non-IG	\$230,753	24.1%	36.0%	\$83,164
	\$958,260			\$263,886

Stress Scenario 2: Firms will use credit lines as they did at the end of 2008

Rating	Credit Line	%	Draw-down rate	Expected draw-down
Unrated	\$146,807	15.3%	39.2%	\$57,549
AAA/AA/A	\$257,444	26.9%	17.0%	\$43,843
BBB	\$323,255	33.7%	23.8%	\$76,902
Non-IG	\$230,753	24.1%	28.5%	\$65,788
	\$958,260			\$244,081

How big is this liquidity stress?

- We look at the 100 largest U.S. banks at the end of 2019, their capitalization and undrawn credit exposure
- If commitments are drawn down as in stress scenario 1, bank Tier 1 capital ratio (as % of risk-weighted assets) drops on average from 12.7% to 11.8%
 - Given better capitalization compared to 2008 and liquidity assistance from the Fed, this does not appear to become a solvency problem
- Extreme adverse scenario? A full draw-down reduces Tier 1 ratio to 10.7%
 - At this point, likely further erosion of their capital through higher default rates
 - Such scenario might bring banks closer to their regulatory minimum requirement
 - Advance planning: temporarily relax capital standards; restrict payout to save capital

Data collected by S&P Global Market Intelligence up to March 20, 2020 based on public company filings shows that 71 firms have almost fully drawn down their credit lines since March 5, 2020 (USD 73 billion out of USD 86 billion commitment).

The draw-downs are concentrated in the most affected industries (Hotels, Restaurants and Retail) and concentrated among few large banks.

5. Systemic Risk (see NYU-Stern [VLAB SRISK ranking](#))

Global SRISK has risen since GFC (Asia, China in particular); in COVID-outbreak, US SRISK has risen the most; conclusions line up with other financial stress measures

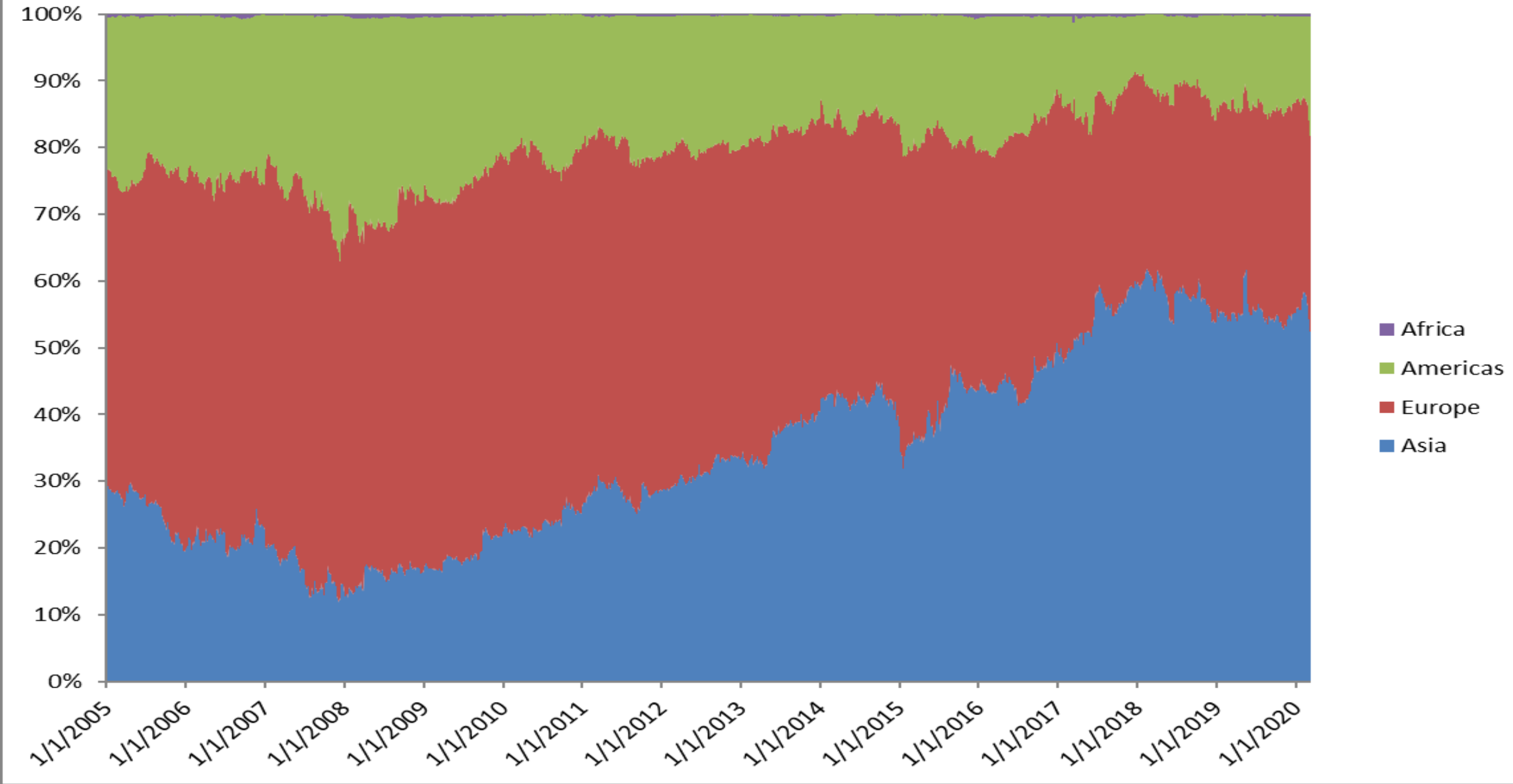
Global SRISK (US\$ million)

