FLORIDA ATLANTIC UNIVERSITY

FREIGHT MOBILITY RESEARCH INSTITUTE




Supply Chain Disruptions - Lessons Learned From Previous Natural Disasters

Sharad K. Maheshwari, Associate Director (Education)
Hampton University, Hampton, VA

Freight Mobility Research Institute (FMRI)
Webinar Series
June 25, 2020

Supply Chain Disruptions: Introduction

- **This webinar is survey of a past few supply chain disruption/s and what lessons, if any, were learnt.**
- **It is not a primary research webinar, but business perspective of impact of such events.**
- **Most of the figures, data and comments are based on the following:**
  - **WTO**
  - **UN-Comtrade**
  - **Journals in business like Journal of Supply Chain Management; Production Economics, etc.**
  - **Trade journals like Wall Street Journal, Forbes**

Supply Chain Disruptions: Introduction

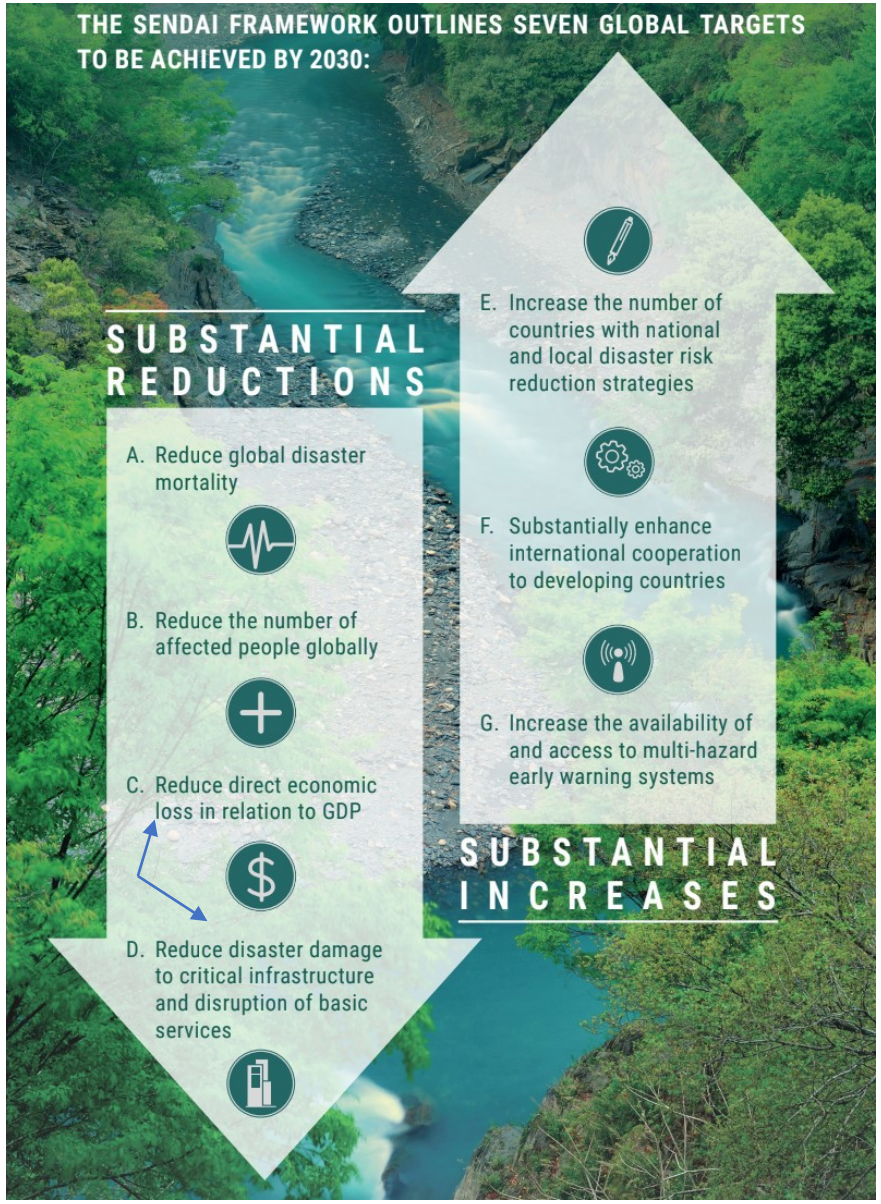
- **Supply chain management includes the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities.**
- **This includes coordination with all channel partners and all aspects of demand and supply.**
- **SCM is a network problem with multiple layers, and goal is to optimize cost, quality, reliability, etc.**

Supply Chain Disruptions: Definition

- **Disruption**
  - **Low Probability Events, High Impact on the supply chain**
  - **High probability events can be anticipated, and mitigation can be planned.**
  - **Low prob, low impact, not necessary to invest much resources.**
- **Risk factors (what generally literature shows)**
  - **Natural Disasters—Floods, Earthquakes, Tsunamis, Hurricanes, Fires, Etc.**
  - **Accidents– Industrial, Nuclear, etc.**
  - **Infrastructure– IT Systems, Ports, Power, Roads, Etc.**
  - **Social/Political– Strikes, Trade Wars, Regulatory, Judicial, Wars, Unrest, etc.**
- **Pandemic/epidemic are not generally considered in literature. This may be dues to lack of data, very low probability of events, etc.**
- **COVID19's impact is probably going to be unique.**

Supply Chain Disruptions—Sendai Framework

- UN Framework--The Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework) was the first major agreement of the post-2015 development agenda and provides Member States with concrete actions to protect development gains from the risk of disaster.—**Understand, reduce, & Increase resilience.**



