What Do We Learn from COVID-19 about the Resilience of GVCs for Medical Supplies?

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AGENDA

1. Novel coronavirus pandemic is a twin crisis: global public health and international economy
2. 3 explanations for shortages of personal protective equipment (PPE) for COVID-19
3. International trade
4. China: scale-up capacity & role of the state
5. United States: PPE supply shortages – market failure vs. policy failure
6. Options for more resilient supply chains

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Coronavirus Global Pandemic

The global coronavirus pandemic is a health and economic crisis of unprecedented scale and scope

- GLOBAL HEALTH CRISIS – 45.5 million cases and1.2 million deaths worldwide (as of Oct. 30, 2020)
- ECONOMIC CRISIS – In first 3 months of 2020, every region and country of the world was affected, with national economies locked down, soaring unemployment, and little or no income.

Economy-wide Shutdowns + Demand Spikes (cases) → Supply Shortages for Medical Products

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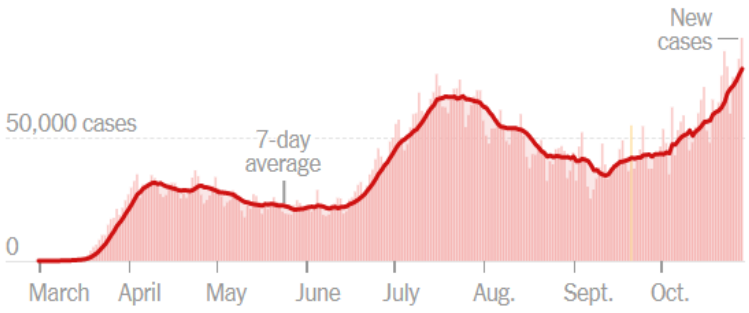
Coronavirus Cases in the United States

The New York Times

Covid in the U.S.: Latest Map and Case Count

By The New York Times Updated October 30, 2020, 12:18 A.M. E.T.

Leer en español



	TOTAL REPORTED	ON OCT. 29	14-DAY CHANGE
Cases	9 million+	90,446	+42% ↗
Deaths	228,701	1,004	+16% →

Source: https://www.nytimes.com/interactive/2020/us/coronavirus-us-cases.html

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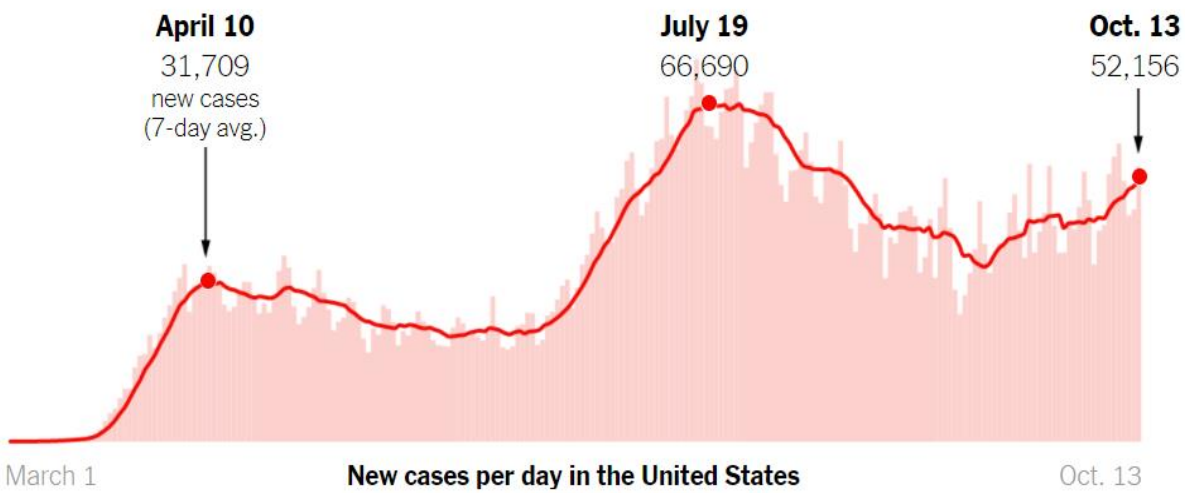
Coronavirus Cases in the U.S. – Third Peak

