MACROECONOMIC PROJECTIONS

- Global projections all point to a dramatic reduction in general economic opportunity as a result of the coronavirus.
- 20+ Million Americans Unemployed and greater unemployment anticipated.
- High levels of low-quality corporate debt and increasing market pressures is likely to push marginal companies into crisis.
  - $15.5T USD corporate debt, 74% of US GDP
  - >40% of companies listed on the US stock exchanges are not profitable.
- States have over $1.5T in unfunded debt and at least 40 states do not have enough money to pay their obligations.
- The impact on Puerto Rico for 2020 will mirror that of the United States due to the interrelationship of the two economies – and expected to have weak performance in 2021 based on underlying economic challenges and the dependence on federal transfers and tax advantages.

### Real GDP, Annual Percent Change

<table>
<thead>
<tr>
<th>Region</th>
<th>2019</th>
<th>2020 Projections</th>
<th>2021 Projections</th>
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<td>Low-income Developing Countries</td>
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</table>

Source: International Monetary Fund, World Economic Outlook, April 2020.
GLOBAL IMPACT

• The Coronavirus pandemic will cause people to rethink existing values and will impact economic models going forward.

• Health and health security will become the most important global issue in the coming months and years, with impacts on insurance business models, telemedicine, & pharma supply chains.

• Experts suggest there will be “a rethink of how much any country wants to be reliant on any other country,” forecasting potential protectionist trade policies.

• Remote work protocols established during the crisis will likely extend well after the crisis is over.

• Long-term disruption in business operations will cause many companies to rethink capital expenditure models.
IMPLICATIONS FOR PUERTO RICO

- Puerto Rico was economically fragile prior to the crisis, therefore the implications for the Island will be amplified without a strong messaging in response.

- The decisive and preemptive quarantine measures activated on the Island framed Puerto Rico as proactive, but balance must be struck as the economy re-opens.

- Favorable press regarding reshoring pharmaceutical production, specifically identifying Puerto Rico’s pharmaceutical industry, positions the Island to be part of both short-term and long-term solutions.
TRENDS TO WATCH

Expanded investment in Life Sciences, Logistics, and Advanced Manufacturing

• 81% of Site Selectors say COVID-19 will have a major impact on global supply chains resulting in an uptick in on-shoring to the US, Canada, and Mexico.
• COVID-19 exposed major gaps in global supply chains with serious national security and economic productivity implications.

Remote Work

• Stay-at-home orders have demonstrated the capacity of workers to be productive remotely.
• Many companies may reconsider their real estate expenditures to opt for more remote working options.
• Shifts in global values will continue to elevate ‘quality of life assets’ as an important and marketable global differentiator.

Resilience as a decision-making factor

• The combination of the COVID-19 pandemic, climactic shifts, and other risks underscore the fragility of all businesses and economies.
• Markets that show the ability to bounce back quicker (employees getting back to work quicker, lower levels of businesses shutting down post crisis, high levels of productivity) will be a stronger consideration in location decisions moving forward.
COVID-19 Webinar: Future Scenarios, Near-Term and Far
Sources


COVID-19: Future Scenarios, Near-term and Far

Webinar
April 30, 2020
The COVID-19 Crisis

- National Economic Outlook
  - How bad will this get?
  - When will the rebound start?
- Regional Issues Will Vary Depending on
  - Spread of COVID-19
  - Type of industries in the region
National Economy
We Entered the Crisis with a Strong Economy

Employment Growth
Monthly Change in Thousands

Real Gross Domestic Product
Quarterly Annualized Percent Change
Fed Speeches

Federal Reserve Bank of St. Louis President and CEO James Bullard was interviewed by Fox Business’ Maria Bartiromo last week. During the interview, President Bullard stressed the uniqueness of the current economic environment.

“It’s going to be a special quarter in macroeconomic history for the United States. We have a pandemic adjustment period. Instead of maximizing output is what we usually do, we are actually trying to minimize output... We’re not trying to produce a lot of things during the second quarter and the numbers are all going to look very funny compared to normal quarters where we are trying to produce as many goods and services as we can. And so, everything is upsidedown in terms of interpreting the numbers. But I think there are plenty of resources I think we can get through the bill that was passed. I like the actions that the Fed has taken. So, I think this is all very doable but it’s a one-time situation. Very unusual. And we have to work hard to get through it here.

President Bullard also said that by the fourth quarter he expects the U.S. economy to be expanding at a healthy pace.