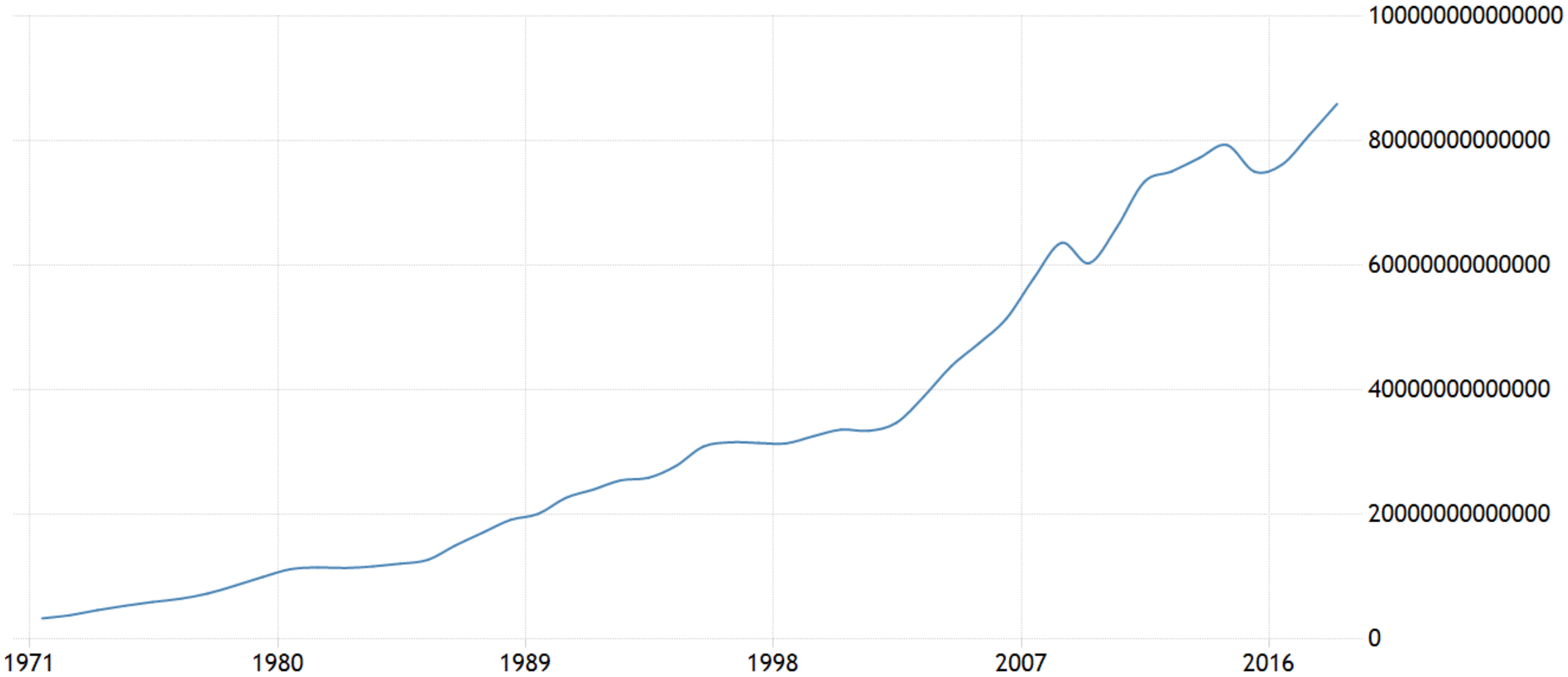
Supply Chain Disruptions—Spanish Flu

- **Spanish Flu 1918-19**
- **World War 1**
- **Huge loss of life**
- **Economic losses: closes $200 billion**
- **One of the FED's studies concluded that economic impact was "short-term."**
- **But in early 1900s world trade was not so robust; hence, economic impact of disaster was different then.**

Supply Chain Disruptions—Beyond Spanish Flu

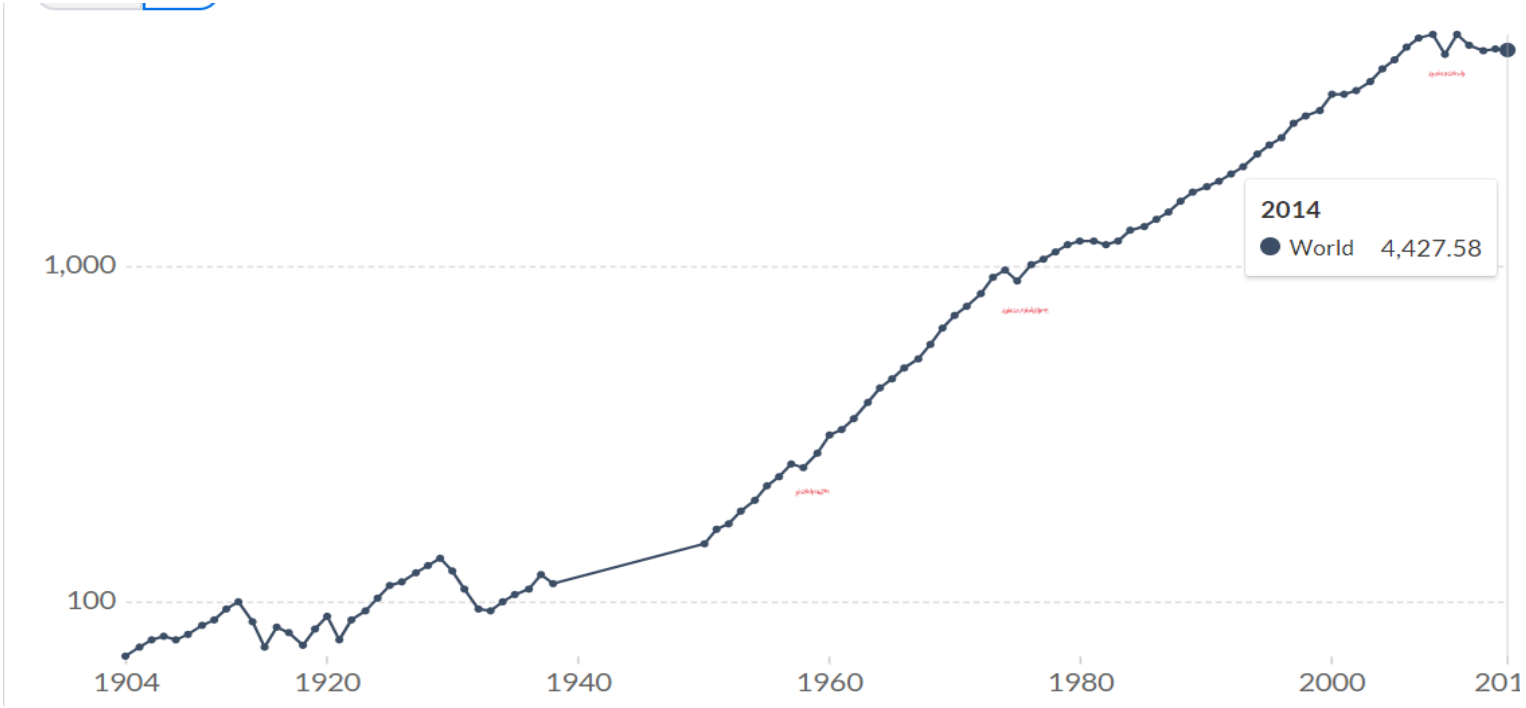
- **Much larger global trade volume**
- **More interdependence**
- **Very competitive environment**
- **Complexity of supply chain**
- **Short product lives**
- **And much more…**