Source: VLAB, NYU Stern



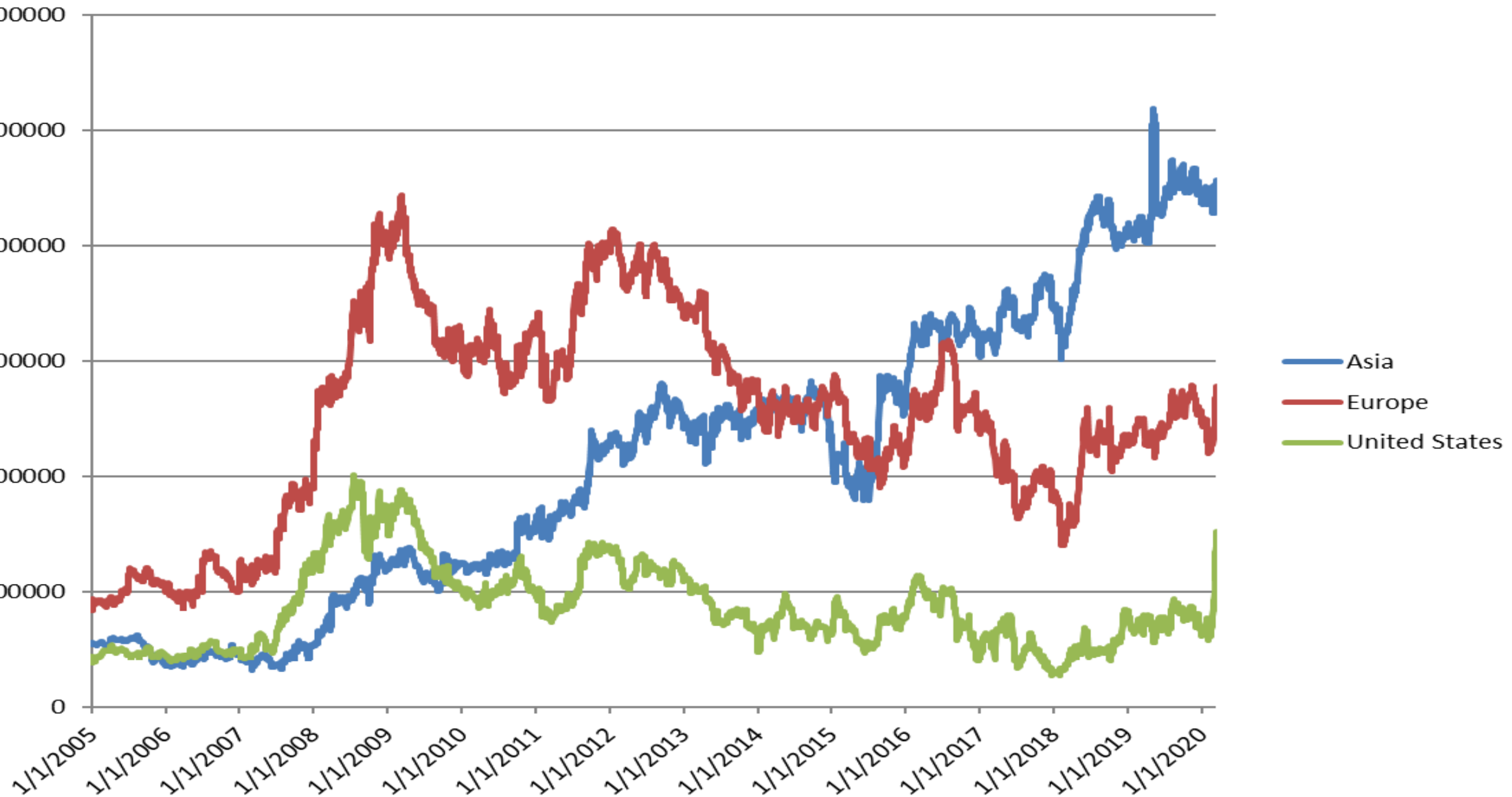
Proportion of Global SRISK

Source: VLAB, NYU Stern

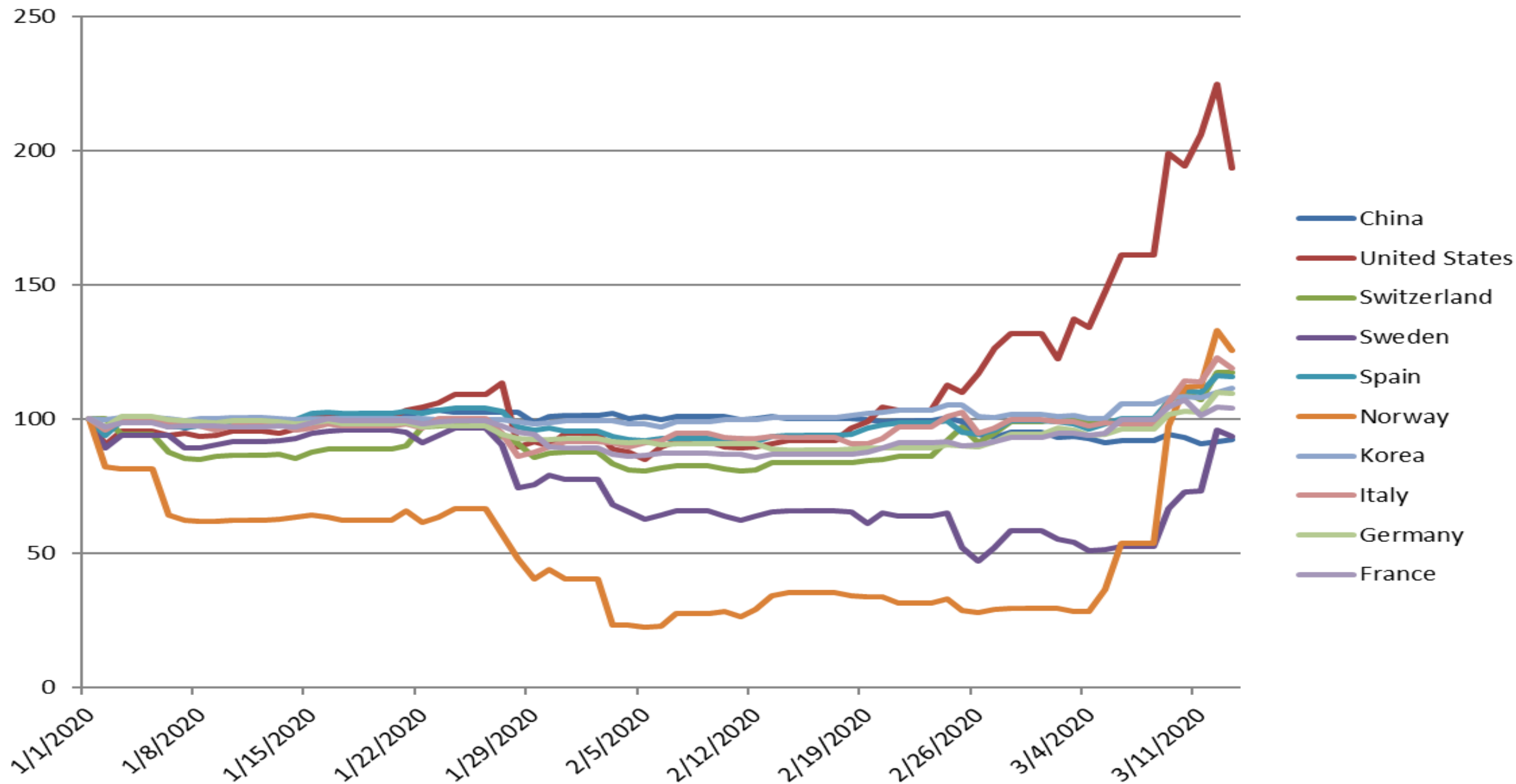


SRISK (US\$ million)

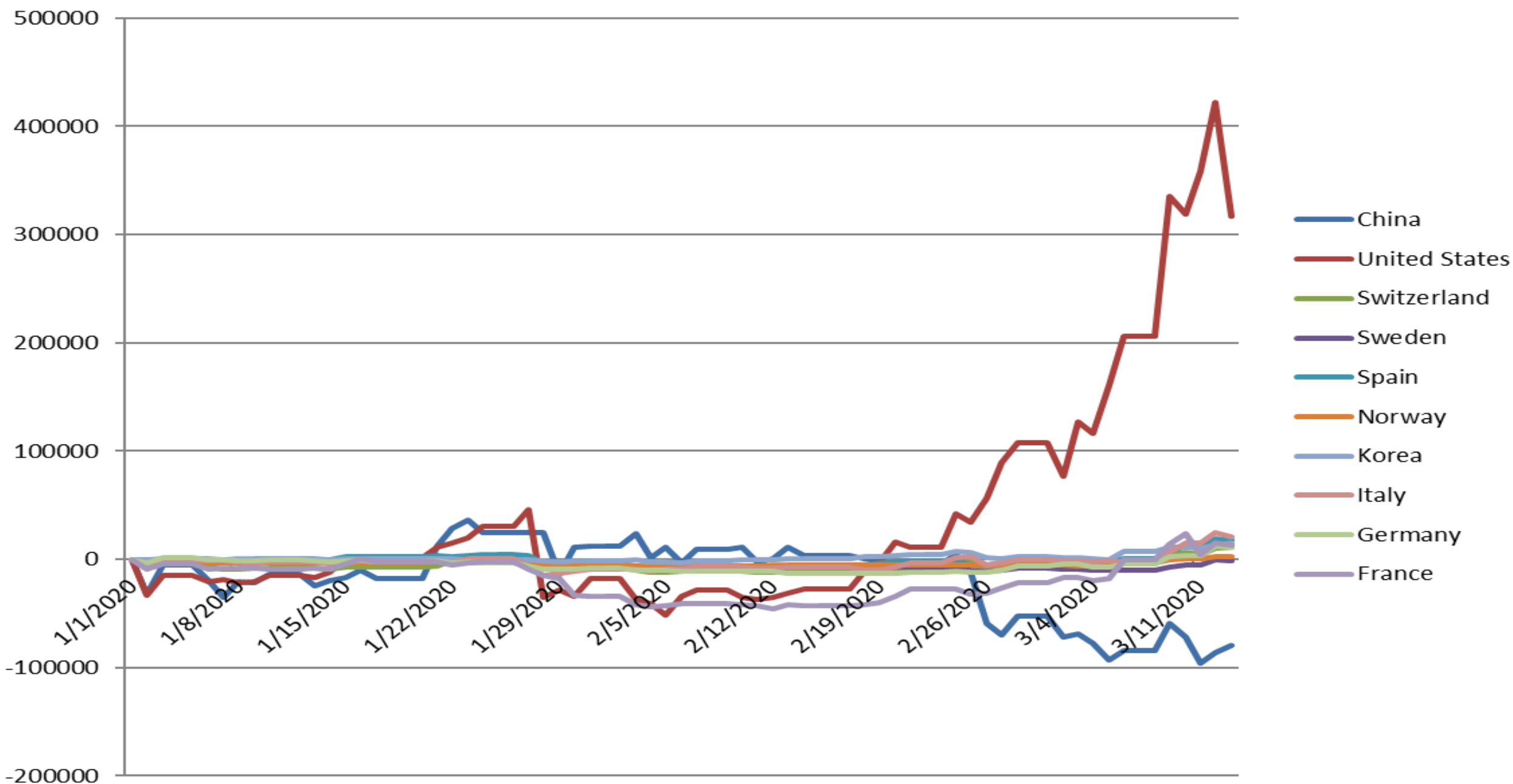
Source: VLAB, NYU Stern



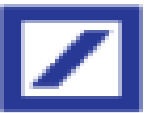
Source: VLAB, NYU Stern



Source: VLAB, NYU Stern



US financial stress near 2011 levels



Source: OFR, Bloomberg Finance LP, Haver Analytics, DB Global Research

The result of the rising vulnerability of the financial sector, notably in the United States, has been that the LIBOR-OIS spread, considered a measure of counterparty or credit risk in financial transactions among top banks and dealers, blew out to 80 basis points by 14th March, 2020.

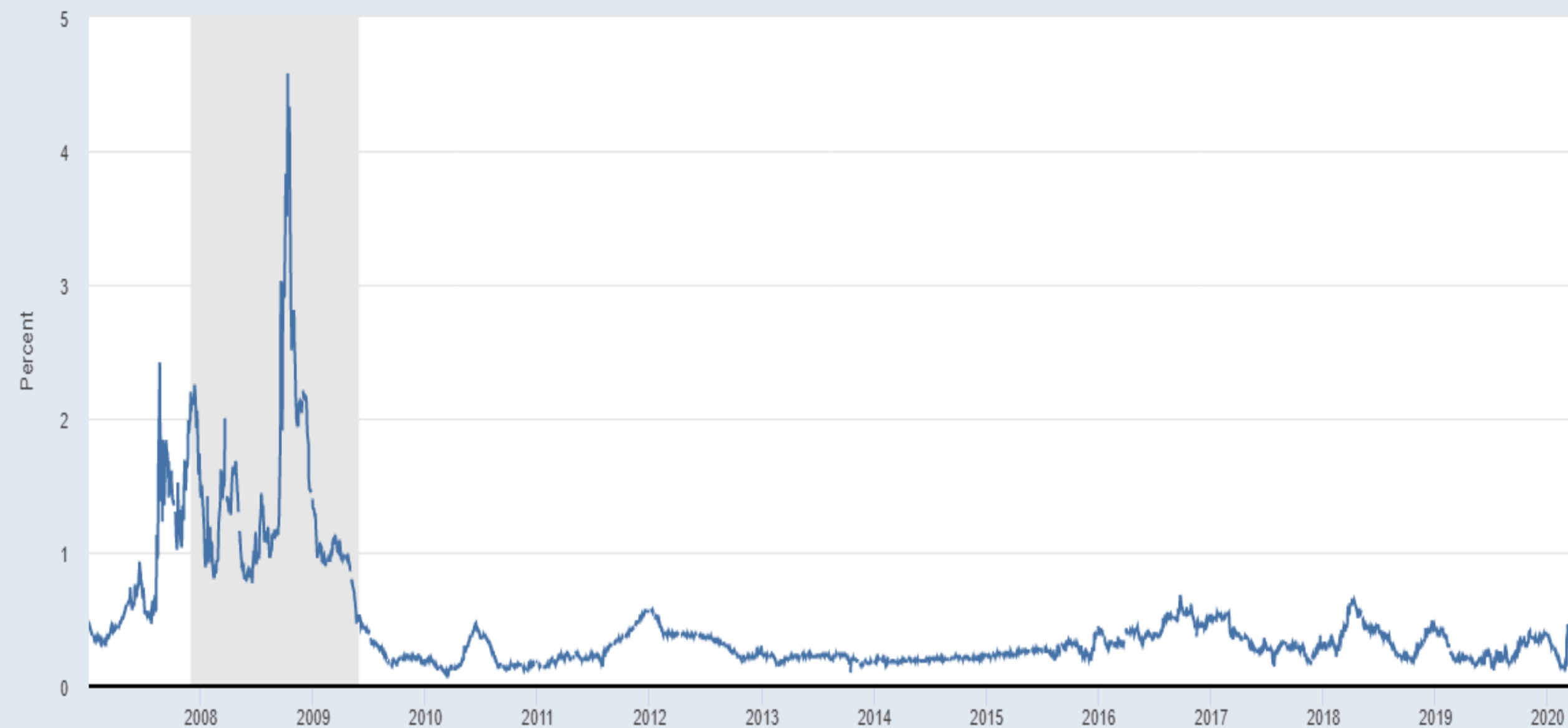
LIBOR-OIS spread stabilized only after the Federal Reserve rate, liquidity and asset-purchase actions over the weekend (16th March, 2020) to 35 basis points.