"...by the time we get to the fourth quarter, I think that will be a boom quarter for the U.S. economy."

Financial Markets

The three major U.S. stock indices ended last week lower with the Dow Jones IndustrialAverage falling 2.7%, the S&P 500 decreasing 2.1%, and the NASDAQ declining 1.7%. Treasury yields fell across the long-end of the curve with the 10-year yield dropping 10 basis points (bps) to 0.62% and the 30-year yield decreasing 5 bps to 2.28%. Oil prices surged 31.5% and ended the week at $26.71 per barrel. The U.S. dollar increased 0.5% against the Japanese yen and the euro was down 3.0% against the greenback last week.

Selected Interest Rates

- Prime: 0.00%
- 10-yr Bond: 0.62%
- Fed Funds: 0.00%

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How Will Economy Be Affected?

3 Scenarios

- Scenario 1
  - COVID-19 lasts 3 months through May

- Scenario 2
  - COVID-19 lasts 6 months through August

- Scenario 3
  - COVID-19 last 3 months through May but includes shelter in place or temporary shutdown of some businesses. This will vary by state and metropolitan area.
Outcome of Scenarios 1 and 2

Scenario 1
Real GDP Q2 = annualized -23.6%
Real GDP Q3 = annualized -7.4%
Real GDP Q4 = annualized +4.1%
Unemployment rates peaks at 20.6% in Q3 2020
Outcome of Scenarios 1 and 2

Scenario 1
Real GDP Q2 = annualized -23.6%
Real GDP Q3 = annualized -7.4%
Real GDP Q4 = annualized +4.1%
Unemployment rates peaks at 20.6% in Q3 2020

Scenario 2
Real GDP Q2 = annualized -24.7%
Real GDP Q3 = annualized -12.7%
Real GDP Q4 = annualized -5.1%
Real GDP Q1 2021 = annualized +3.5%
Unemployment rates peaks at 23.3% in Q4 2020
Employment Growth (Monthly Change in Thousands)

Source: Bureau of Labor Statistics
Initial Unemployment Claims (in Thousands)

Source: Bureau of Labor Statistics
Last 2 Months Initial Unemployment Claims (In Thousands)

Source: Bureau of Labor Statistics
Job Postings Are a Leading Indicator of Jobs Lost

![Bar Chart: Total Online Job Ads, United States, by Week Posted]

- Feb 23: 671,213
- Mar 1: 664,988
- Mar 8: 596,161
- Mar 15: 488,029
- Mar 22: 415,376
- Mar 29: 393,723
- Apr 5: 372,136

Source: JobsEQ
Federal Aid Package Will Help

- Economic Development p. 230 and 231
  - $1.5 billion
  - Prevent, prepare and respond to coronavirus

- DOL p. 273
  - $345 million through September 30, 2022 to assist dislocated workers.
  - May replace grant funds previously obligated to impacted areas.

- Payroll Protection Program (PPP), p. 6
  - SBA loans: $349 billion
  - Loans can be forgiven if used to cover approved expenses
  - SBA current interest rate is 0.5% (was 1.0%) with 2-year repayment

- Federal Reserve Board
  - $2.3 trillion in lending
  - $500 billion loans for state and municipalities
  - 4-year loans for companies with 10,000 of fewer employees

Economic Development in H.R. 748
https://www.congress.gov/116/bills/hr748/BILLS-116hr748enr.pdf
COVID-19 Economic Impact: Sharp and Short; Not Sustained (Real GDP)
Not a Depression

(a) The Unemployment Rate

(b) Aggregate Output

27% fall in real GDP from 1929 to 1933
Great Variation by Region
University of Washington
(Available By State)

https://covid19.healthdata.org/projections
How Vulnerable Is My Region to COVID-19?

Impact of Coronavirus Average Projected Job Losses, United States

- Accommodation and Food Services: > 60%
- Arts, Entertainment, and Recreation: > 60%
- Other Services (except Public Administration): 10-25%
- Transportation and Warehousing: 10-25%
- Retail Trade: 10-25%
- Wholesale Trade: 10-25%
- Information: 10-25%
- Manufacturing: 5-10%
- Construction: 5-10%
- Mining, Quarrying, and Oil and Gas Extraction: 5-10%
- Real Estate and Rental and Leasing: < 5%
- Health Care and Social Assistance: < 5%
- Finance and Insurance: < 5%
- Educational Services: < 5%
- Administrative and Support and Waste Management and Remediation Services: < 5%
- Agriculture, Forestry, Fishing and Hunting: < 5%
- Public Administration: < 5%
- Professional, Scientific, and Technical Services: < 5%
- Management of Companies and Enterprises: < 5%
- Utilities: < 5%
- Active Military: < 5%