Supply Chain Disruptions—Economic Data GDP



Supply Chain Disruptions—Trade

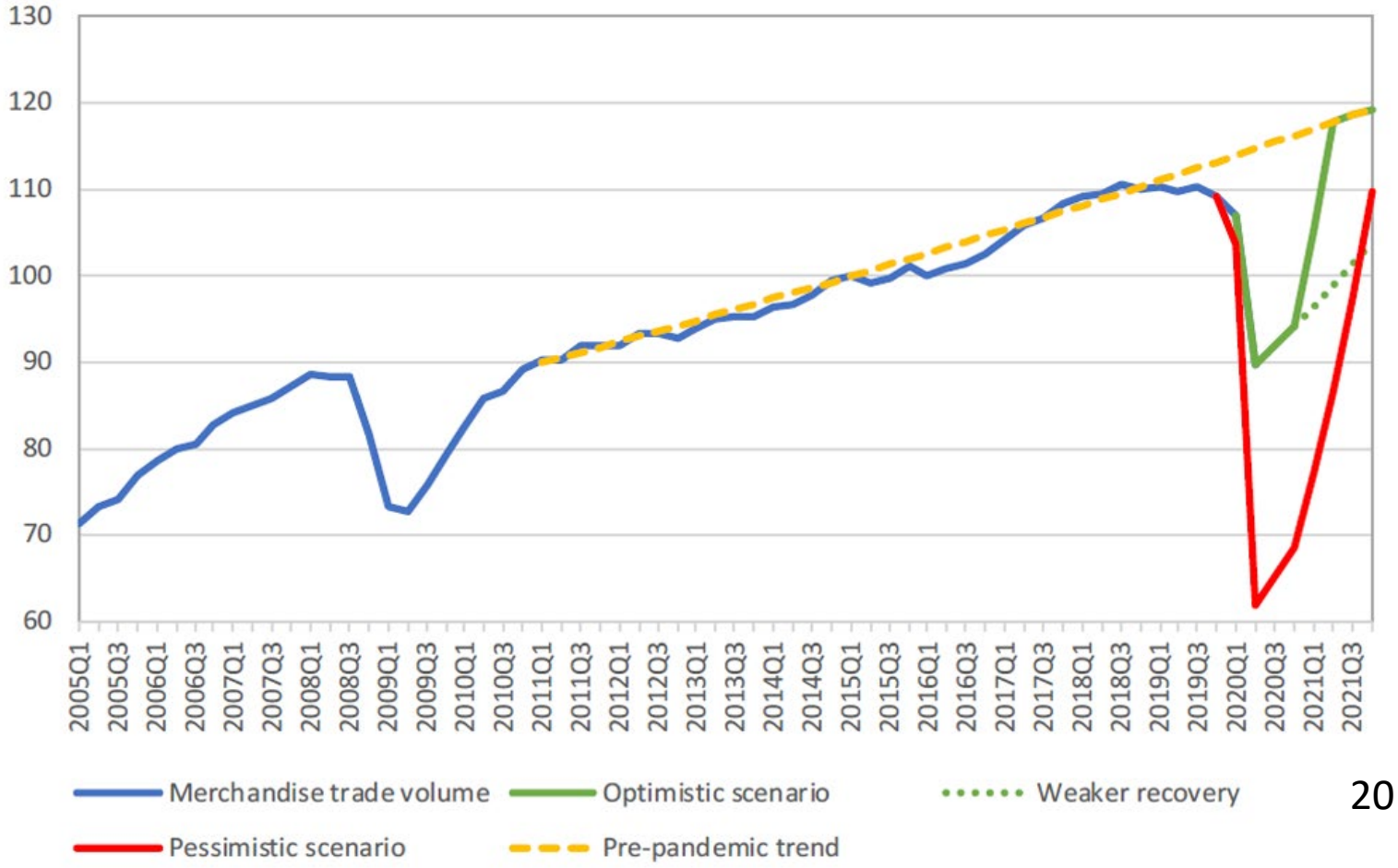
- **World Exports in 1913 dollars (1993=100)**
- **In 2014 it was 45 times higher than 1913 exports**
- **It has increased another 10%-15% since 2014, i.e., 50 times of 1913 exports.**