Shaded areas indicate U.S. recessions

Source: Federal Reserve Bank of St. Louis

fred.stlouisfed.org

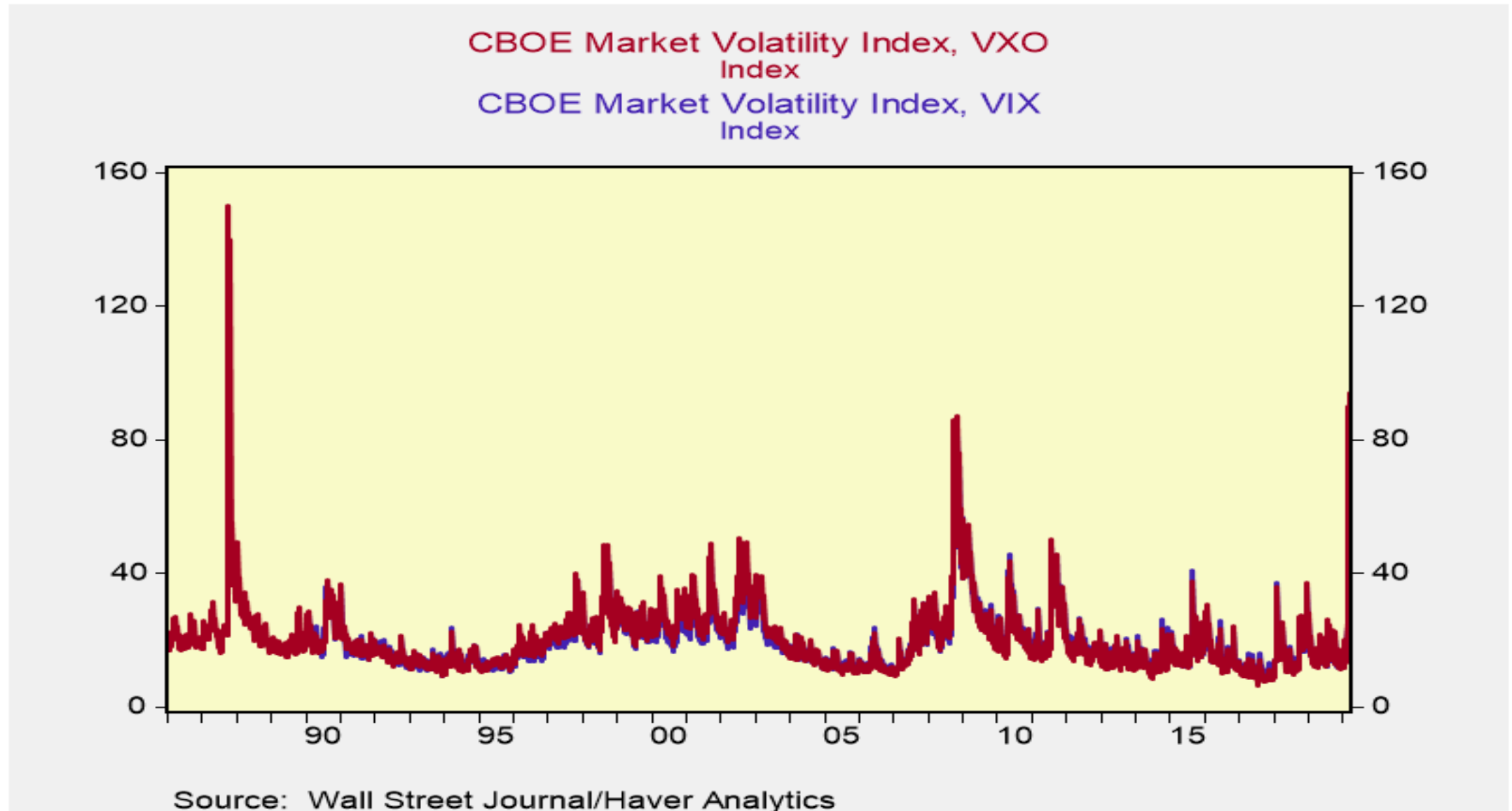


Shaded areas indicate U.S. recessions

Source: Federal Reserve Bank of St. Louis

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VIX not yet at 1987 level (and is below realized vol)

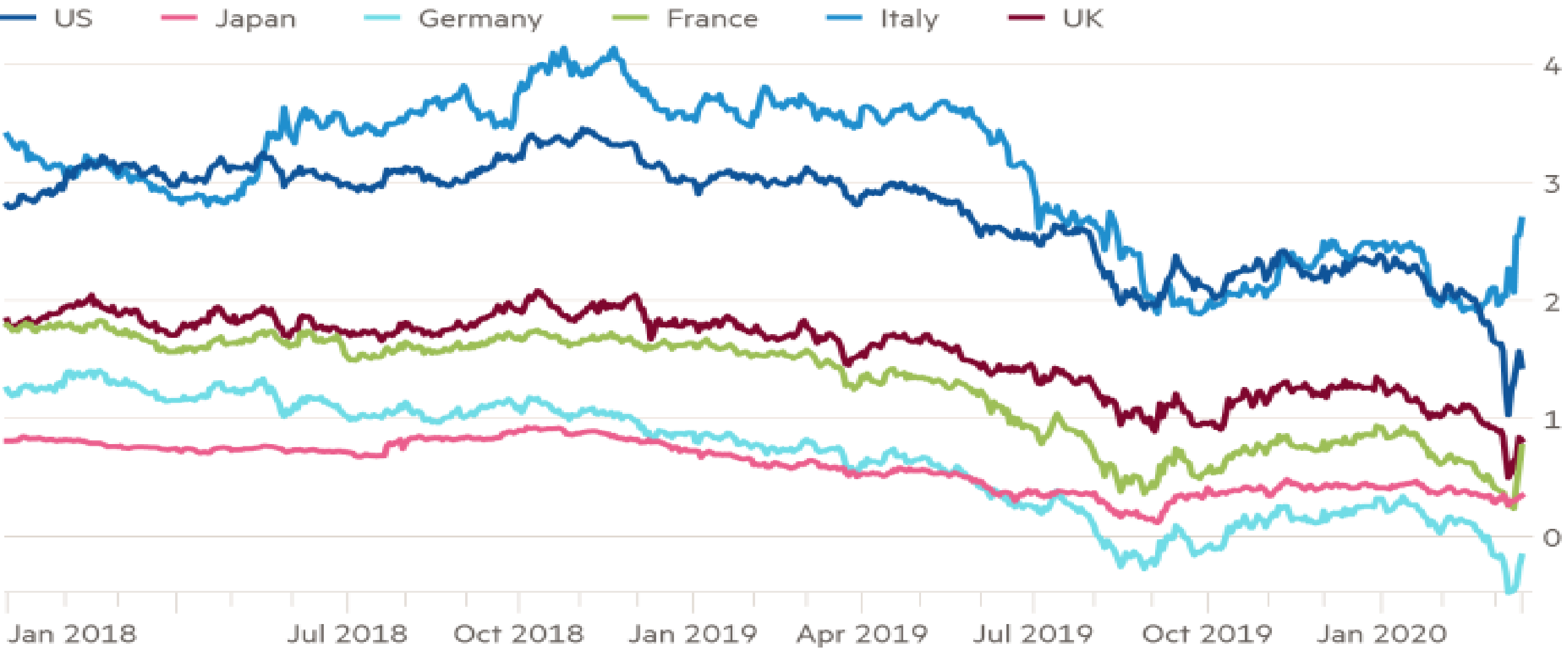


6. Government Bonds

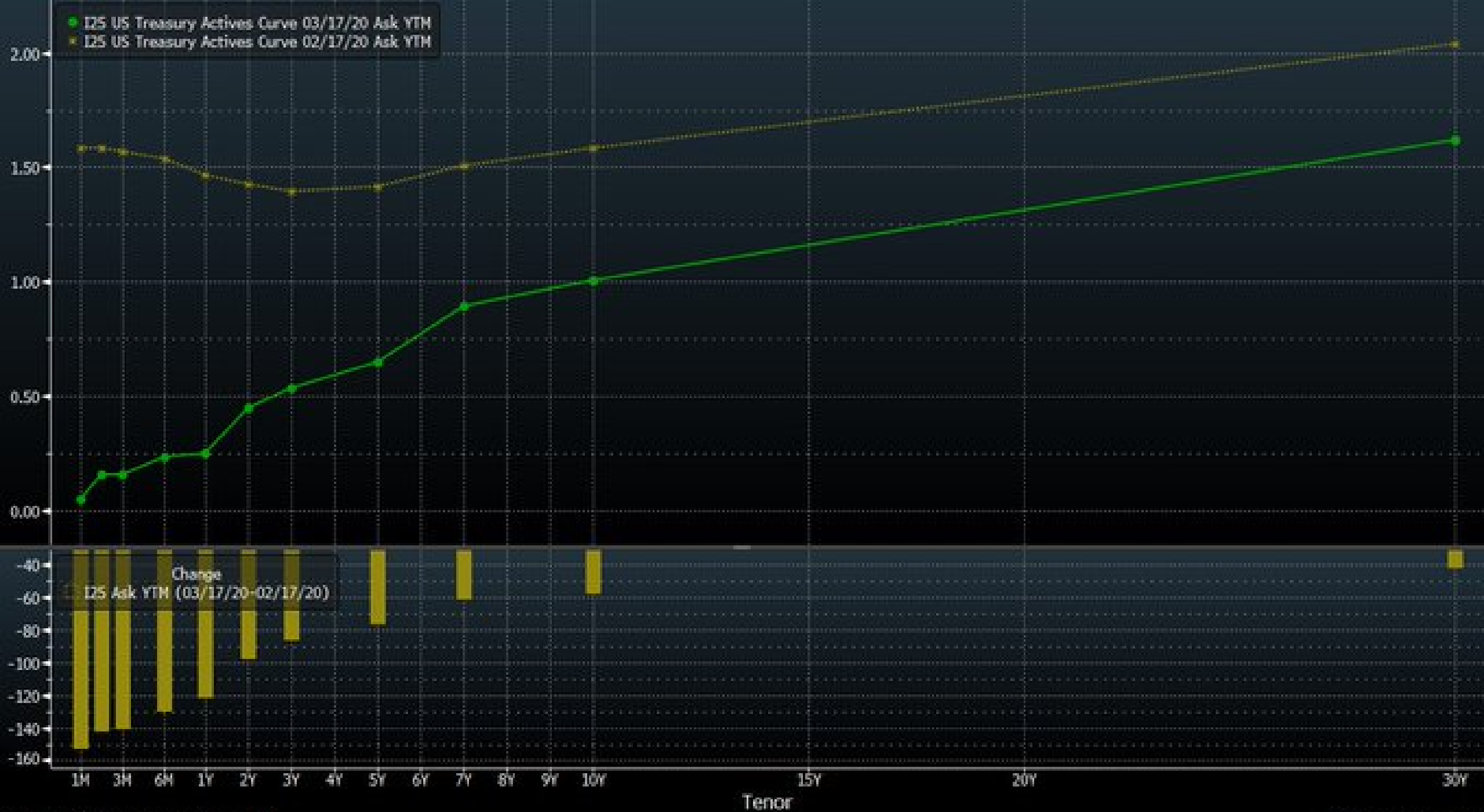
Overall reduction in safe-haven yields due to flight to quality, but reversals past month with anticipation of fiscal measures; nevertheless, heightened dispersion across countries (safe havens vs EMs, oil-importer vs oil-exporter, FPI flow-sensitive or not) and within-country