Source: Chmura Economics & Analytics

Percent Decline in Online Job Ad Volume Compared to Vulnerability Index, Twenty-five Largest MSAs, Week Ending April 11, 2020

<table>
<thead>
<tr>
<th>MSAs</th>
<th>Vulnerability Index</th>
<th>Percent Decline in Job Ads, Week Ending April 11 / February Weekly Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington-Arlington-Alexandria, DC-VA-MD-WV MSA</td>
<td>119.2</td>
<td>56.0</td>
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<tr>
<td>San Jose-Sunnyvale-Santa Clara, CA MSA</td>
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<tr>
<td>Boston-Cambridge-Newton MA-NH MSA</td>
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<tr>
<td>San Francisco-Oakland-Berkeley CA MSA</td>
<td>114.4</td>
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<tr>
<td>Baltimore-Columbia-Towson, MD MSA</td>
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<tr>
<td>Portland-Beaverton-OR-WA MSA</td>
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<td>Minneapolis-St. Paul-Blaine-MN-WI MSA</td>
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<td>Seattle-Tacoma-Clinton-WA MSA</td>
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<tr>
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<td>Seattle-Tacoma-Seattle, WA MSA</td>
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AGENDA

• Fragility of modern supply chains
• Can we do better?
  • Rebuild more robust supply chains
  • Innovate in forms that surge capacity takes
• Who should pay, and how (social vs private incentives)
• Implications for regional advantage
CHALLENGES OF COVID-19

1) Exponential growth of disease
   - First detected in China about November 2019
     - To date, already 2 million confirmed cases worldwide, 125,000 deaths

2) People are infectious before they have symptoms

Implication of 1 and 2: you have to take action before you are really sure there’s a problem
   - So, we need to prepare in advance
   - How do we innovate in supply networks to do this?

Goal of this talk: responding better to future pandemics
   - Design supply-chain policies that provide medium-term stimulus, long-term capability
     - Examples excessively from the US for now
Every infected person infecting 0.3 other people every day (forever)

Beginning on Day 31
Every infected person infecting 0.2 other people every day (forever)

1.3 Rate
1.2 Rate

Comparing Two Exponential Rates
COVID SHOWS THE FRAGILITY OF MODERN SUPPLY CHAINS

• Nations unable to meet surge in demand for masks, ventilators because production concentrated in China
  • Production hampered by disease
  • Desire to prioritize domestic distribution

• Even national supply chains are inflexible
  • In US, food being dumped due to inability to shift from restaurant to grocery supply
  • Shortage of toilet paper due to inability to shift from office to home supply
  • Different marketing channels, package sizes, product characteristics
THIS IS NOT THE FIRST TIME…

- Supply chains were disrupted by crises such as:
  - 2009-2010 financial crisis
  - 2011 Fukushima Daiichi tsunami in Japan
  - SARS epidemic in China and Hong Kong in 2002–2003

- And won’t be the last
  - There will be another pandemic—or several.
  - Climate change increases the probability of other kinds of natural disasters that can disrupt supply chains
    - Shipping and reshipping of components across the globe is a significant contributor to climate change (3% now; possibly 20% by 2050).
CURRENT STRUCTURE OF GLOBAL SUPPLY CHAINS IS NOT INEVITABLE

• Origin in particular set of global and managerial incentives:
  • 1990s trade agreements with few protections for labor rights
    • Entry of China in WTO in 2000
  • Large payouts for managers based on observable financial metrics, not always closely tied to operational performance
    • Often but not always short-term

• Collapse of US manufacturing is recent
  • 1/3 of US capacity lost 2000-2010, with some rebound since

• Now there is little domestic supply of key medical products
  • 95% of surgical masks and 70% of respirators used in the US are now produced abroad.
  • In a single year (circa 2004), surgical masks went from being 90% domestically produced to 95% foreign produced when Kimberly Clark shut down its US factories and offshored its production.
  • Last US penicillin factory closed in 2004; now 80% of pharmaceutical ingredients sourced abroad (most from China and India)

Sources: Helper, Gray, Osborne 2020; Adler and Breznitz 2020
CURRENT SUPPLY NETWORKS NOT OPTIMAL FOR FIRMS

• While long supply chains inevitably increase disruption risk, the typical models used to make global sourcing decisions do not sufficiently consider this risk to individual firms.