Supply Chain Disruptions—Economic Data

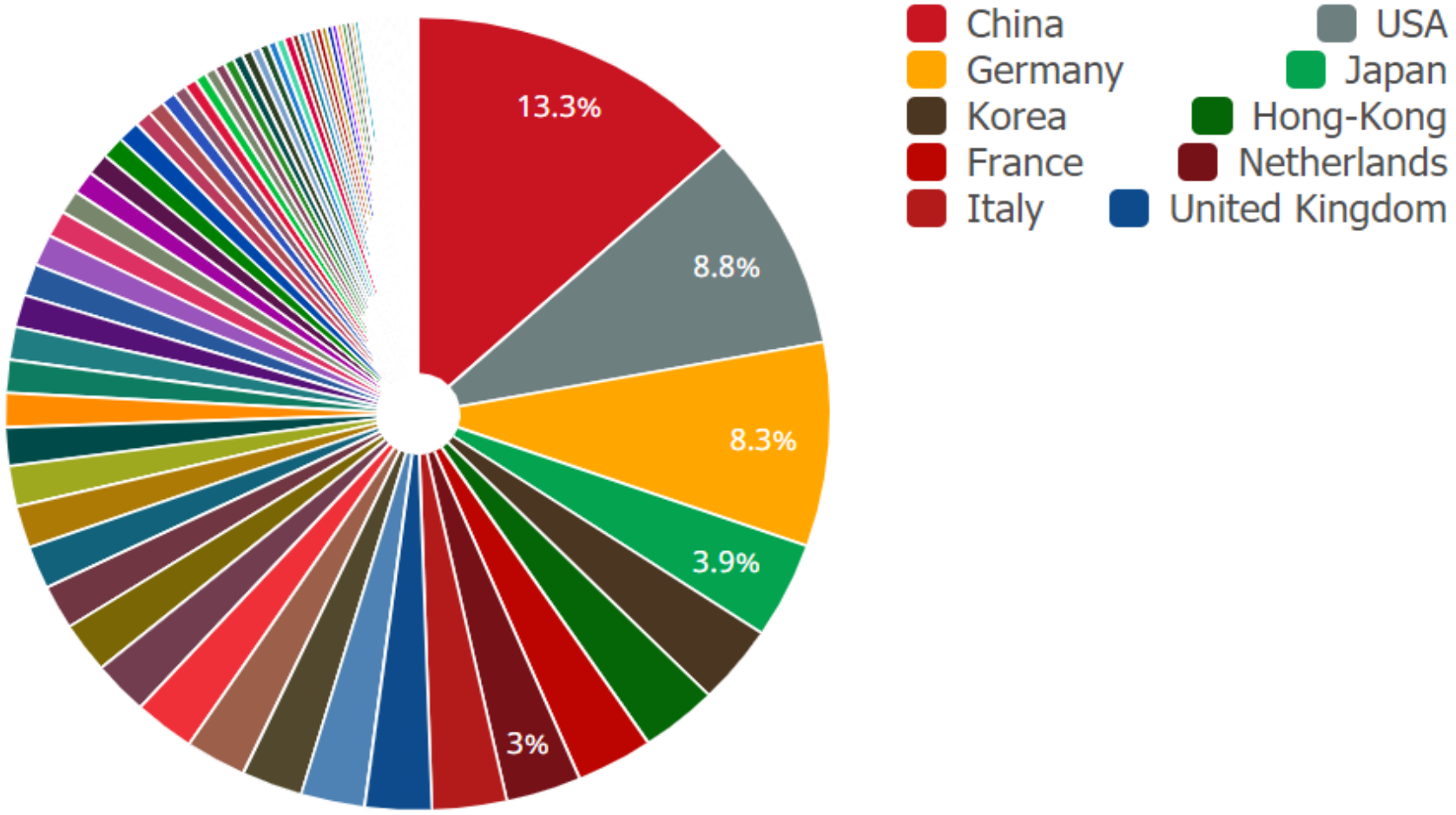
- **1971**
  - **GDP $20 T (in todays dollars)**
  - **Real GDP $3.25 T**
  - **Population about 3.8 billions**
- **2018**
  - **Nominal GDP $85 T**
  - **Real GDP $85T**
  - **Population about 7.7 billions**
- **5 decades later**
  - **GDP is up 4 times**
  - **Population is up 2 times**
  - **Exports are up about 10 folds**