The New York Times



Oct. 29
90,446

U.S. Virus Cases Climb Toward a Third Peak

By Lauren Leatherby Oct. 15, 2020

Source: https://www.nytimes.com/interactive/2020/us/coronavirus-us-cases.html

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3 Explanations for Supply Chain Shortages in COVID-19

- **Logistics Approach**
  - Wholesale vs. retail distribution channels have different customers and distinct suppliers
    - E.g., fresh produce and dairy; toilet paper
- **Supply-Chain Structure Approach**
  - Rigid vs. resilient supply chains – Cost-optimization is more efficient, but is vulnerable in a crisis
    - E.g., medical face masks and PPE for COVID-19
- **Role of the State Approach**
  - Governments lead markets in a crisis
    - E.g., Chinese govt. control over face mask production & trade

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A Global Value Chain (GVC) Analysis of COVID-19 and Medical Supplies

Analytical Approach

RESEARCH QUESTION: How can we explain the contrasting experiences of China and the United States in handling PPE shortages during COVID-19?

METHODOLOGY: Look at medical supply GVCs at 3 points in time

- Pre-crisis – How were GVCs organized pre-COVID-19?
- During the crisis – How did China (the largest producer of PPE) and the USA (the country most affected by COVID-19) handle medical shortages?
- Post-crisis – What would more resilient and effective GVCs look like post-crisis?

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INTERNATIONAL TRADE

Top Exporters of COVID-19 Goods, 2018

Country shares in global exports by good

***Textile face mask**: China 50.4%, Germany 6.3%, USA 5.3%.

Intubation kits: USA 17.7%, Germany 14.1%, Mexico 11.9%

Patient monitoring devices: USA 22%, Japan 14.4%, Germany 12%

Protective spectacles: China 48%, USA 6.1%, Germany 5.7%

***Paper bed sheets**: China 23.9%, Germany 8.2%, USA 7.5%

Masks with mechanical parts: Germany 19.6%, UK 16.8%, USA 16.2%

***Non-woven protective garments**: China 42.8%, Cambodia 6.6%, Belgium 5.6%.

***Other rubber gloves**: Malaysia 59.3%, Thailand 14.1%, China 8.4%.

Surgical gloves: Malaysia 39.1%, Thailand 20.1%, China, 9.7%

Needles, catheters and cannulae: USA 19.6%, Ireland 13%, Mexico 11.3%

Source: OECD, "Trade Interdependencies in COVID-19 goods," May 5, 2020.

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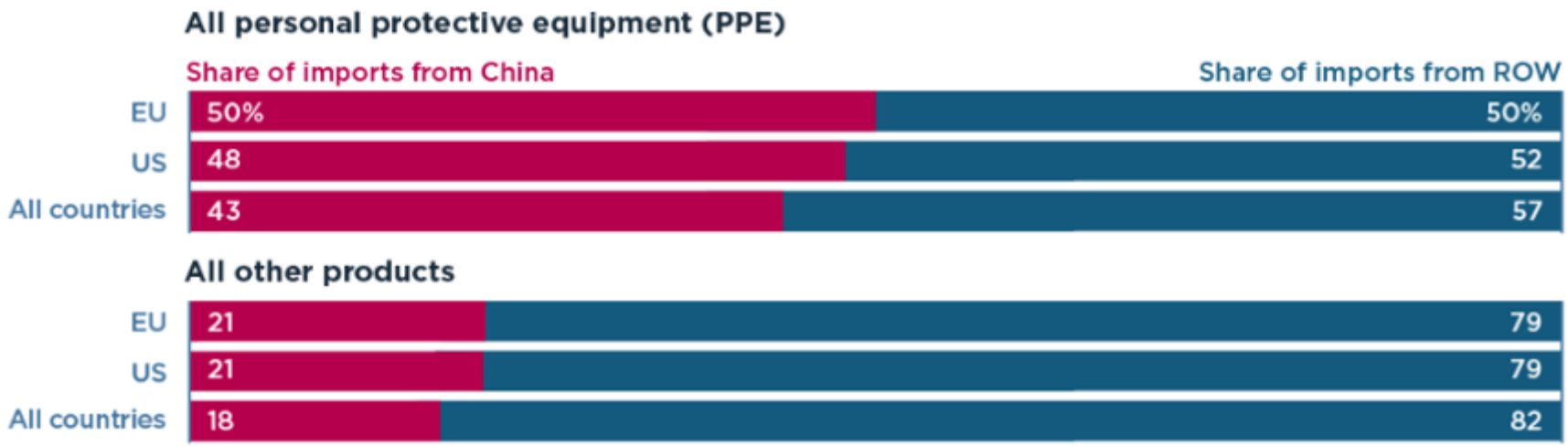
EU and US Imports of PPE from China, 2018