• Purchasing function has become strategic/material to firms in last few decades – but incentives and data collection have not evolved to reflect this
  • Purchasing agents incentivized to buy items with lowest unit price—little consideration of hidden costs of far-flung supply chains
HIGH-ROAD SUPPLY CHAINS

• There’s another way to design supply chains so that all the players—shareholders, workers, and consumers worldwide—are less exposed to the risks and social costs inherent in today’s global supply chains.

• Collaboration between management and workers along the length of the supply chain promotes sharing of skills and ideas, innovative processes, and, ultimately, better products that can deliver higher profits to firms and higher wages to workers.
TOTAL VALUE CONTRIBUTION

• Our TVC method encourages managers to first consider how decisions affect value drivers, before considering costs.

• TVC encourages firms to tap into the expertise of their personnel in marketing and engineering, who have information on what customers value and the potential hidden costs and risks of using suppliers whose prices appear low.

• TVC empowers purchasing agents to contribute their expertise on the multidimensional capabilities of the supply base, rather than pushing them to prioritize cost cutting.

• It also helps firms make sourcing decisions for groups of products, rather than deciding on a case-by-case basis and, only too late, realizing excessive dependence on a single supplier or region.

• Gray, Helper, Osborne 2019
“REAL OPTIONS” FOR REGIONS?

• We don’t know the exact future dimensions of the next crisis

• We can stockpile some likely items in advance, eg, some masks, ventilators etc.
  • A useful part of the response

• But more efficient would be to create “real options”: operations that can provide what turns out to be needed.
  • surge capacity: producers buy more general equipment than they otherwise might (eg, flexible instead of fixed automation, and maintain inhouse the capability to reprogram; additive manufacturing).

• Could the government reimburse companies for the extra expense involved in buying and maintaining this equipment? Periodic drills to test compliance?
  • Hidden benefit of US/Canada auto rescue: maintain organizational ability of Ford and GM to quickly identify suppliers of parts and equipment, maintain broadly trained workforce
PUBLIC POLICIES

- Individual companies, even huge firms like Apple, can’t rebuild domestic supply chains all on their own

- National governments can help match supply and demand for specialized assets and skills
  - Convene supply chain players to develop a roadmap for products ripe for reshoring

- Nurture supportive ecosystems of innovative small and large firms
  - Provide better access to trained workers, applied R&D, and finance

- Subsidies for innovation and production that help achieve national goals
  - Respond to crises
  - Prevent future crises, eg climate change
REMOVE HIDDEN SUBSIDIES FOR OFFSHORING

• Require drug companies to indicate on all labeling where both the finished drug and the active pharmaceutical ingredients were made. This transparency will allow consumers to know where their drugs come from and possibly allow domestic drugs to fetch a price premium.

• Institute unannounced inspections of foreign drug facilities; the current practice is to preannounce foreign plant inspections, giving them a regulatory advantage over domestic plants, where inspections are unannounced.

• Pass on the increased costs of oversight and the societal impact of foreign production of drugs to the firms that produce them.
SOME OPEN QUESTIONS

• Can we innovate in forms that surge capacity takes? (additive mfg, govt payments for flexibility)
  • Who should pay to maintain this capacity, and how (social vs private incentives)

• Implications for future nature and amount of globalization
  • foreign ingenuity has contributed much to our prosperity, so U.S. supply chains should not become 100% domestic. But both public and private leaders need to fully take into account the risks of far-flung supply chains.
  • Currently-poor countries could benefit
    • More focus on domestic demand, building integrated capabilities
    • Less instability, need to curry favor with multinationals
CONCLUSION

• Distribution-sensitive innovation policy would improve performance of supply networks
  • For consumers and firms: Faster response to demand fluctuations
  • For workers: Better jobs, more stable employment
  • For environment: Reduced carbon emissions

• Examples of supply chain DSIPs:
  • R&D for flexible production technologies and management
    • Additive manufacturing, democratic data analytics
    • Convening for identification of hidden needs and strengths

• Vision: Competition and cooperation based not on low wages, high pollution—but innovation
BACK-UP
Chart 11: Timeline of Events in Hubei

Source: Tomas Pueyo analysis over chart and data from the Journal of the American Medical Association

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