Supply Chain Disruptions—Merchandise Trade



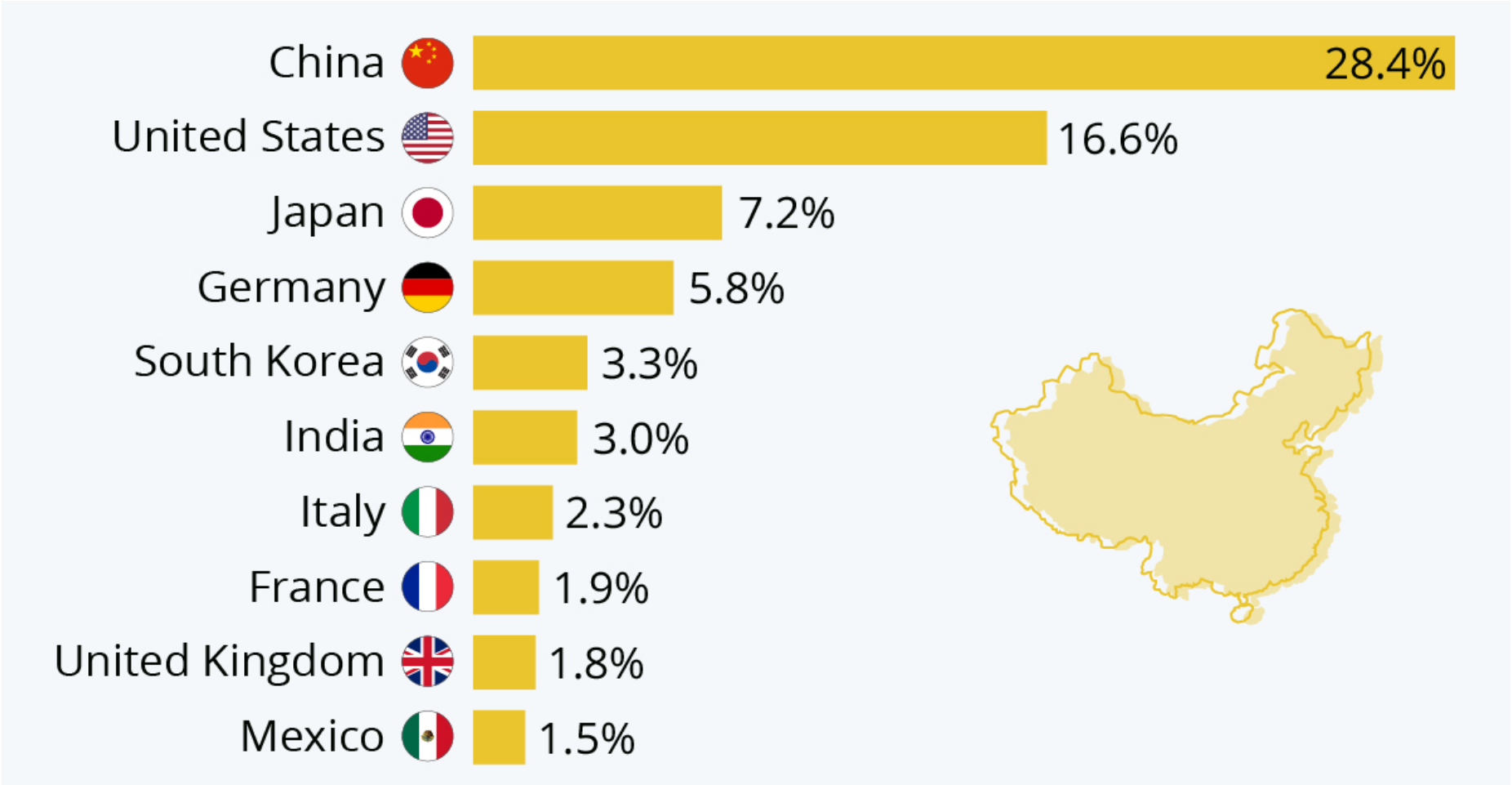
2015 q1 = 100

Major Exporters in the World

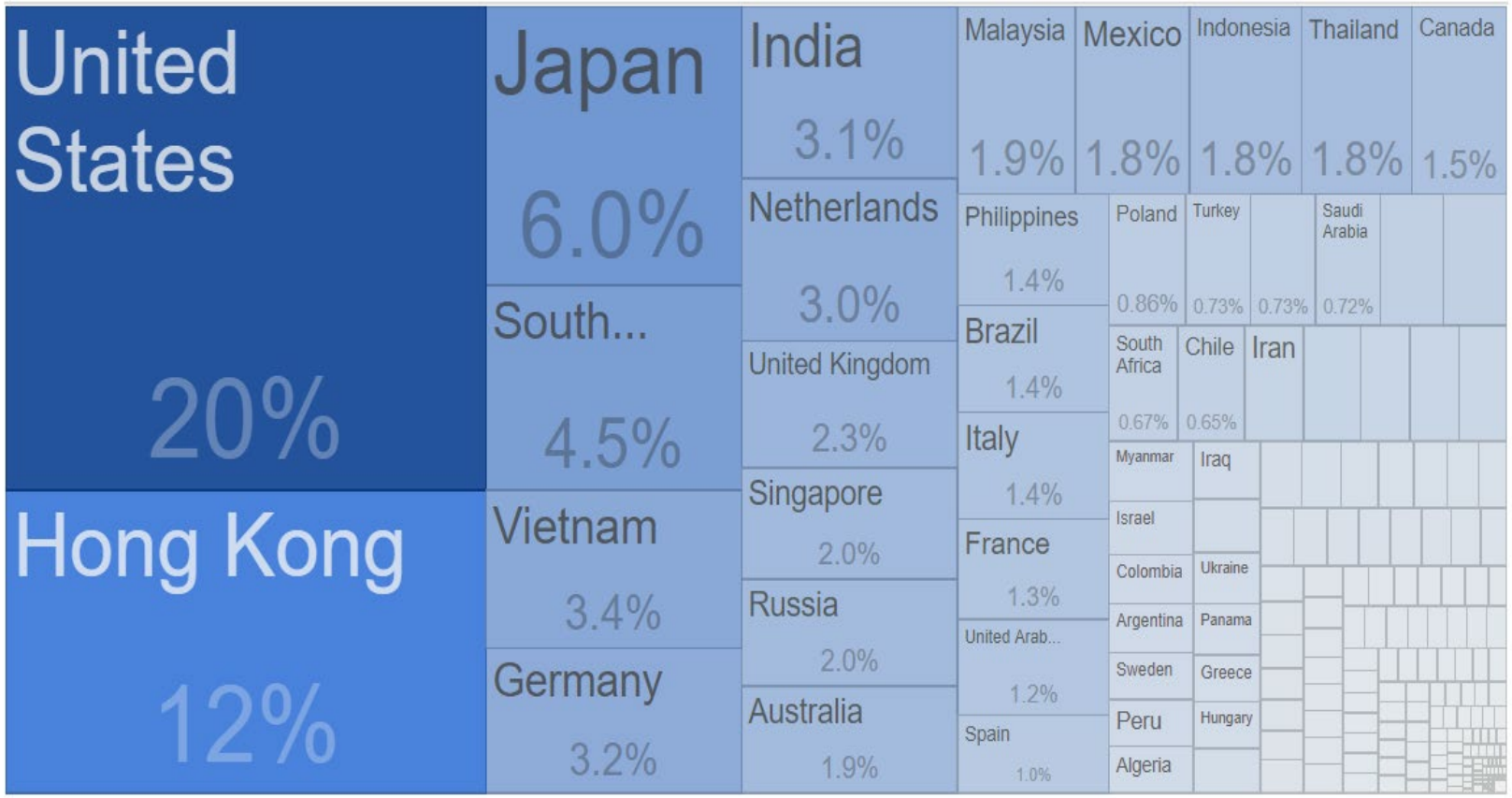