Figure 1

Much of the world's imports of personal protective equipment come from China

Imports by product and source, 2018



Source: Chad Bown, Petersen Institute for International Economics, Washington, DC, March 26, 2020. https://www.piie.com/blogs/trade-and-investment-policy-watch/covid-19-chinas-exports-medical-supplies-provide-ray-hope

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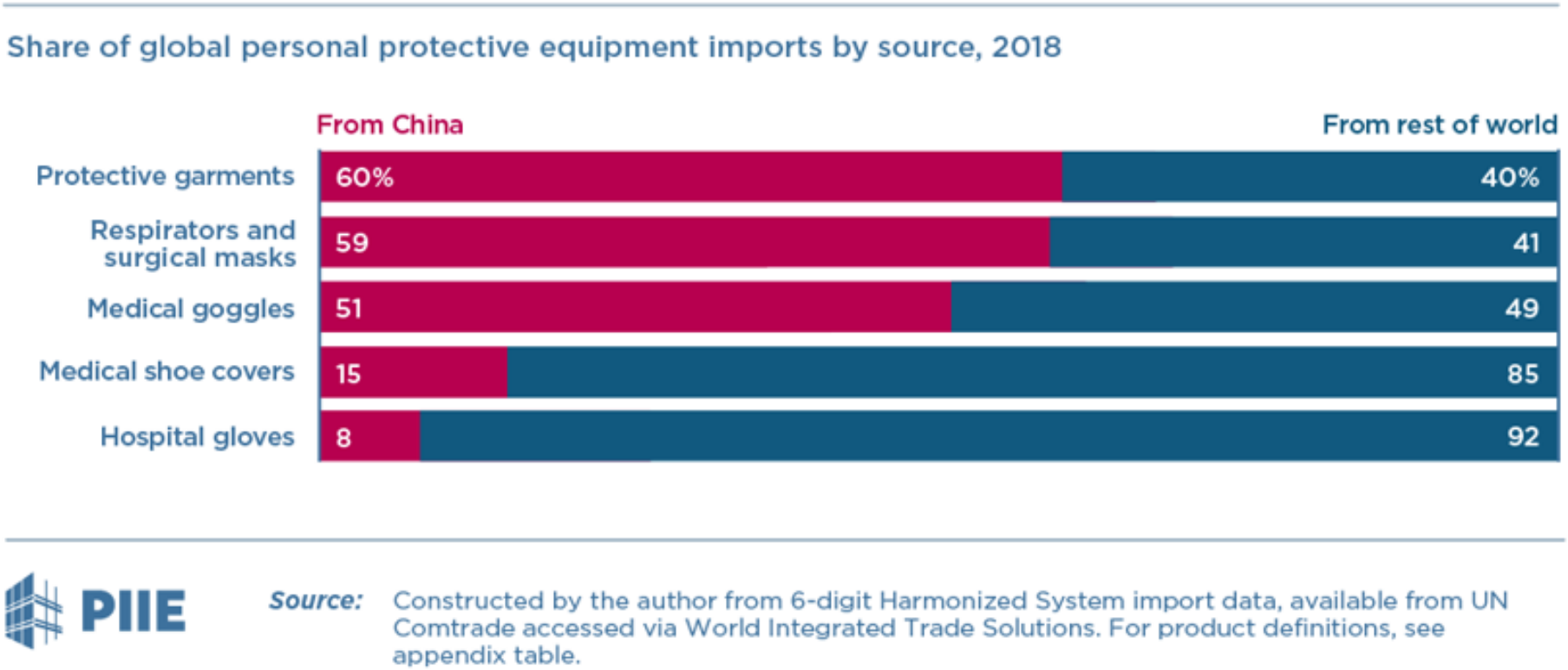
Much of the world's PPE comes from China



Source: Chad Bown, Petersen Institute for International Economics, Washington, DC, May 5, 2020. https://www.piie.com/blogs/trade-and-investment-policy-watch/china-should-export-more-medical-gear-battle-covid-19

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Why Does China (& Asia) Dominate PPE Exports?