Except for Italy, long-term borrowing costs have plummeted

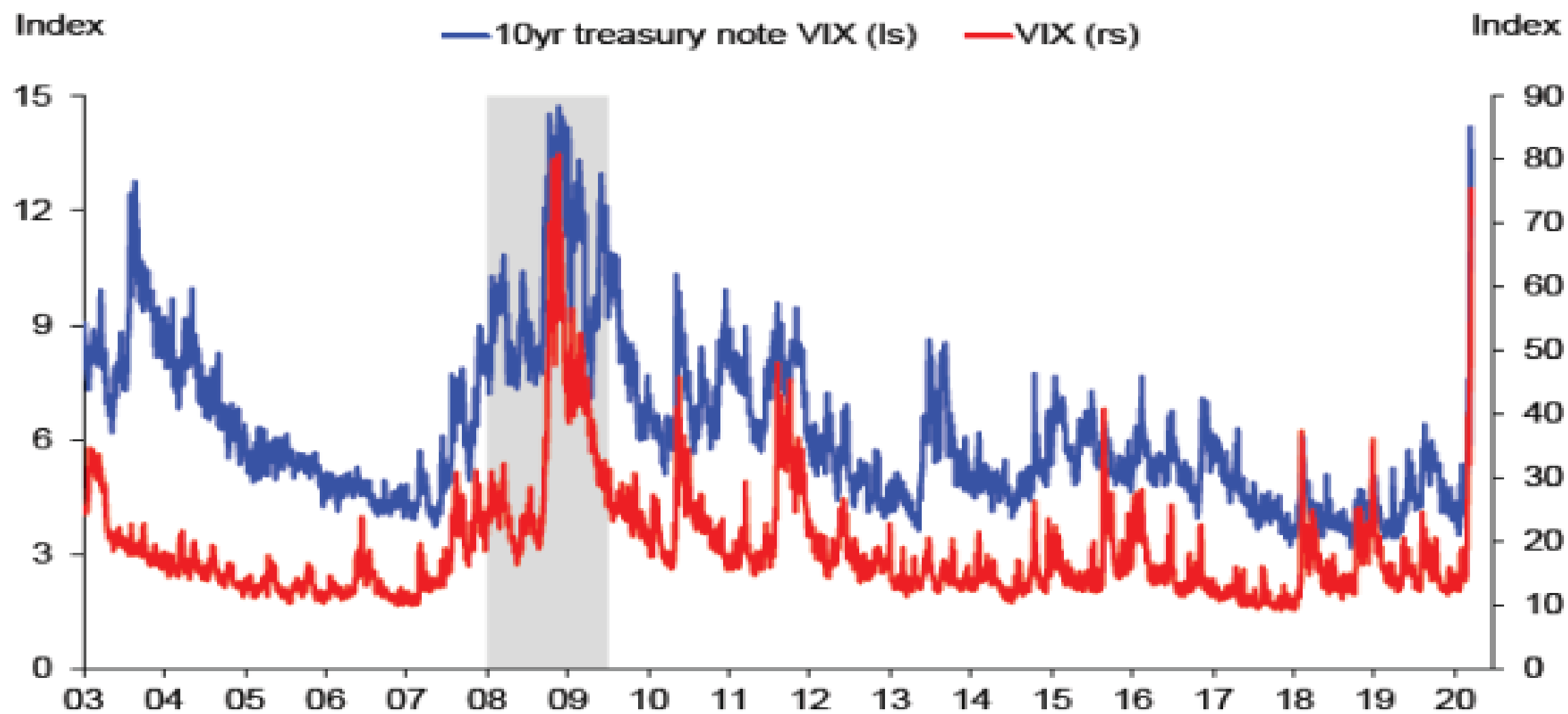
30-year government bond yields(%)





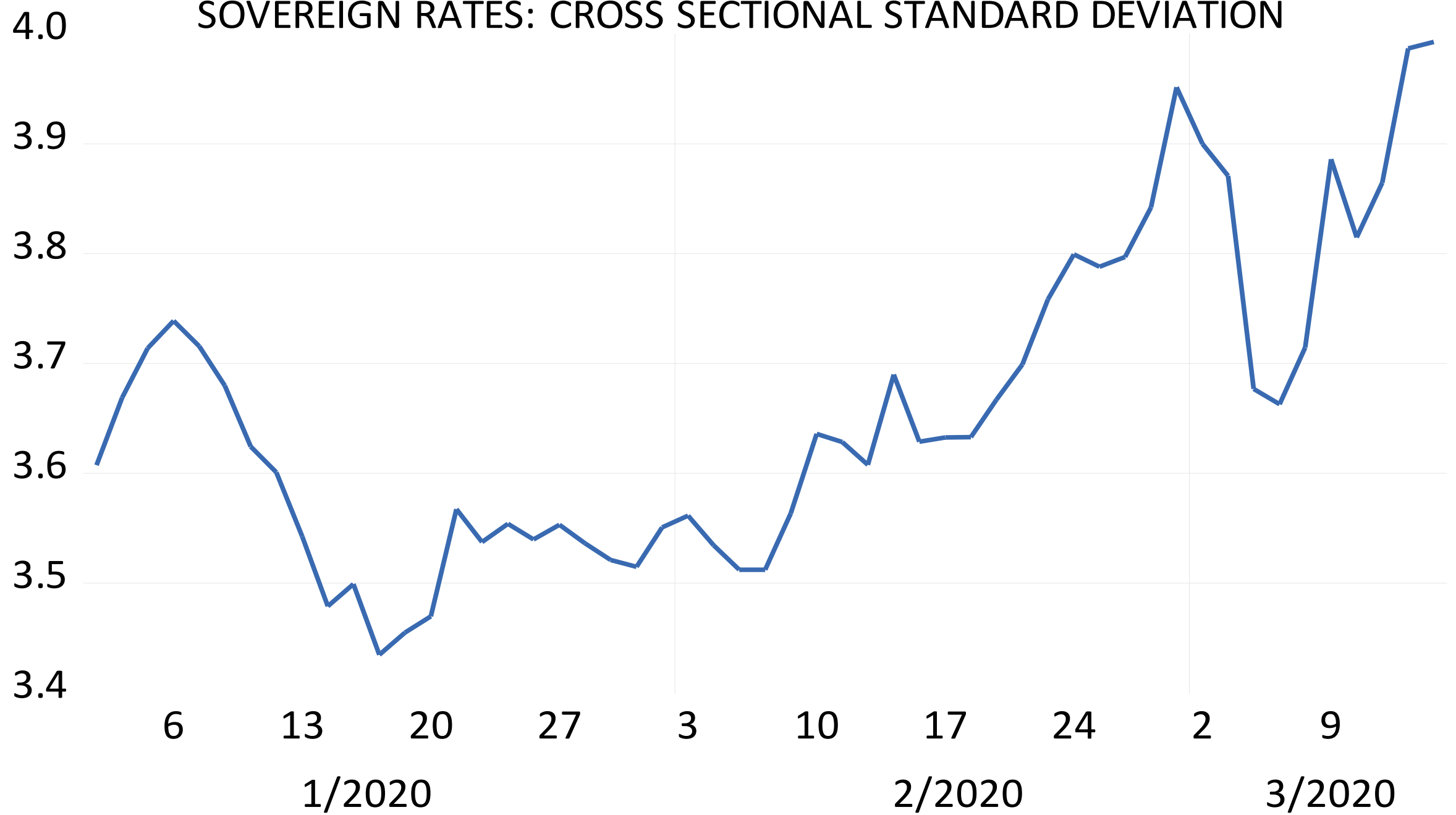


Rates and equity vol at 2008/2009 levels



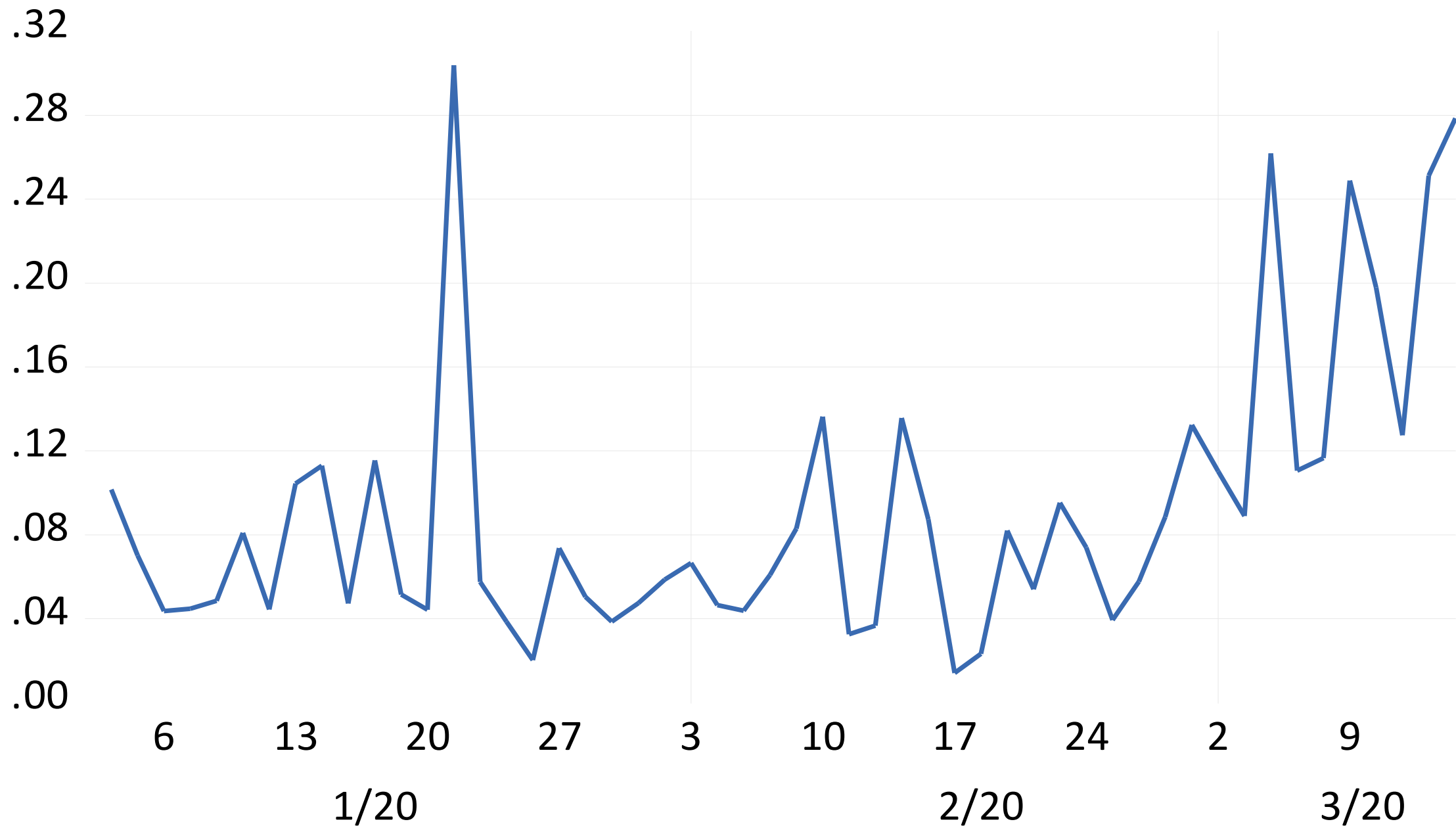
Source: CBOE, WSJ, Haver Analytics, DB Global Research