Supply Chain Disruptions—Manufacturing

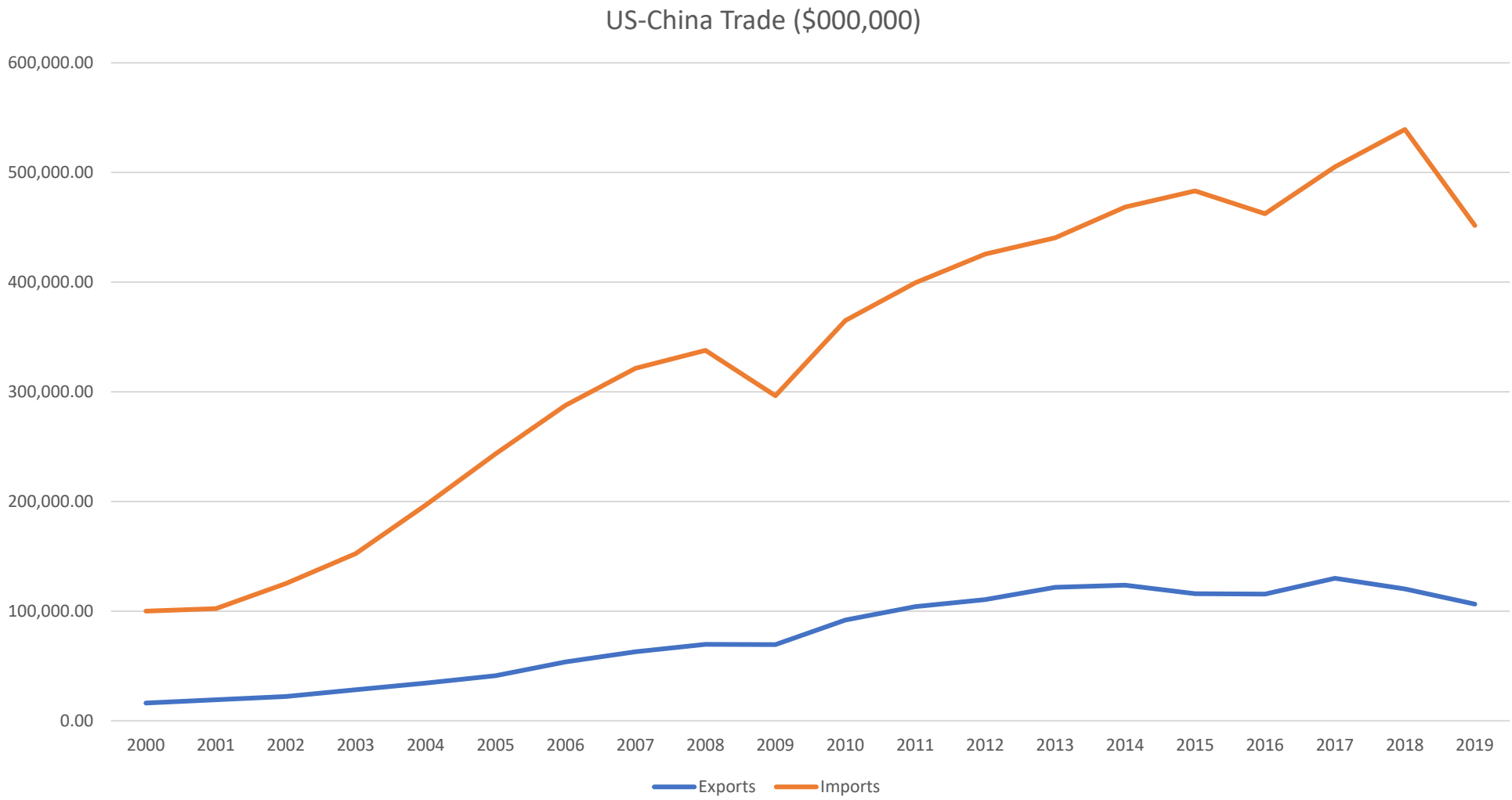
Percentage of world manufacturing by top 10 nations (2018, $16 T)