Before the pandemic, China exported more PPE (face masks, medical goggles & protective garments) than the rest of the world combined.

China has 2 big advantages:

1. Low costs
2. Unprecedented scale up of production

US manufacturers and hospitals preferred JIT (just-in-time) production & purchasing with low inventories to maximize cash flow.

COVID-19 challenge: By April, 2020, 80 countries had imposed export controls on essential PPE items, such as face masks, medical gloves, and hospital gowns

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FACE MASKS

N95 and surgical face masks

When it shifted a Southern California factory to making medical masks this year, QYK Brands had to import the fabric-cutting machines from China. Brvan Denton for The New York Times

Source: *New York Times*, July 5, 2020.

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Face Masks: Low Costs + Scale Up

Surgical masks – loose fitting & designed to trap sprays & droplets from coughing and sneezing

N95 respirators – fit more tightly & protect user from 95% of far smaller airborne particles (associated with a virus)

All masks have at least 3 layers of non-woven & textile fabrics assembled through ultrasonic welding (inner layer absorbs moisture + filter layer + outer layer for splashes)

Before COVID-19 crisis, face masks were cheap

- Box of 100 surgical masks – US$4.00
- Box of 20 N95 respirator masks -- $17.00 (after pandemic, shortages & price surges)

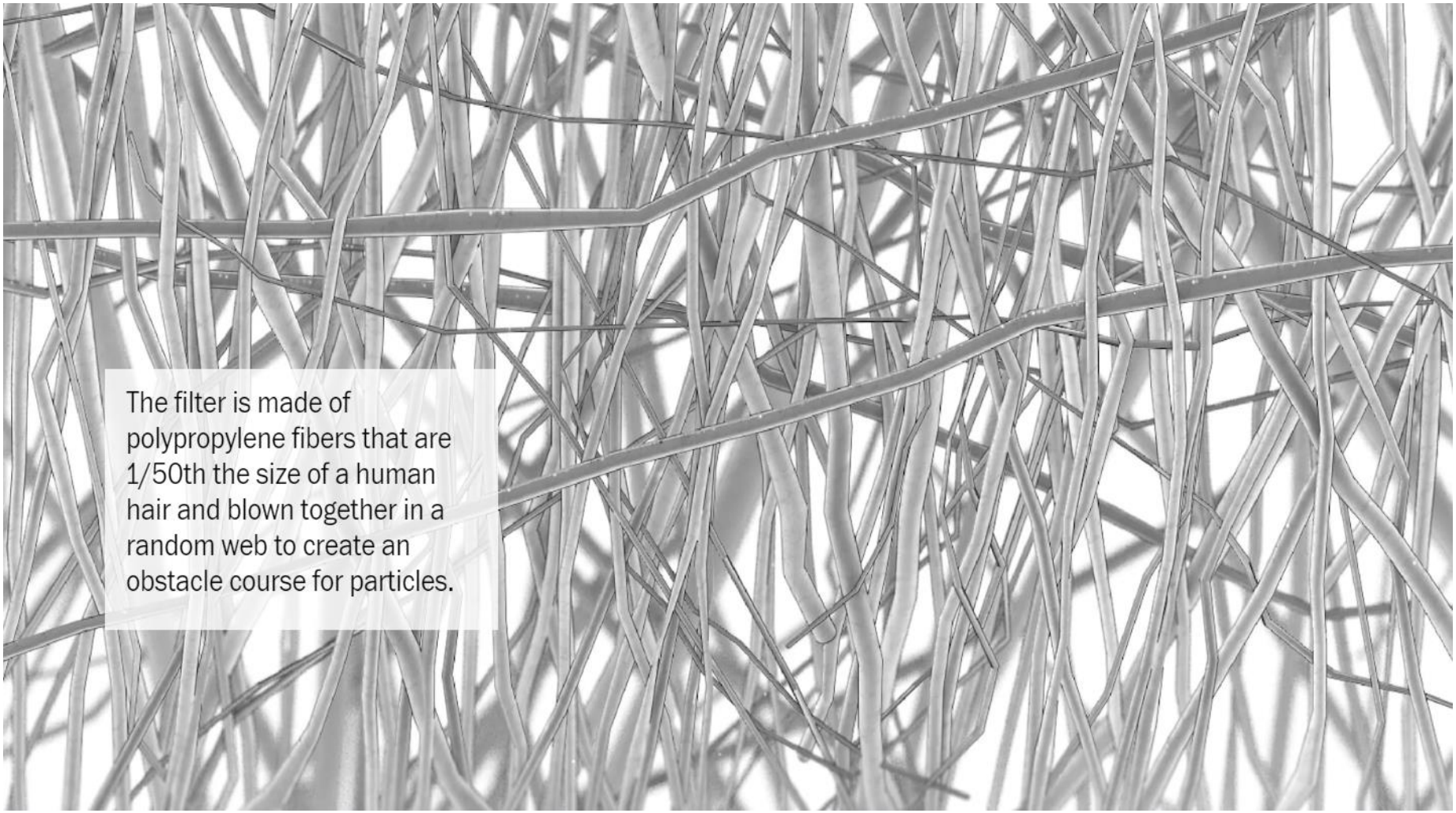
Face Mask Bottleneck: Meltblown Filters

The main input in face mask production is a non-woven polypropylene (PPP) fabric, widely used in baby diapers, feminine hygiene products, and disposable wipes.

- PPP is "meltblown" to obtain fibers of a smaller diameter in a random pattern that can trap small particles
- The meltblown PPP used in filters for face masks is a specialty fabric made by a limited number of companies worldwide
- N95 masks are more complex products (>65 parts) with added protection (e.g., finer filters; splash proof)

Source: K. Bradsher, "China dominates medical supplies, in this outbreak and the next," *New York Times*, July 5, 2020.

Polypropylene Meltblown Fibers for Filter in N95 Mask



Source: Jessica Contrera, “The N95 Shortage America Can’t Seem to Fix,” *Washington Post*, Sept. 21, 2020.

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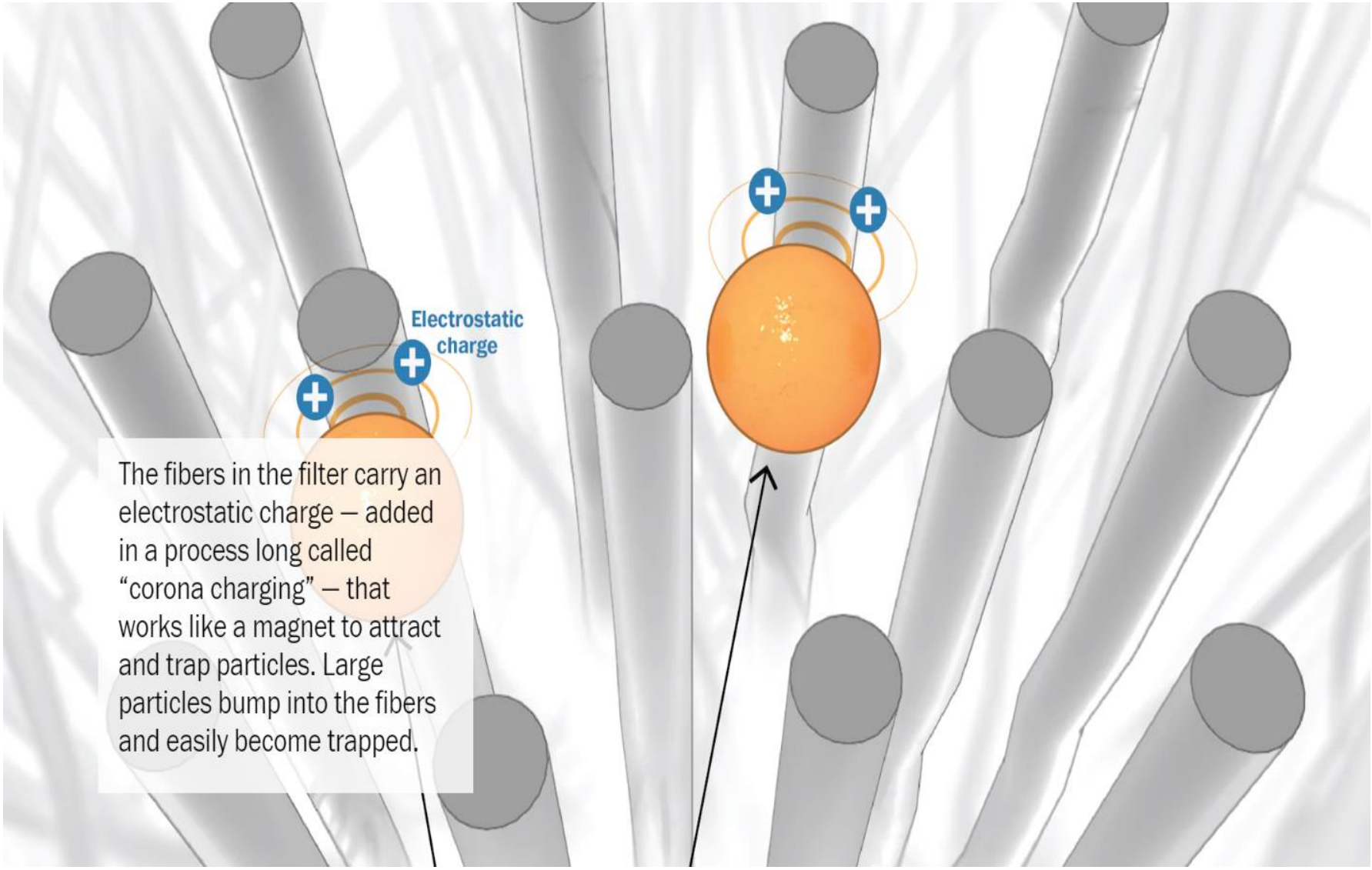
How N95 Fibers Attract & Trap Particles [2]