SOVEREIGN RATES: CROSS SECTIONAL STANDARD DEVIATION

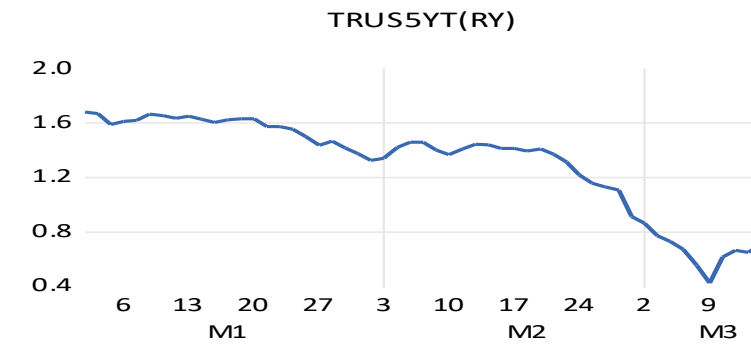
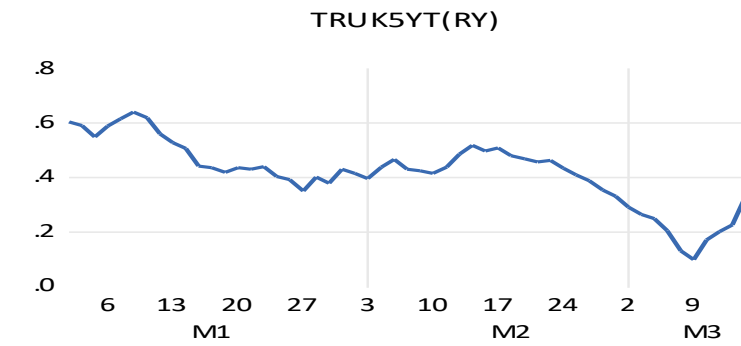
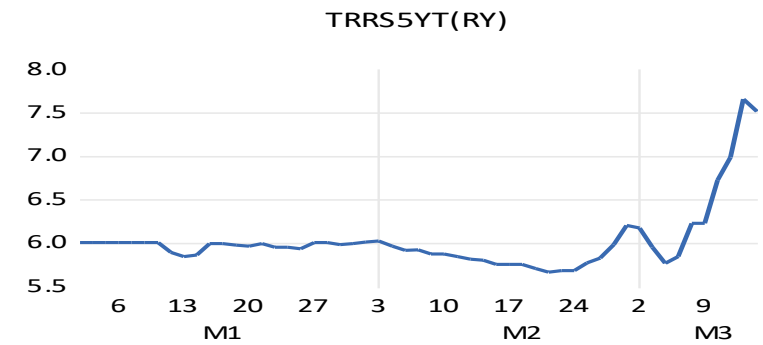
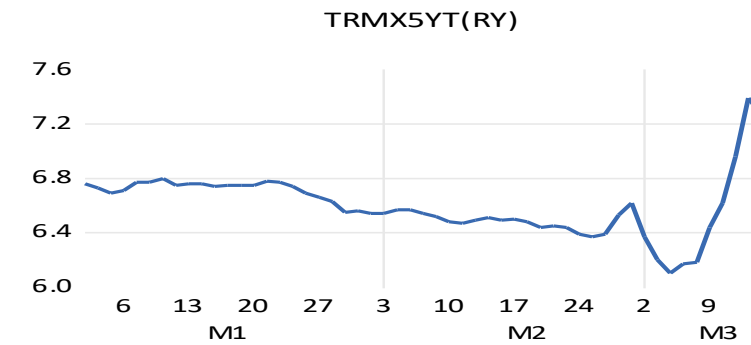
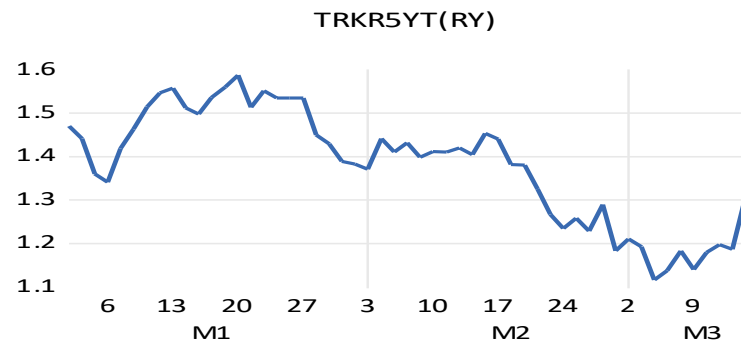
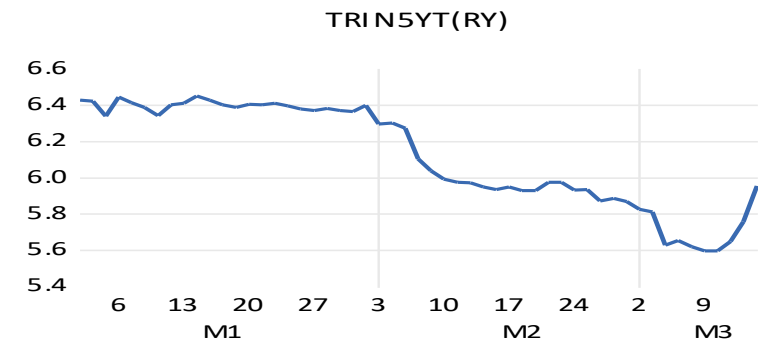
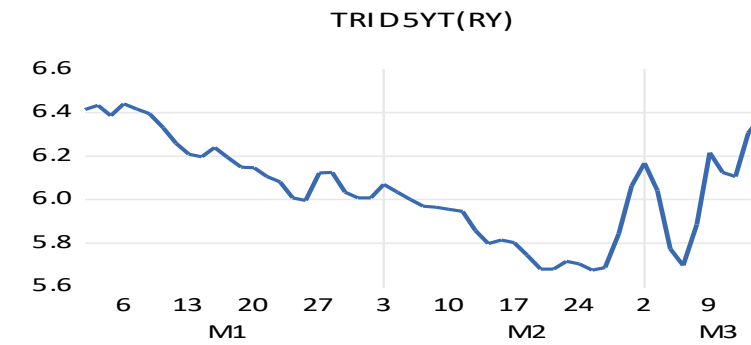
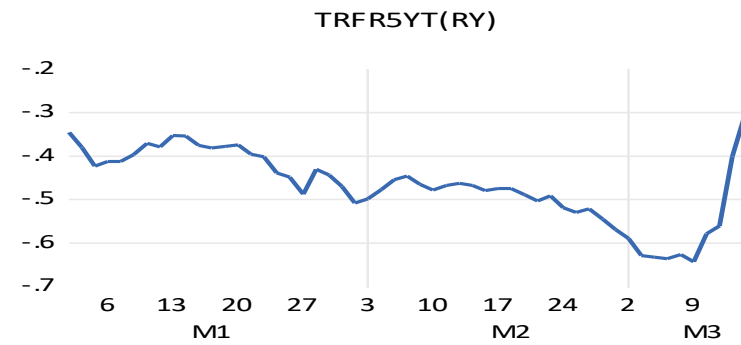
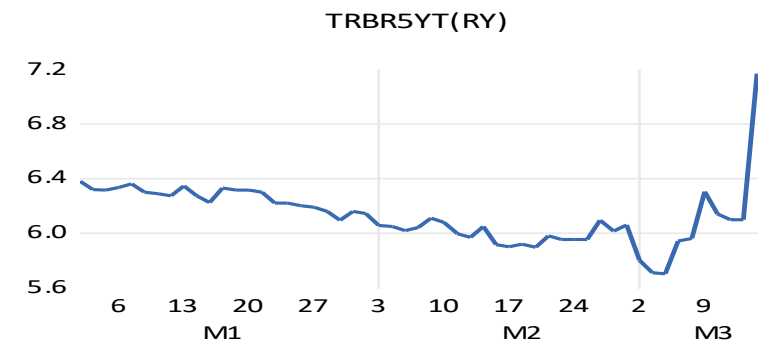
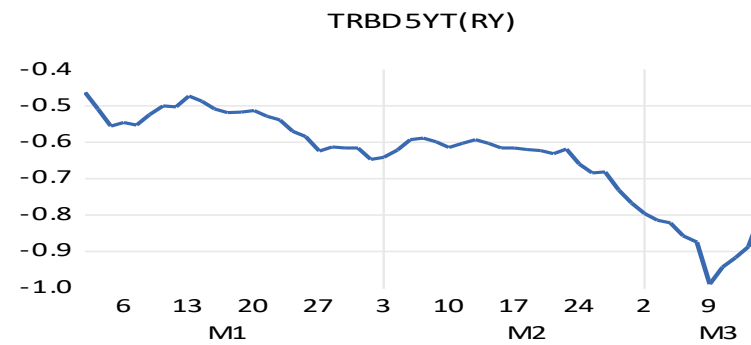
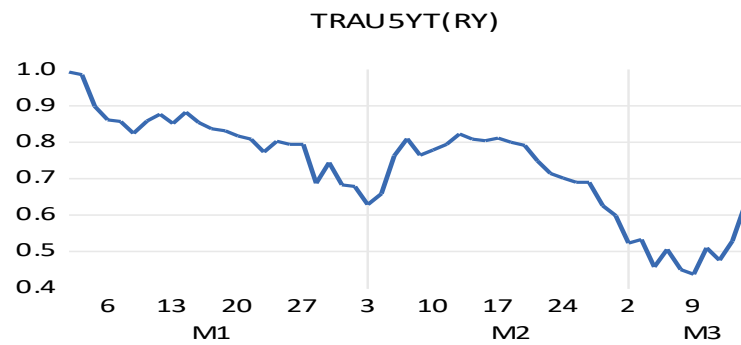