China's Export

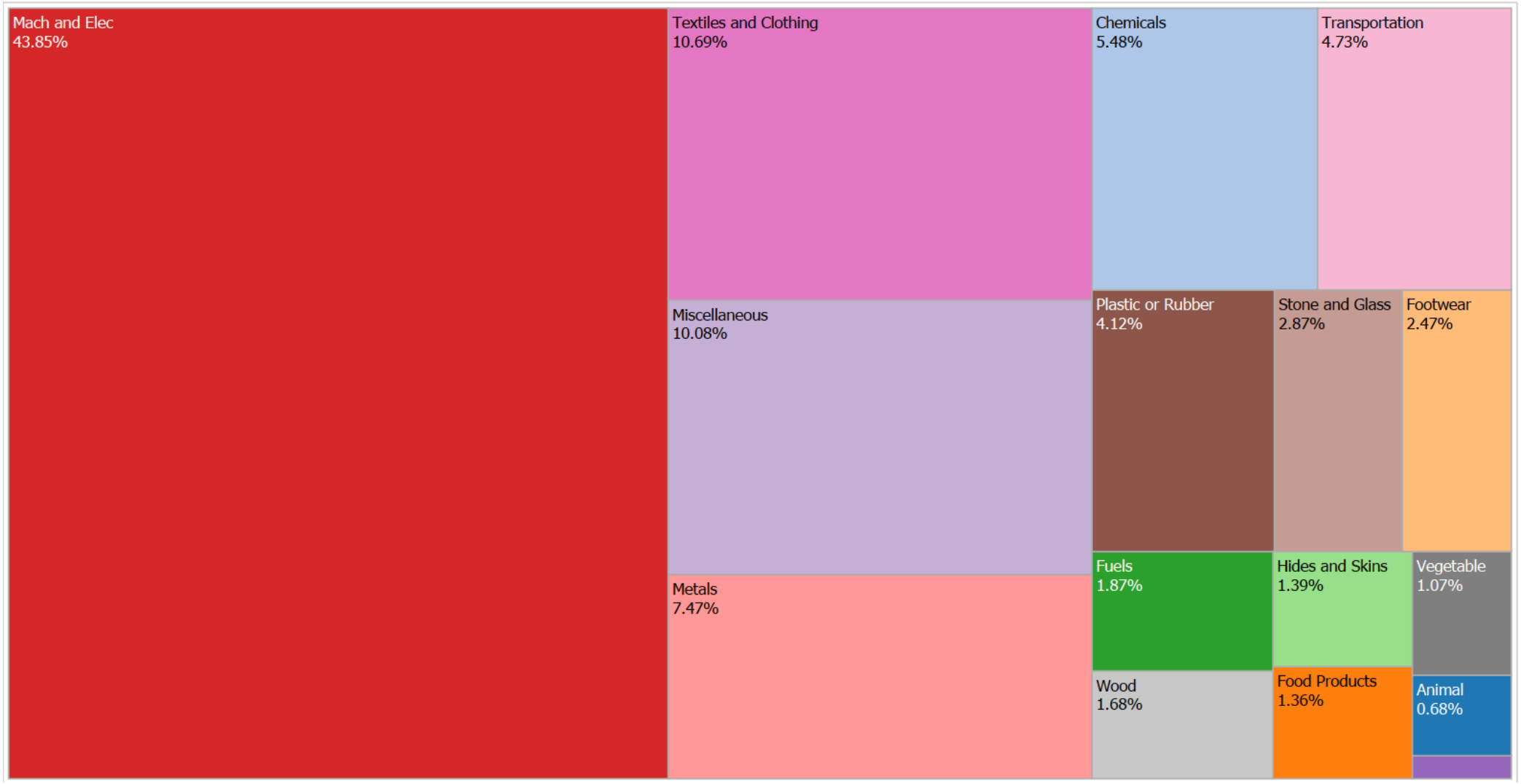


Supply Chain Disruptions—Trade US-China



Supply Chain Disruptions—Chinese Export by Product

China, Export by Product



Supply Chain Disruptions—Some Disruptions in 2000s

- 2001 9/11 terrorism
- 2004 Indian Ocean Tsunami
- 2005 Katerina
- ~~2008-09 Great recession~~
- 2011 Japanese Tsunami
- 2011-12 Flood in Thailand (industrial area)

Supply Chain Disruptions—Some Disruptions in 2000s

- **2001 9/11 terrorism—$100 b+**
- **2004 Indian Ocean Tsunami $10 b**
- **2005 Katerina $82 b**
- **2011 Japanese Tsunami $275 b**
- **2011-12 Flood in Thailand (industrial area) $4-6 b**

Supply Chain Disruptions—Tsunami 2011

- **Most studied supply chain disruptions (low prob/high impact)**
  - **Large financial damage**
  - **Worldwide impact**
  - **World's premier car company, Toyota, was impacted the most**
  - **Systematic response to recovery from Tsunami**
  - **Longest of the other low probability-high impact disruptions until then**
  - **Generally disruption impact on supply last about 1-2 weeks**
  - **Japanese Tsunami -3 weeks to a few months**

Supply Chain Disruptions—Tsunami 2011

- Iryou--Medical devices
- Kenki--Construction equipment
- Sangyo--Industrial equipment
- Zyuden—Electric equipment
- Renesas Electronics—Automotive Controllers
- Merck's Onahama paint factory—Specialty Paint
- Other Auto parts—Generic parts Supplier

Supply Chain Disruptions—Tsunami 2011

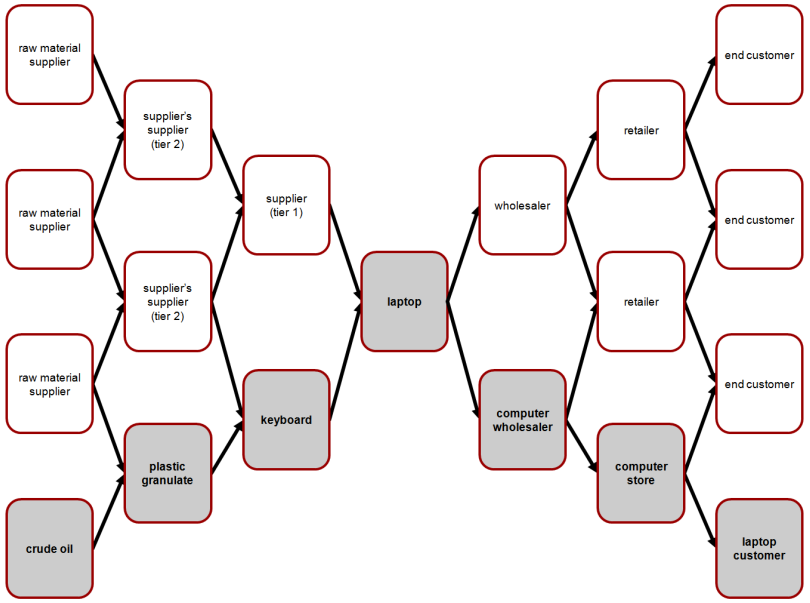
- **Alternative Sources**
  - **China**
  - **Philippines**
- **Restoration of Power Supply**
- **Design sharing and alternative IT based manufacturing**
- **Full recovery in about 3 months**

Supply Chain Disruptions—Lessons from Tsunami 2011

- Supply Chain Visibility
- Higher Inventory levels
- Second Sourcing (Renesas Electronics was high specialty unit)
  - Increasing the number of lines/ facilities/suppliers
- Design Portability
  - Modular Designs
  - Standardized component parts
- Disaster Prediction and Risk Assessment