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CHINA'S SCALE UP – FACE MASKS: DOMESTIC PRODUCTION AND TRADE

China's Production and Trade in Face Masks

Chinese surgical mask production increased 12-fold in Feb. 2020 (10m → 115m masks per day)

March to May, 2020 – China exported >70 billion face masks (more than triple total world production of 20 billion masks in 2019)

Number of Chinese companies registered to make and trade face masks in mid-2020: 67,000

Most mask-making machinery comes from Asia (e.g., China, Taiwan), with big backlog for imports in 2020

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China's Prodigious Scale Up of Meltblown Fabric

China has scaled up its production of the meltblown non-woven PPP fabric used for face masks to 150 tons/day

- 5 times what China could make before the pandemic
- 15 times the total output of U.S. companies, even after they ramped up their own production in spring 2020

American companies are reluctant to make big investments in fabric manufacturing because they believe U.S. mask demand will be temporary.

Source: K. Bradsher, "China dominates medical supplies in this outbreak and the next," *New York Times*, July 5, 2020.

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Role of the State in China's Scale-up of PPE

- China centralized the coordination of PPE supply in the powerful, inter-ministerial National Development and Reform Commission (NDRC)
- China directed its petroleum SOEs, Sinopec and PetroChina, to ramp up production of key PPE intermediate products – e.g., meltblown PPP
  - E.g., Sinopec added 2 lines for meltblown fabrics in Beijing by early March to produce 4 tons of fabric per day → used for 1.2 million N95s or 6 million surgical masks per day
- China asked 3,000 companies, including 700 tech firms, to add face masks and other PPE items to their production lines
  - E.g., Foxconn added 2 million face masks daily to its production capacity by the end of February, 2020, mainly for its 1 million domestic employees

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FACE MASK SHORTAGES IN U.S. CASE: POLICY FAILURES OR MARKET FAILURES?

U.S. Government Response to COVID-19: Denial, Delays and Disruption

- **PPE** – Never a top priority; Trump in public denial of COVID-19 (early) & playing catch-up
- **Social distancing** – Late advisories (mid-March); face masks seen as political weakness
- **Defense Production Act** – Clumsy tool for fast-moving virus; used to goad large firms (GM and 3M) to action.
- **Vaccines** – Focus of Trump's government incentives; global R&D race; danger of "vaccine nationalism"

Source: Gary Gereffi, "What does the COVID19 pandemic teach us about GVCs: The case of medical supplies," *J. of Internat'l Business Policy*, 3(3), 2020: 287-301.