Source: VLAB, NYU Stern

SOVEREIGN RATE CHANGES: CROSS SECTIONAL STANDARD DEVIATION

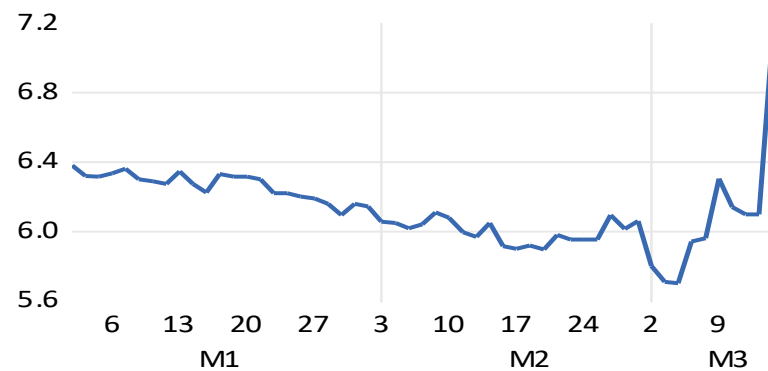


Source: VLAB, NYU Stern

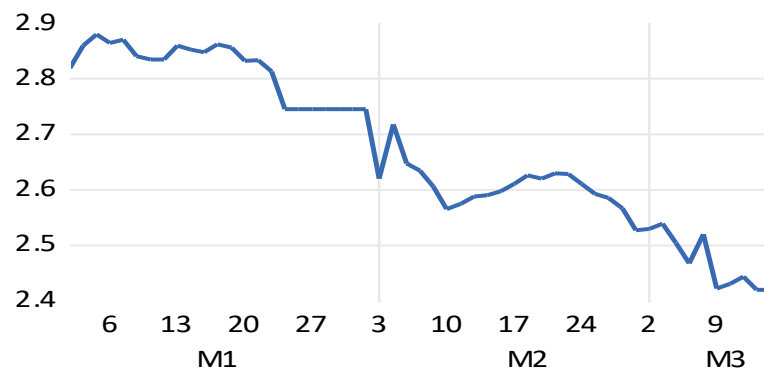


Source: VLAB, NYU Stern

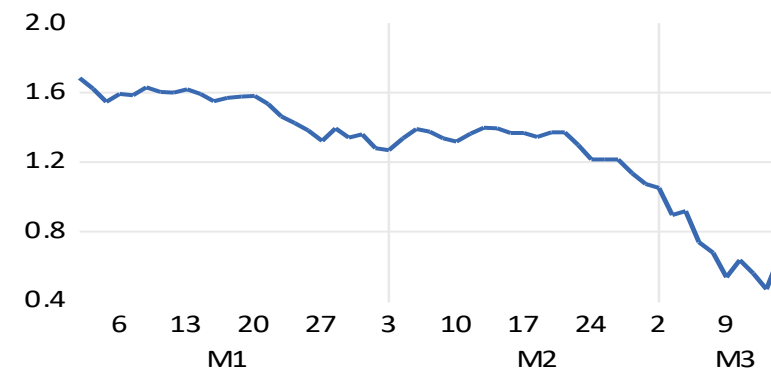
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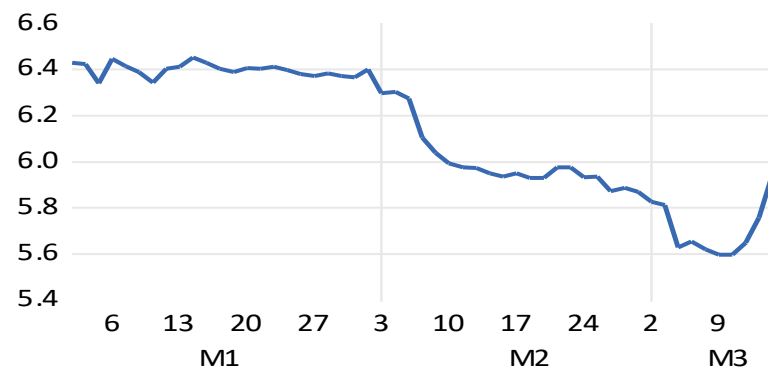
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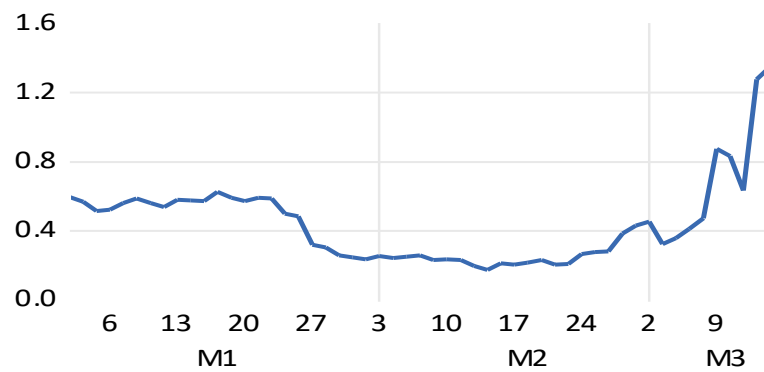
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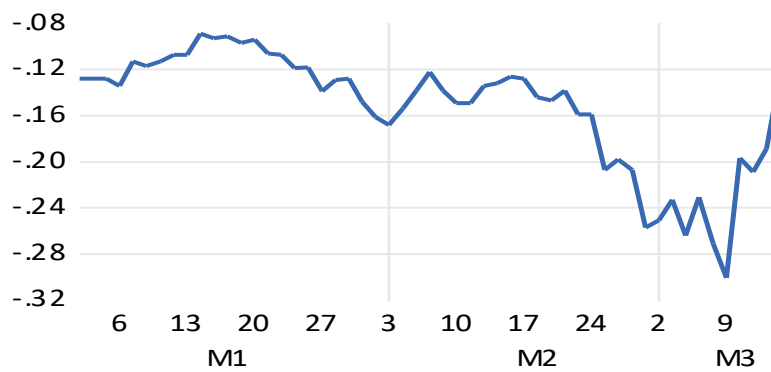
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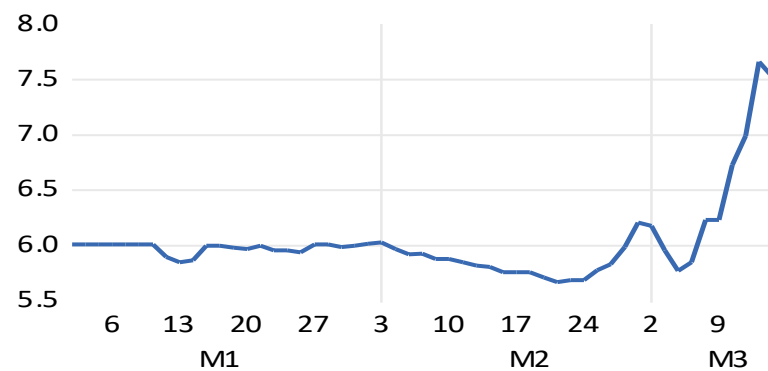
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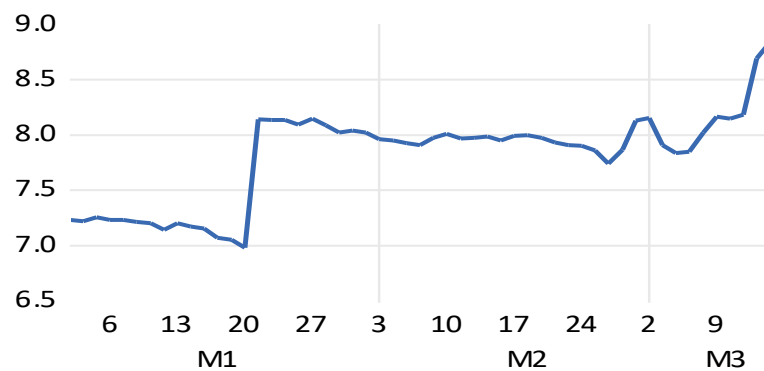
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TRRS5YT(RY)



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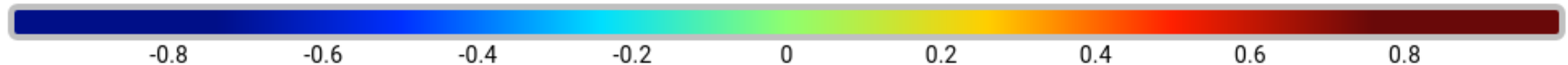
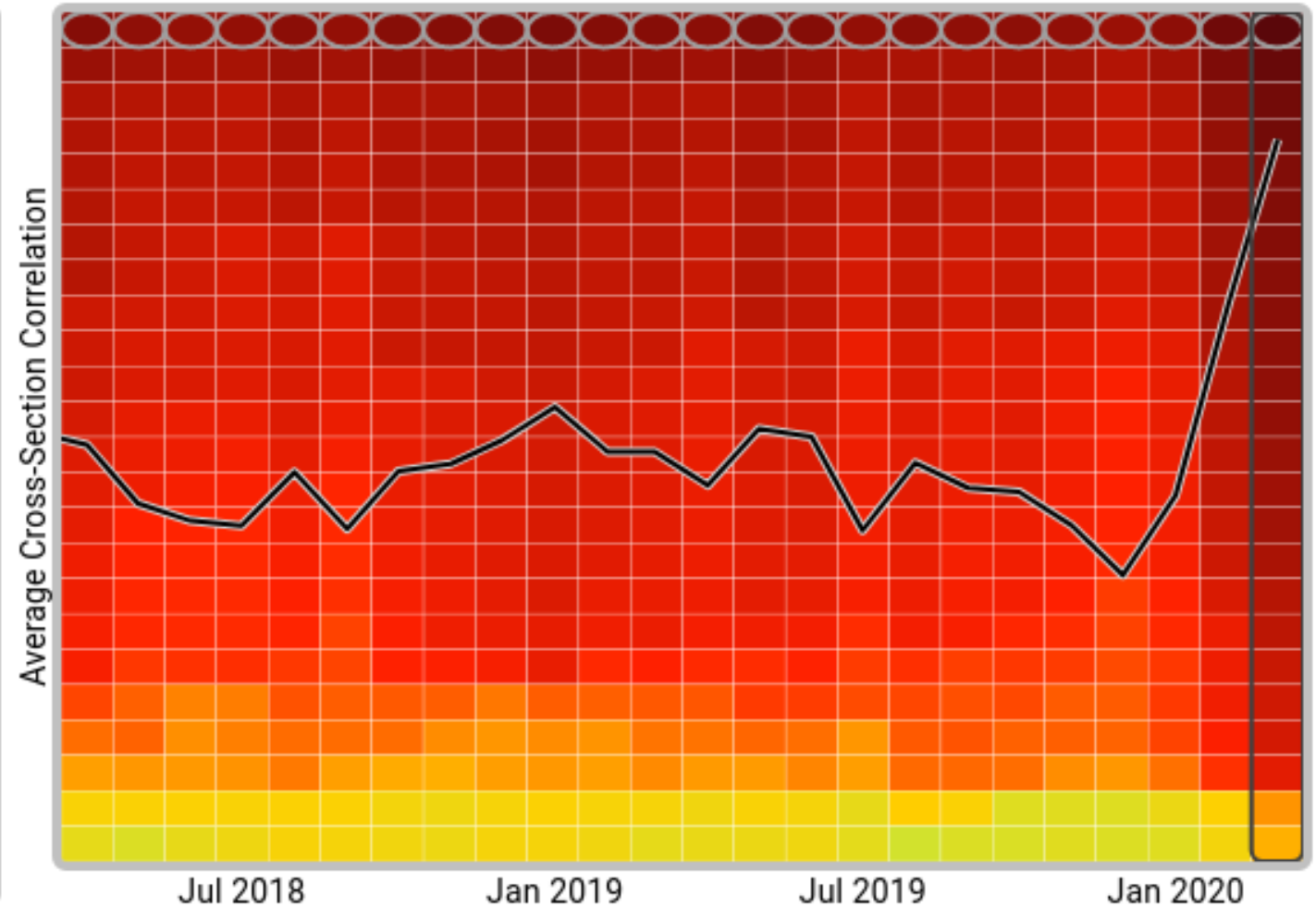
TRTK5YT(RY)



7. Cross-market correlations (see [NYU Stern VLAB](#))

Rising equity market move correlations, but dampening currency-market correlations (expect similar dampening of bond-market moves)

Average Correlation: 0.7114



Date:

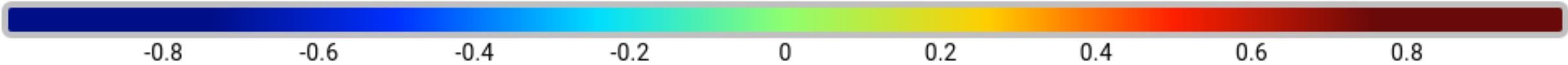
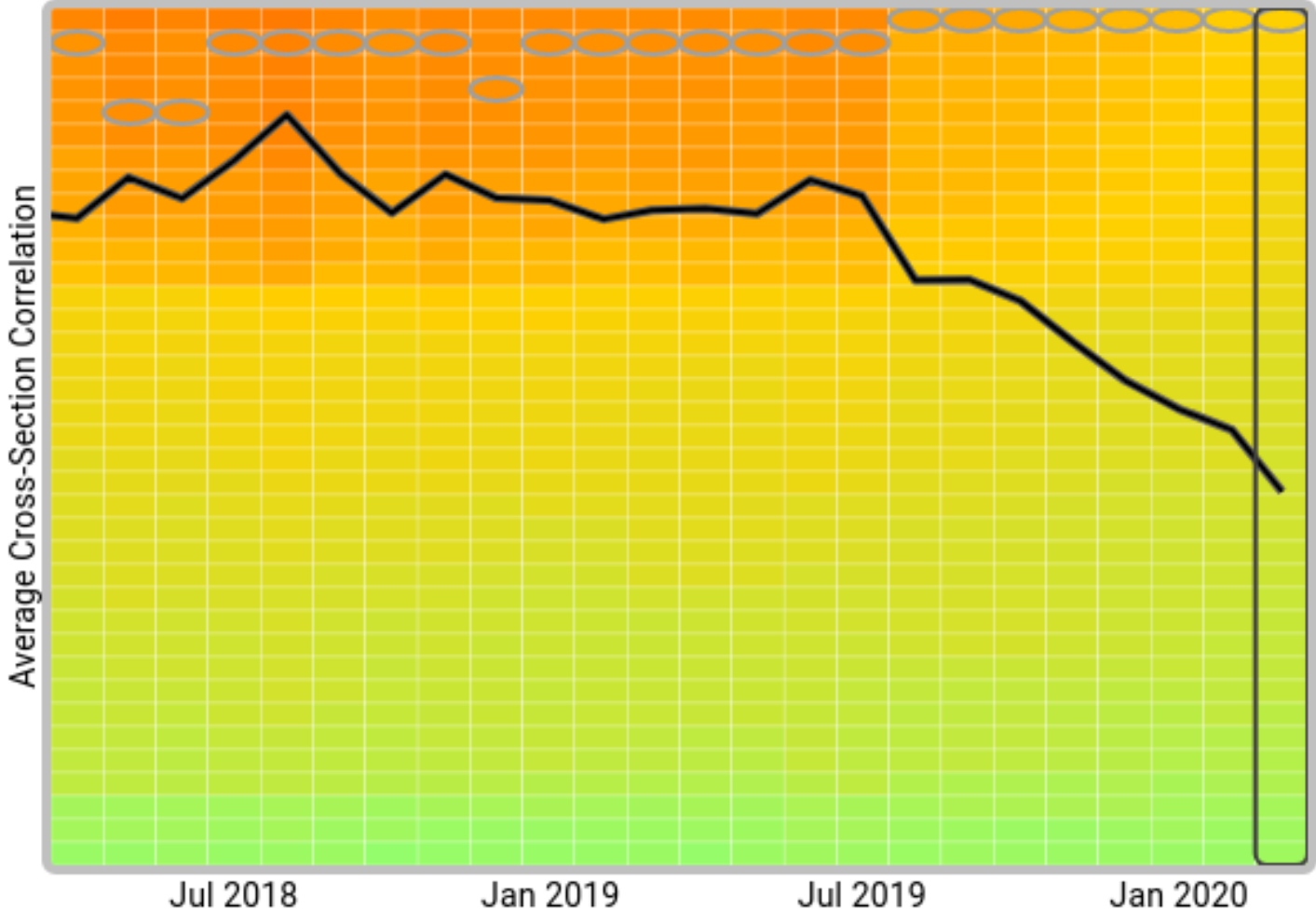
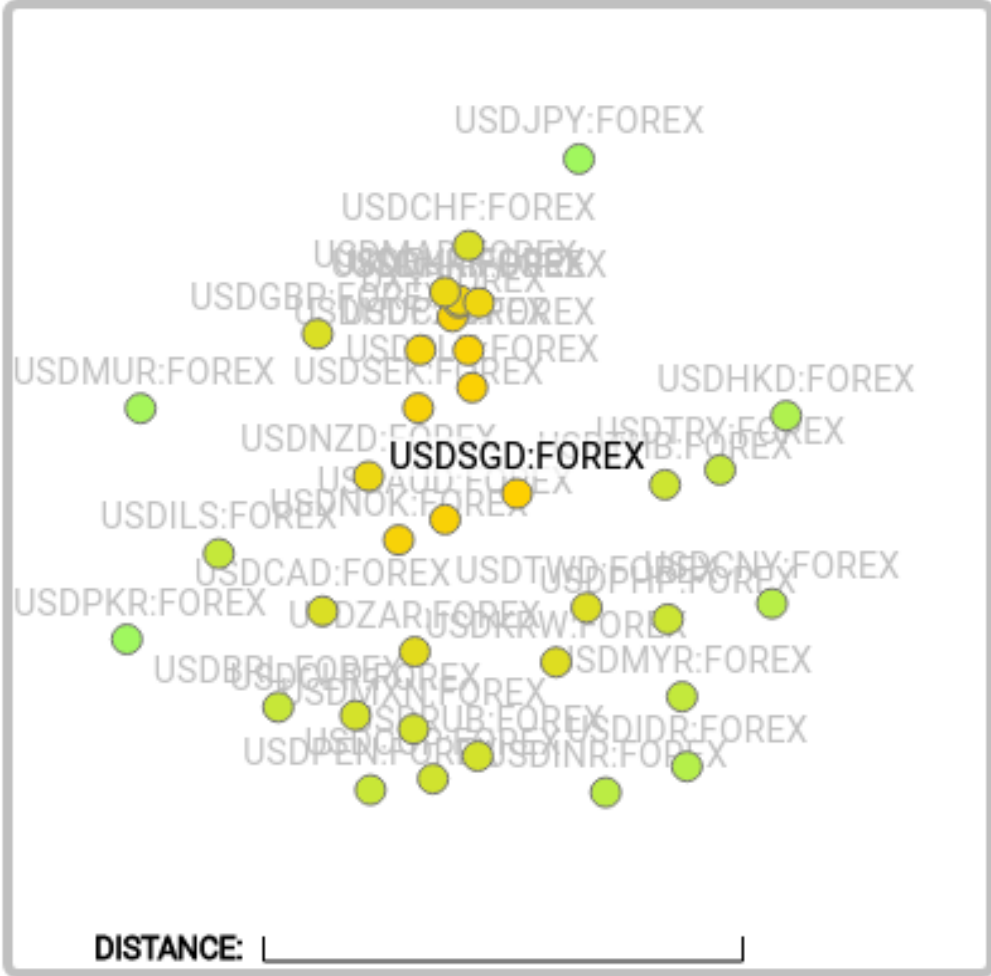
March 2020

US Dollar to Singapore Dollar Average Correlation:

0.3950

Average Correlation:

0.2567



200 Refresh

201 Table

202 Export

World Currency Ranker

203 Single Ranking

204 Historical Ranking

205 Multiple Ranking

Period Custom ▾ Basket Expanded Majors ▾ ✎ Base USD ▾

Range 03/11/20 📅 - 03/19/20 📅

Best Spot Returns (%)

	1) Hong Kong Dollar	HKD	0.04
-1.04	2) Argentine Peso	ARS	
-1.09	3) Taiwanese Dollar	TWD	
-1.54	4) Chinese Renminbi	CNY	
-1.57	5) Peruvian Sol	PEN	
-1.93	6) Indian Rupee	INR	
-2.77	7) Swiss Franc	CHF	
-2.94	8) Euro	EUR	
-2.95	9) Danish Krone	DKK	
-3.61	10) Singapore Dollar	SGD	

Worst Spot Returns (%)

-7.25	21) South African Rand	ZAR	
-7.39	22) Polish Zloty	PLN	
-7.88	23) Hungarian Forint	HUF	
-8.08	24) Swedish Krona	SEK	
-9.63	25) New Zealand Dollar	NZD	
-9.77	26) British Pound	GBP	
-9.89	27) Russian Ruble	RUB	
-10.16	28) Czech Koruna	CZK	
-11.91	29) Australian Dollar	AUD	
-12.41	30) Mexican Peso	MXN	
-18.13	31) Norwegian Krone	NOK	

8. Failure of parity relationships

Cash-futures basis trade blowup in US Treasuries; Negative swap-treasury spreads widen; Italy divergence from Eurozone “risk-free” rates; Others (CIP, CDS-Bond)?

Spread Shred

Spread widens between 2-year bonds linked to futures and those that aren't



Source: Bloomberg

912828U8 Govt (T 2 12/31/21) SPRD Daily 18MAR2019-17MAR2020

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18-Mar-2020 10:15:45

USSP30 -58.500 As of 13 Mar Source BGN

USSP30 BGN Curncy 95) Compare 96) Actions ▾ 97) Edit ▾ Yield Chart

03/14/2006 - 03/14/2020 BGN Last Px Local CCY ▾ Mov Avgs ▾ Key Events

1D 3D 1M 6M YTD 1Y 5Y Max Daily ▾ Table << Chart Content ⚙

Track Annotate News Zoom





VI. Policy responses and challenges

Uncertainty about virus outbreak and containment requires robust planning

Robust policy response amidst uncertainty

- Medical (Real?) – address the COVID-19 outbreak
 - Suppression measures: Social distancing, isolation
 - Credibility measures: Test, test, test (including anti-body tests of those who recover)
 - Remedial measures: Hospital beds, critical care
 - Longer-term measures: Search for vaccine
- Financial (Real?) – address the financial fallout/amplifiers from COVID-19:
 - Monetary: Rate cuts, market-wide liquidity (asset-purchases, sectoral, individual?)
 - Fiscal: Unemployment insurance, paid leave, helicopter cash-drop, tax deferrals
- Purely financial remedial response without investing enough in addressing the outbreak and convincing investors of its containment will not suffice

Questions to answer for the “right” policy mix

- Do we slow the spread of the virus quickly?
 - This will determine the intensity of desirable social distancing measures
 - In turn, this will affect the extent of economic and financial disruption
- Do we have confidence the virus outbreak will not recur, or can be contained quickly if it recurs? How to deal with this uncertainty in real time?
 - China 2Q crucial to observe along with early-infected countries in SE Asia
 - If outbreak recurs, it may alter the tradeoffs of social distancing measures
- Before resolving this uncertainty, how do we ensure households, firms, banks, municipalities, sovereigns, ... do not implode?
 - Presently, financial market implosions are in the face, so are being addressed head-on and at break-neck pace

Table 4: Monetary policy rate easing cycles

Basis point change over episode

	Global financial crisis	EMU credit crisis	EM credit unwind	US-China trade war	Global Coronavirus crisis*
Global	-297	-10	-36	-53	-55
Developed	-341	-14	4	-40	-76
US	-438	0	38	-75	-150
EMU	-275	-25	-20	-10	0
UK	-525	0	-25	0	-50
Japan	-40	0	-20	0	0
Emerging	-190	-39	-98	-82	-23
China	-198	-6	-75	-5	-10
India	-300	75	-100	-135	0
Korea	-300	-25	-50	-50	-50
Brazil	-200	-450	150	-200	-35
Mexico	-276	-43	170	-103	-13
Poland	-150	-50	0	0	-50
Czech	-200	-70	0	25	-25
Russia	350	250	-400	-150	-25
Turkey	-750	-29	-8	-1200	-225
S. Africa	-300	-50	125	-25	-25

