COVID-19

Spring break class for PhD and Langone students

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(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?
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.

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)!
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 ≈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 (~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](https://www.imperial.ac.uk/) 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
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
Figure 1: Aggregate trend in buybacks for S&P500 firms. Source: Edward Yardeni www.yardeni.com.

US stocks are still not all that cheap

Cyclically adjusted price/earnings ratio vs Long-term interest rate, 10-year bond yield (%)

Source: Robert J. Shiller

The virus is an economic emergency too, Martin Wolf, Financial Times, 17 March 2020
The virus is an economic emergency too, Martin Wolf, Financial Times, 17 March 2020.
The virus is an economic emergency too, Martin Wolf, Financial Times, 17 March 2020
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 LP; bank CDS spreads: Bloomberg Finance LP, IHS Markit
Copyright © 2020 Hutchins Center at the Brookings Institution and Yale Program on Financial Stability, www.som.yale.edu/financialcrisischarts

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.
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

Source: VLAB, NYU Stern
2. Volatility (see NYU-Stern VLAB)

Pervasive rise beyond GFC levels; Ignition globally once the pandemic spread
3. Corporate bonds

Junk bond stress in markets has “taken off” + Case study of the airline industry
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
<table>
<thead>
<tr>
<th>S&amp;P 500 Airlines + Jetblue</th>
<th>Free Cash Flow past 10yrs in mln</th>
<th>Stock buybacks in mln</th>
<th>Buybacks/FCF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southwest Airlines</td>
<td>$15,103</td>
<td>$10,650</td>
<td>71%</td>
</tr>
<tr>
<td>Alaska Air Group</td>
<td>$4,948</td>
<td>$1,590</td>
<td>32%</td>
</tr>
<tr>
<td>Delta Air Lines</td>
<td>$23,186</td>
<td>$11,430</td>
<td>49%</td>
</tr>
<tr>
<td>United Airlines Holdings</td>
<td>$11,526</td>
<td>$8,883</td>
<td>77%</td>
</tr>
<tr>
<td>American Airlines Group</td>
<td>-$7,935</td>
<td>$12,957</td>
<td>N/A</td>
</tr>
<tr>
<td>JetBlue Airways</td>
<td>$2,347</td>
<td>$1,771</td>
<td>75%</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>$49,175</strong></td>
<td><strong>$47,281</strong></td>
<td><strong>96%</strong></td>
</tr>
</tbody>
</table>

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

Source: Ivashina and Scharfstein (JFE 2010): Bank lending during the financial crisis of 2008
Fig. 6. Relation between Deposits/Assets and Revolvers/Total loans.

Source: Ivashina and Scharfstein (JFE 2010): Bank lending during the financial crisis of 2008
### Table III: Usage of credit lines and economic performance

#### Panel A: Measuring economic performance via equity returns

<table>
<thead>
<tr>
<th>Quintile</th>
<th>IG</th>
<th>Non-IG</th>
<th>Not rated</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Highest equity return)</td>
<td>18.45%</td>
<td>29.89%</td>
<td>28.62%</td>
<td>25.23%</td>
</tr>
<tr>
<td>2</td>
<td>20.18%</td>
<td>28.57%</td>
<td>29.65%</td>
<td>25.98%</td>
</tr>
<tr>
<td>3</td>
<td>22.64%</td>
<td>24.79%</td>
<td>32.60%</td>
<td>27.19%</td>
</tr>
<tr>
<td>4</td>
<td>19.97%</td>
<td>28.35%</td>
<td>34.53%</td>
<td>27.83%</td>
</tr>
<tr>
<td>5 (Lowest equity return)</td>
<td><strong>20.20%</strong></td>
<td><strong>36.04%</strong></td>
<td><strong>43.20%</strong></td>
<td><strong>33.23%</strong></td>
</tr>
</tbody>
</table>

|        |        |        |           |        |
| 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)

<table>
<thead>
<tr>
<th>Quintile</th>
<th>IG</th>
<th>Non-IG</th>
<th>Not rated</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Increasing profitability)</td>
<td>21.56%</td>
<td>32.46%</td>
<td>33.74%</td>
<td>29.63%</td>
</tr>
<tr>
<td>2</td>
<td>19.88%</td>
<td>33.10%</td>
<td>31.82%</td>
<td>28.35%</td>
</tr>
<tr>
<td>3</td>
<td>18.58%</td>
<td>28.76%</td>
<td>32.87%</td>
<td>27.48%</td>
</tr>
<tr>
<td>4</td>
<td>20.72%</td>
<td>31.75%</td>
<td>31.81%</td>
<td>28.31%</td>
</tr>
<tr>
<td>5 (Decreasing profitability)</td>
<td>24.27%</td>
<td>36.87%</td>
<td>39.93%</td>
<td>34.33%</td>
</tr>
</tbody>
</table>

|        |        |        |           |        |
| Q5 – Q1| 2.71%  | 4.41%* | 6.18%***| 4.70%***|
| t-stat | (1.58) | (1.88) | (3.94)   | (4.39) |

Source: Berg, Saunders, Steffen (JF 2016): The total cost of corporate borrowing: Don’t ignore the fees
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 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
Huge price drop reflects tightening of credit conditions in the primary loan market.
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.