Defense Production Act

March 27 – President Trump used the Defense Production Act (1950) to order GM and others to produce ventilators

- April: GM signed $490m deal to provide 30,000 ventilators to U.S. govt. (~$17,000 per ventilator), with longer-term plans to build 200,000 ventilators
  - GM partnered with Ventec Life Systems (Seattle)
- Ford's target: make 50,000 ventilators by July 4
  - Ford partnered with Airon (Florida-based) to make simpler mobile ventilators

Why are auto firms good production partners for ventilators?

- They can manage large, complex supply chains.
  - Automobiles – 20,000 – 30,000 parts
  - Ventilators – 250-650 parts

April 2 – Trump issues executive order to invoke the DPA to require 3M to cease exports and increase supply of N95 masks

U.S. Ventilators – From Shortage to Glut

Unexpectedly, the vast majority of ventilators produced by GM and Ford in this warlike mobilization effort are going unused.

- Supply of ventilators in U.S. stockpile surged from 10,000 in April to over 95,000 by mid-August
  - Only 1,000 of these used to treat COVID-19 patients; >94,000 ventilators are now **unused surplus**.

Why such a dramatic mismatch between supply and demand?

- Treatment of COVID-19 patients evolved, and % of hospital patients put on ventilators has fallen significantly

Source: F. Siddique, "The U.S. forced major manufacturers to build ventilators. Now they're piling up unused in a strategic reserve," *Washington Post*, August 18, 2020.

U.S. Private Sector Response: Late but Surging, Cautious & Collaborative

Top U.S. producers of N95 masks: 3M & Honeywell

- **3M** – Trump invoked Defense Production Act on April 2 to require 3M to expand U.S. production of N95s and to import 166.5 million N95s from its mfg. plant in China
- March 2020 – **3M** produced 50 million N95s per month & **Honeywell** 20 million

Ramp up by 3M:

- Jan. to May, 2020 – doubled its output to 1.1 billion N95s (400 million in US, including partners) and plans to double capacity again to 2 billion by end of 2020

By May, U.S. govt. issued $600m in new contracts for N95s to a number of 3rd-party suppliers at prices many times higher than for the large established producers