Supply Chain Disruptions—Tsunami 2011

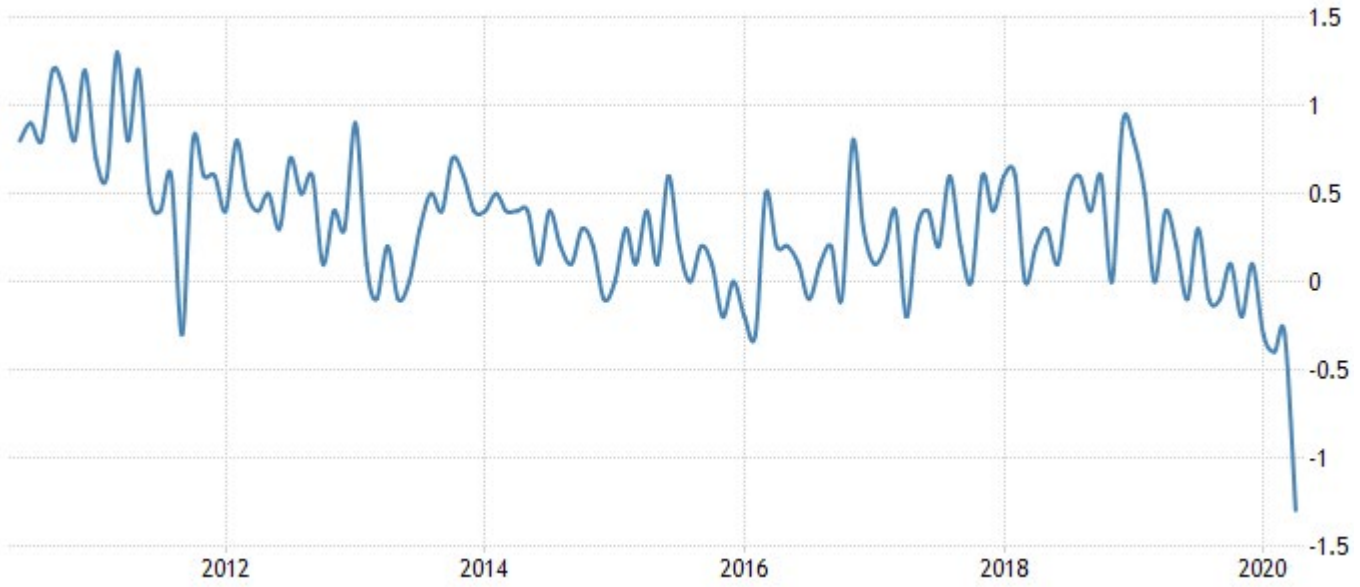
- Supply Chain Visibility
  - Most customers have relationship with 1-tier supplier and customers.
  - Customers are generally unaware of how stretched are the supply chains.
  - That is why they are unable of to predict and foresee any troubles within the network.
  - 2017 survey of procurement officers
    - 6% felt that they have complete visibility.
    - This 6% represents full 1-tier supplier visibility only.



Depiction of Supply Chain Network

Supply Chain Disruptions—Tsunami 2011

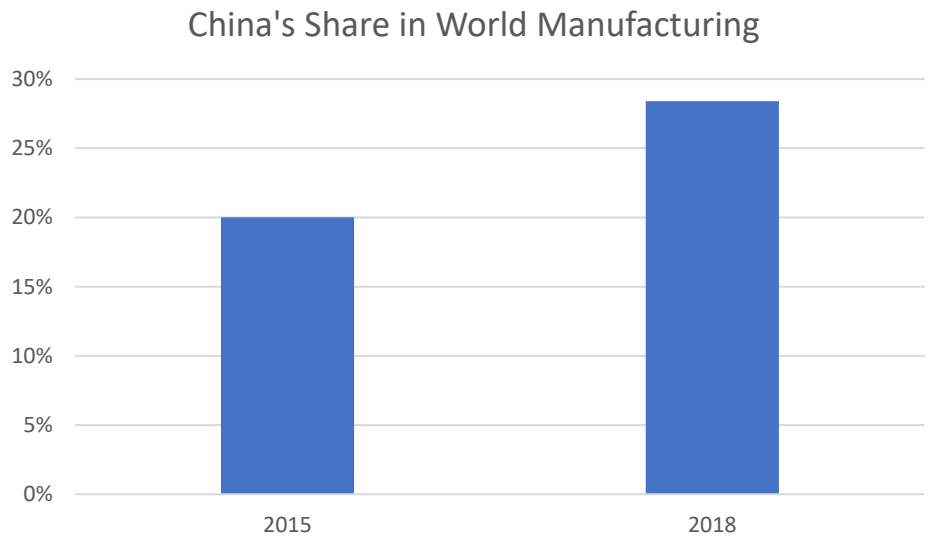
- Maintain Inventory to sustain disruption.
- This is a costly alternative, hence hardly any organization is doing it.
- Shorter product lives require large inventories at upstream levels.



Percentage Change in US Inventories

Supply Chain Disruptions—Tsunami 2011

- Second Sourcing
  - Japanese companies learnt that production can be moved from Japan to China to lower cost.
- But it is resulting in concentration of manufacturing in China
  - However if there is disaster (like Covid 19) in China, supply chain can be strained.



Supply Chain Disruptions—Tsunami 2011

- Design Portability
  - Modular Designs
  - Standardized Parts
- Modular Design
  - Boeing Vs. Airbus
    - 737 Max vs A320 neo
    - Boeing faced delays and now crashes of 73 max
    - A320 adopted less complex modular design (as oppose to complex proprietary model)
- If possible and if business allows, use standard parts (specialty non-standard parts are profitable business)

Supply Chain Disruptions—Lessons Status

- Supply Chain Visibility
  - IT infrastructure needs to strength
- Inventory levels
  - Cost may prohibit this option
- Second Sourcing
  - Locational diversity is desirable
- Design Portability
  - Managerial level decision, wide acceptability is not possible
- Disaster Prediction and Risk Assessment
  - Forecasting??

Supply Chain Disruptions—Covid 19

- Few risk analyses considered risks on this scale!!
- Crises are quickly forgotten
- Hardly any lesson from 2011 Tsunami is learnt (that is, implemented at large scale), Covid is forcing to re-visit those options.
- Emphasis on sourcing
  - Effective supply chain risk management can identify, analyze, address, and control supply chain risks.
- Better forecast and plan for future crises

Supply Chain Disruptions—Covid 19

- Supply Chain Visibility
  - Investment in IT
- Inventory levels
  - Must be re-visited
- Design Portability
  - Virtual Design networks
- System Approach to mitigate the risk.

Supply Chain Disruptions—Just a thought

- Osotua
  - Masai word meaning resource sharing
  - That is when, there is a disaster you help your competitor to recover
    - Sharing load
    - Helping to rebuild
  - Cooperation in supply chain between competitor