Source: J.P. Morgan; * Change year-to-date

Appendix: Policy measures in response to the Global Coronavirus Crisis of 2020

	Fiscal thrust %pt GDP chg	Rate cuts		Credit support		Regulatory
		bp	Intermtg	Central Bank	Govt	
US	1.9	-150	YES	QE \$500bn UST, \$200bn MBS, RRR cut, Large liq injections, CP Program, PDCF	SBA credit increased	RRR cut to ease bank B/S pressure
Euro area	0.6	0		QE of E120bn in 2020 (incl corp bonds), LTROs, reduced TLTRO rates	KfW and ERP loans, fed budget guar., eased budget rules, targeted lending, guarantees on loans	Capital requirement reductions
Japan	0.5	0		ETF and corp bond purch pace increase, corp lending supports	Central gov't off-budget credit line, interest free loans for SMEs, employee & SMEs compensation	
UK	1.4	-65	YES	Lending program		Cap req cut to 0%
Norway	0.3	-125		Lending to banks for liquidity	NOK50bn SME loan guarantee	
Sweden	3.3	0		SEK500bn SME lending	SEK300bn in tax relief	
Canada	1.8	-100	YES	New lending facility	New bus credit program	
Australia	0.4	0		Increased liquidity operations		
N. Zealand	2.1	-25	YES			Delay bank cap. req. hike
China	0.9	-20		Targeted credit, RRR cuts	Waiver of soc sec contrib, tax deferrals, fiscal subsidies for operation costs	
India	0.3	0		0.5% of GDP in LT Repos, FX Swaps		
Korea	0.6	-50	YES	Raised ceiling of concessional lending to SMEs, expanded eligible collateral for open market operations	Ramped up policy lending facilities to SMEs and troubled sectors	Administrative fees waived and tax amnesty with delayed payments, deregulation of customs processing
Indonesia	0.3	-50			Targeted aid for housing loans, subsidies for the bottom 30 income percentile	
Malaysia	0.3	-25		M\$2 billion Special Relief Facility	M\$20bn support package	

Singapore	2.1	...			Income tax rebates for NFCs, targeted services sector support, GST hike delayed beyond 2021
Thailand	0.3	-50			
Philippines	0.2	-25			
Argentina	0.0	...			
Brazil	0.3	-50		Reduction of reserve req rate on time deposits, relaxed provisioning requirements	Ext. of payroll linked lending, lending to SMEs, deferral of employer social payments, 3m deferral of federal tax payment
Chile	1.1	-75	YES	Expand loan financing, expanded eligible collateral for liquidity operations, purchases of bank bonds	
Colombia	0.2	0		Expanded collateral eligibility to corp bonds, local currency liquidity support	
Mexico	0.3	25			
Peru	0.5	25			
Czech Rep	0.4	-50	YES	Increased liquidity operations	Relaxed regulations on Covid-19 related NPL's
Hungary	0.9	0		Liquidity injection (FX swap)	
Poland	0.4	-50	YES	QE (announced), 3%-pts cut in RRR, TLTRO-style refinancing of loans to NFCs	
Romania	0.6	0			
Russia	1.1	0		Lower risk weights for drugs and med. equip. producers, targeted loan relief to affected industries	90-day (1Q) delay in tax payments by SMEs, delay in dividend payments by SOEs
Turkey	0.3	-75	YES	Liquidity support to banks, increase liquidity limits, FX RRR cut 500bps	
South Africa	0.0	-50			

Source: J.P. Morgan

COVID-19 bailouts in billions (USD)



Data from Times of London

To measure the magnitude of fiscal commitment, you need to adjust for the size of each country's GDP

GDP-adjusted bailouts in billions



Campbell R. Harvey 2020

Global coordination

- If COVID-19 continues to spread in waves to some parts of the world while others are recovering, global inter-connectedness would imply limited capacity for real economy to rebound robustly and swiftly
 - Depth of global slowdown and its duration may be inversely linked? (JPMorgan)
- Vulnerable countries within a currency union may require fiscal transfers
 - If the “euro” doesn’t work for Italy and Spain now, when will it?
- Many EMs will be vulnerable to risk-off as well as oil-price crash
 - Given their reliance on external finance, dollar swap-lines may need to be extended to larger EMs outside of the G7
 - IMF can provide support to the smaller EMs not brought within the dollar swap-lines

VII. Lessons for the future

Preparing for the worst; New financial risks on the horizon; Other emerging risks

Can we prepare for the worst?

How should businesses, economies, supply-chains, etc., be designed to survive a “[pandemic stress test](#)”?

How should health-care be remodeled to deal with future epidemics and pandemics?

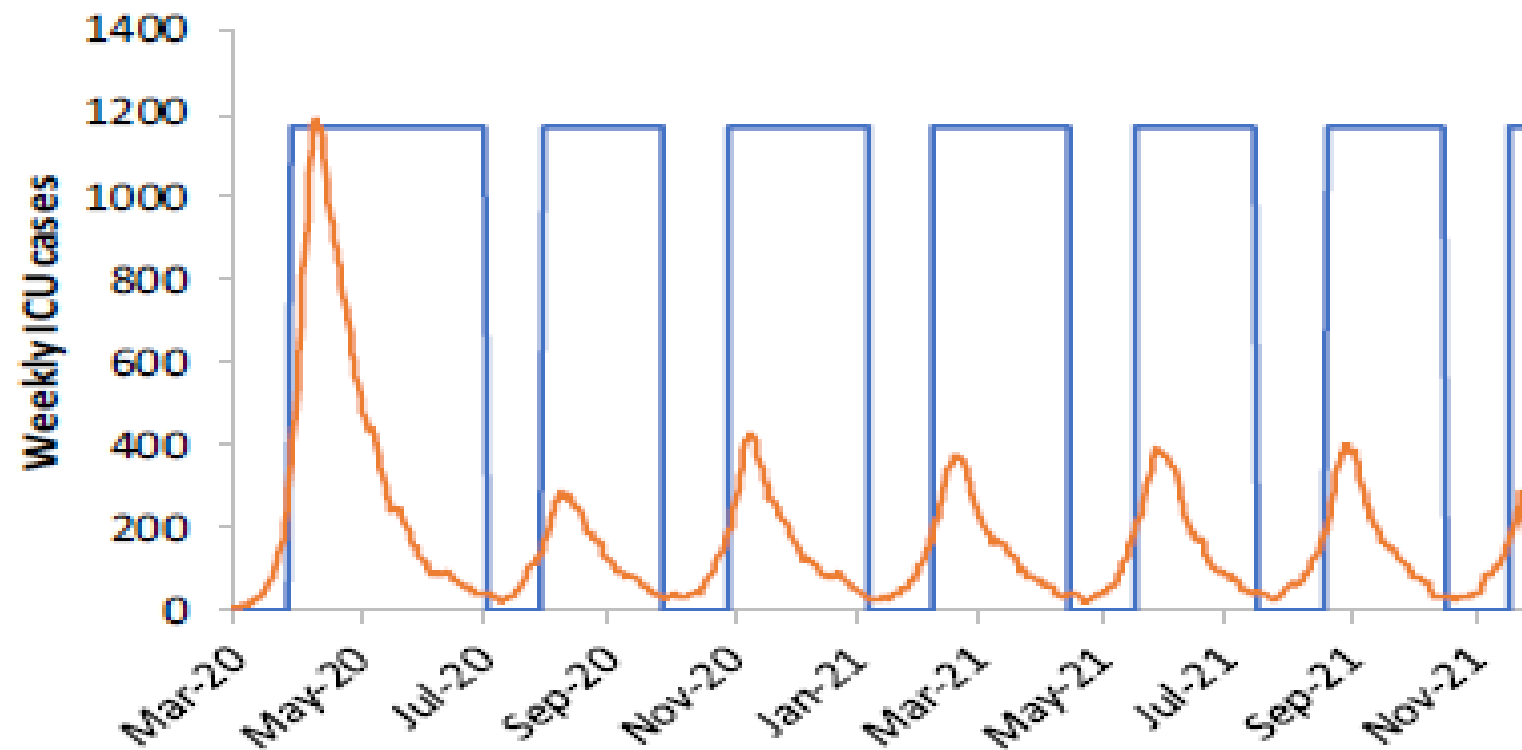


Figure 4: Illustration of adaptive triggering of suppression strategies in GB, for $R_0=2.2$, a policy of all four interventions considered, an “on” trigger of 100 ICU cases in a week and an “off” trigger of 50 ICU cases. The policy is in force approximate 2/3 of the time. Only social distancing and school/university closure are triggered; other policies remain in force throughout. Weekly ICU incidence is shown in orange, policy triggering in blue.

Where are the new warfronts?

So far, authorities – especially central banks – are fighting well the “past” wars...
Are there new pockets of systemic risk and vulnerability to pay attention to?

An important post-GFC tail financial risk (thankfully!) not yet at the forefront

- Post-GFC, large number of derivative contracts in fixed income and credit markets moved to centralized counterparty (CCP) clearing
- CCPS mutualize counterparty risk, but in so doing, face liquidity risk, especially in a stress scenario when collateral becomes illiquid
 - How robust are the capitalization, waterfalls, and contingent capitalization arrangements of these CCPs?
 - The relevant financial event at present is a global financial sector meltdown, *i.e.*, systemic risk where several dealers fail at once due to further market corrections
- Can the CCPs handle such stress? Conversely, what level of stress can the CCPs handle? Might they need emergency 13(3) Fed access?
 - 1987 October crash: Chicago Mercantile Exchange + Fed put

CCP regulation under the Dodd-Frank Act

- CCPs are jointly regulated by the CFTC, SEC and Fed under Title VIII of Dodd-Frank
- Under Title VIII of Dodd Frank, CCPs self-insure by depositing funds with the Fed
- A designated financial market utility may borrow from the Fed discount window only in unusual and exigent circumstances upon a majority vote of the Board of Governors following consultation with the Treasury Secretary ([Powell 2017](#))
 - A major shortcoming?
 - Should CCPs have a standing liquidity facility with appropriate governance and oversight?
- In a paper ([here](#)) Richard Berner, Stephen Cecchetti and Kermit Schoenholtz describe some of the risks for CCPs and using SRISK for stress tests
 - CFTC and ESMA have done liquidity stress tests for CCPs; those are first steps...
 - Should the stress tests jointly assess solvency and liquidity?
- CCP recovery and resolution planning is still evolving
 - Data quality for swaps is still lacking, which is critical for risk assessment
 - Another [paper](#) by Richard Berner with Robin Doyle and Ken Lamar assesses the issues

Are there lessons for managing other risks?

Climate, Geo-political, Cyber, ... Managing the risk that risks will change!



Should we be preparing in a stress-test manner also to deal with emerging “climate change” risks?

Source: NASA

VII. Thank you – Time for Q&A

To be added

1. Bank stock cumulative returns plot relative to S&P500 cumulative returns since 1st Jan.
 2. Bank CDS spreads since 1st Jan.
 3. LIBOR-OIS spread: short and long time-series (spanning GFC)
 4. VIX vs. realized vol: short and long time-series (spanning GFC)
 5. Liquidity measures for the stock market
 6. Gold -- why has it corrected in a time of flight to quality?
- Deflationary projections?
7. DXY behavior