- Charges of price gouging; counterfeit products; poor quality

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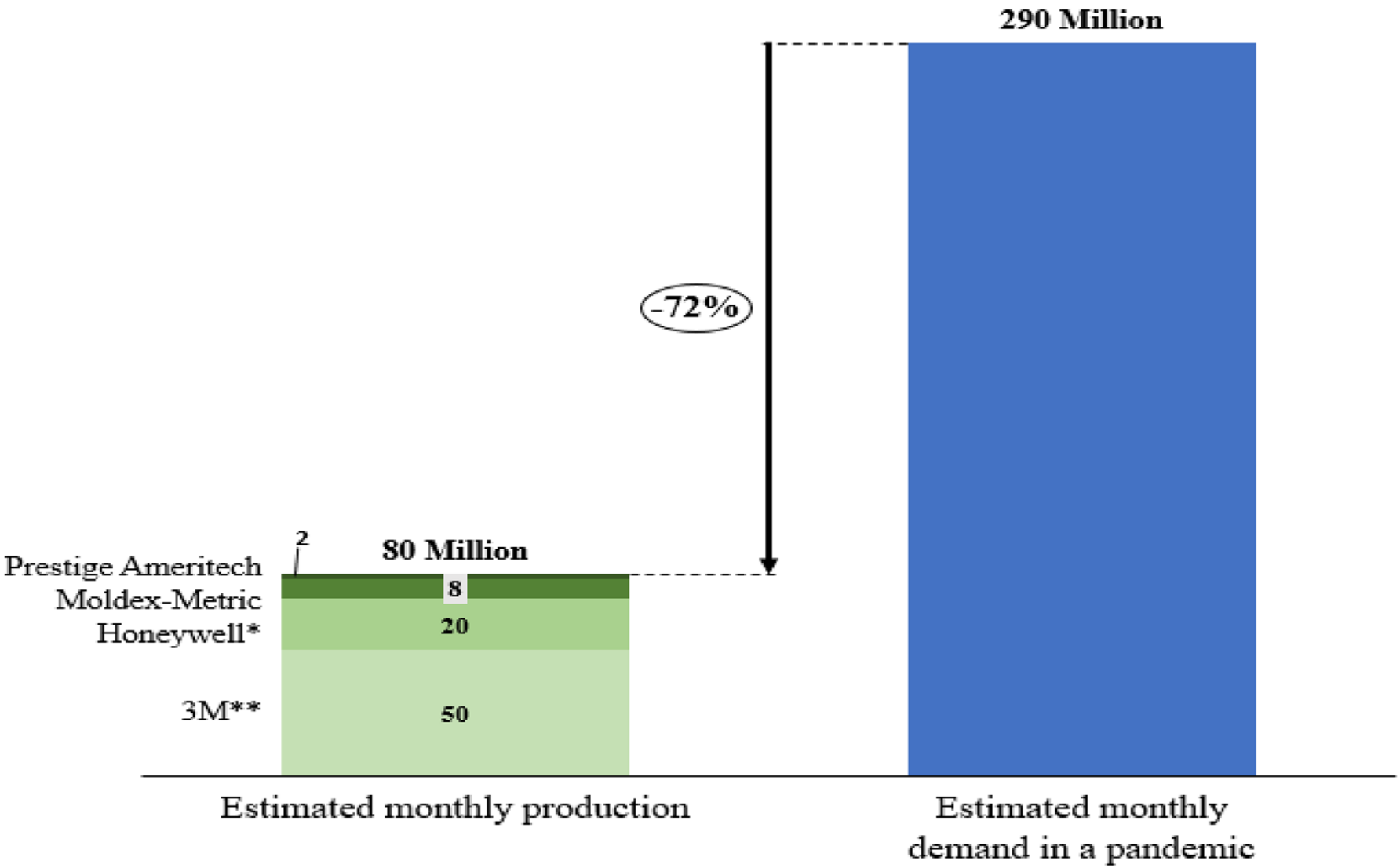
Shortfall in U.S. Production of N95 Masks



Source: U.S. Dept. of Health & Human Services estimates, March 2020.

Overall Assessment: Policy Failures > Market Failures

U.S. private sector response – Despite a late start, domestic producers of face masks increased output 4-fold to 8-fold in March – Aug. 2020.

- Some partnerships slow to develop
- Industry sources claim it is simply not profitable to make N95 masks in U.S. without govt. guarantees

Trump administration response – Denial there was a problem; slow decision-making; no prior planning; misinformation; no lead agency in federal govt.; no distribution strategy for PPE to states and hospitals.

Main cause of PPE shortages – policy failure > market failure.

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WHAT WOULD RESILIENT SUPPLY CHAINS LOOK LIKE, POST-PANDEMIC?

Options for More Resilient Supply Chains

There are several options to reduce rigidity and build greater resilience in global supply chains:

- Make them **more domestic** – e.g., reshoring & stockpiles
- Make them **shorter** – e.g., near-shoring (regionalization of production, such as Mexico & Central America for U.S.)
- Make them **more diversified** – e.g., reduce dependence on one or few countries

Currently, policymakers tend to associate resilience with more localized or shorter supply chains.

– However, reshoring PPE that is not profitable (e.g., face masks) or no longer scarce (e.g., ventilators, plastic face shields) is economically inefficient, not resilient.

Resilience in the post-COVID-19 era

No single country can be expected to produce all of the goods needed to fight the COVID-19 pandemic.

- E.g., for face masks, global demand was 10 times higher than world production capacity prior to the pandemic.

Open questions about resilience, post-pandemic:

- Resilience for whom? – resilience for firms (risk mgmt.) vs. political goals (like bringing jobs back home)
- Reshoring does not guarantee resilience or efficiency
- Firms vs. GVCs – latter involves internat'l divisions of labor, & greater role of govt. policies & institutions
- Innovation (who controls GVCs for vaccines?)
- Political landscape has changed – security & inward-looking strategies more important, post-COVID-19

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THANK YOU

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