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

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

<table>
<thead>
<tr>
<th>Rating</th>
<th>Credit Line</th>
<th>%</th>
<th>Draw-down rate</th>
<th>Expected draw-down</th>
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<tbody>
<tr>
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<td>$257,444</td>
<td>26.9%</td>
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<td>$43,843</td>
</tr>
<tr>
<td>BBB</td>
<td>$323,255</td>
<td>33.7%</td>
<td>23.8%</td>
<td>$76,902</td>
</tr>
<tr>
<td>Non-IG</td>
<td>$230,753</td>
<td>24.1%</td>
<td>28.5%</td>
<td><strong>$65,788</strong></td>
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<tr>
<td></td>
<td><strong>$958,260</strong></td>
<td></td>
<td></td>
<td><strong>$244,081</strong></td>
</tr>
</tbody>
</table>
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
US financial stress near 2011 levels

Financial stress in the United States

- OFR Financial Stress Index (0=Average Stress Level) (ls)
- Bloomberg United States Financial Conditions Index (Inverted axis, rs)

Latest obs: March 13, 2020

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.
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

The virus is an economic emergency too, Martin Wolf, Financial Times, 17 March 2020
Rates and equity vol at 2008/2009 levels

Source: CBOE, WSJ, Haver Analytics, DB Global Research
SOVEREIGN RATE CHANGES: CROSS SECTIONAL STANDARD DEVIATION

Source: VLAB, NYU Stern
Source: VLAB, NYU Stern
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)
GARCH-DCC-NL Correlation Between International Equities

Date: March 2020

iShares MSCI EAFE ETF Average Correlation: 0.8205
Average Correlation: 0.7114
Date: March 2020

US Dollar to Singapore Dollar Average Correlation: 0.3950

Average Correlation: 0.2567

Source: VLAB, NYU Stern
### Best Spot Returns (%)

1. Hong Kong Dollar (HKD) -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%

### Worst Spot Returns (%)

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

<table>
<thead>
<tr>
<th>Basis point change over episode</th>
<th>Global financial crisis</th>
<th>EMU credit crisis</th>
<th>EM credit unwind</th>
<th>US-China trade war</th>
<th>Global Coronavirus crisis*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>-297</td>
<td>-10</td>
<td>-36</td>
<td>-53</td>
<td>-55</td>
</tr>
<tr>
<td>Developed</td>
<td>-341</td>
<td>-14</td>
<td>4</td>
<td>-40</td>
<td>-76</td>
</tr>
<tr>
<td>US</td>
<td>-438</td>
<td>0</td>
<td>38</td>
<td>-75</td>
<td>-150</td>
</tr>
<tr>
<td>EMU</td>
<td>-275</td>
<td>-25</td>
<td>-20</td>
<td>-10</td>
<td>0</td>
</tr>
<tr>
<td>UK</td>
<td>-525</td>
<td>0</td>
<td>-25</td>
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<td>-50</td>
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<tr>
<td>Japan</td>
<td>-40</td>
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<td>India</td>
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<td>75</td>
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<td>Russia</td>
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<td>250</td>
<td>-400</td>
<td>-150</td>
<td>-25</td>
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<td>Turkey</td>
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<td>-1200</td>
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<td>S. Africa</td>
<td>-300</td>
<td>-50</td>
<td>125</td>
<td>-25</td>
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Source: J.P. Morgan; * Change year-to-date
<table>
<thead>
<tr>
<th>Country</th>
<th>Fiscal thrust</th>
<th>Rate cuts</th>
<th>Credit support</th>
<th>Regulatory</th>
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<tbody>
<tr>
<td>US</td>
<td>1.9</td>
<td>-150 bp</td>
<td>QE $500bn UST, $200bn MBS, RRR cut, Large liq injections, CP Program, PDCF</td>
<td>SBA credit increased</td>
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<td>Euro area</td>
<td>0.6</td>
<td>0</td>
<td>QE of €120bn in 2020 (incl corp bonds), LTROs, reduced TLTRO rates</td>
<td>KfW and ERP loans, fed budget guar., eased budget rules, targeted lending, guarantees on loans</td>
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<tr>
<td>Japan</td>
<td>0.5</td>
<td>0</td>
<td>ETF and corp bond purchace increase, corp lending supports</td>
<td>Central govt off-budget credit line, interest free loans for SMEs, employee &amp; SMEs compensation</td>
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<tr>
<td>UK</td>
<td>1.4</td>
<td>-65 bp</td>
<td>Lending program</td>
<td>Cap req cut to 0%</td>
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<tr>
<td>Norway</td>
<td>0.3</td>
<td>-125 bp</td>
<td>Lending to banks for liquidity</td>
<td>NOK50bn SME loan guarantee</td>
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<td>Sweden</td>
<td>3.3</td>
<td>0</td>
<td>SEK500bn SME lending</td>
<td>SEK300bn in tax relief</td>
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<tr>
<td>Canada</td>
<td>1.8</td>
<td>-100 bp</td>
<td>New lending facility</td>
<td>New bus credit program</td>
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<tr>
<td>Australia</td>
<td>0.4</td>
<td>0</td>
<td>Increased liquidity operations</td>
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<td>N. Zealand</td>
<td>2.1</td>
<td>-25 bp</td>
<td>Targeted credit, RRR cuts</td>
<td>Delay bank cap. req. hike</td>
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<tr>
<td>China</td>
<td>0.9</td>
<td>-20 bp</td>
<td>Targeted credit, RRR cuts</td>
<td>Waiver of soc sec contrib, tax deferrals, fiscal subsidies for operation costs</td>
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<tr>
<td>India</td>
<td>0.3</td>
<td>0</td>
<td>0.5% of GDP in LT Repos, FX Swaps</td>
<td>Administrative fees waived and tax amnesty with delayed payments, deregulation of customs processing</td>
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<tr>
<td>Korea</td>
<td>0.6</td>
<td>-50 bp</td>
<td>Raised ceiling of concessional lending to SMEs, expanded eligible collateral for open market operations</td>
<td>Ramped up policy lending facilities to SMEs and troubled sectors</td>
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<tr>
<td>Indonesia</td>
<td>0.3</td>
<td>-50 bp</td>
<td>Targeted aid for housing loans, subsidies for the bottom 30 income percentile</td>
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<tr>
<td>Malaysia</td>
<td>0.3</td>
<td>-25 bp</td>
<td>MS$2 billion Special Relief Facility</td>
<td>MS$20bn, support package</td>
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<tr>
<td>Country</td>
<td>Change</td>
<td>Policy Measures</td>
<td></td>
<td></td>
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<td>---------------------------------------------------------------------------------</td>
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<tr>
<td>Singapore</td>
<td>2.1</td>
<td>Income tax rebates for NFCs; targeted services sector support; GST hike delayed beyond 2021</td>
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<tr>
<td>Thailand</td>
<td>0.3</td>
<td>Reduction of reserve req rate on time deposits, relaxed provisioning requirements</td>
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<tr>
<td>Philippines</td>
<td>0.2</td>
<td>Ext. of payroll linked lending, lending to SMEs, deferral of employer social payments, 3m deferral of federal tax payment</td>
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<tr>
<td>Argentina</td>
<td>0.0</td>
<td>Relaxed asset quality req., simplification of loan and debt renegotiation, paperwork</td>
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<tr>
<td>Brazil</td>
<td>0.3</td>
<td>Chile-expanded loan financing, expanded eligible collateral for liquidity operations, purchases of bank bonds</td>
<td></td>
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<tr>
<td>Colombia</td>
<td>0.2</td>
<td>Expanded collateral eligibility to corp bonds, local currency liquidity support</td>
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<tr>
<td>Mexico</td>
<td>0.3</td>
<td>Increased liquidity operations</td>
<td></td>
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<tr>
<td>Peru</td>
<td>0.5</td>
<td>Relaxed regulations on Covid-19 related NPL’s</td>
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<tr>
<td>Czech Rep</td>
<td>0.4</td>
<td>Hungary-liquidity injection (FX swap)</td>
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<tr>
<td>Poland</td>
<td>0.9</td>
<td>QE (announced), 3%-pts cut in RRR, TLTR-style refinancing of loans to NFCs</td>
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<tr>
<td>Romania</td>
<td>0.6</td>
<td>Liquidy support to banks, increase liquidity limits, FX RRR cut 500bps</td>
<td></td>
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<tr>
<td>Russia</td>
<td>0.1</td>
<td>90-day (1Q) delay in tax payments by SMEs, delay in dividend payments by SOEs</td>
<td></td>
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</tr>
</tbody>
</table>

Source: J.P. Morgan
COVID-19 bailouts in billions (USD)

- US
- Germany
- France
- UK
- Italy
- Spain
- Japan

Data from Times of London

GDP-adjusted bailouts in billions

- US
- Germany
- France
- UK
- Italy
- Spain
- Japan

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

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 approximately $2/3$ 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

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