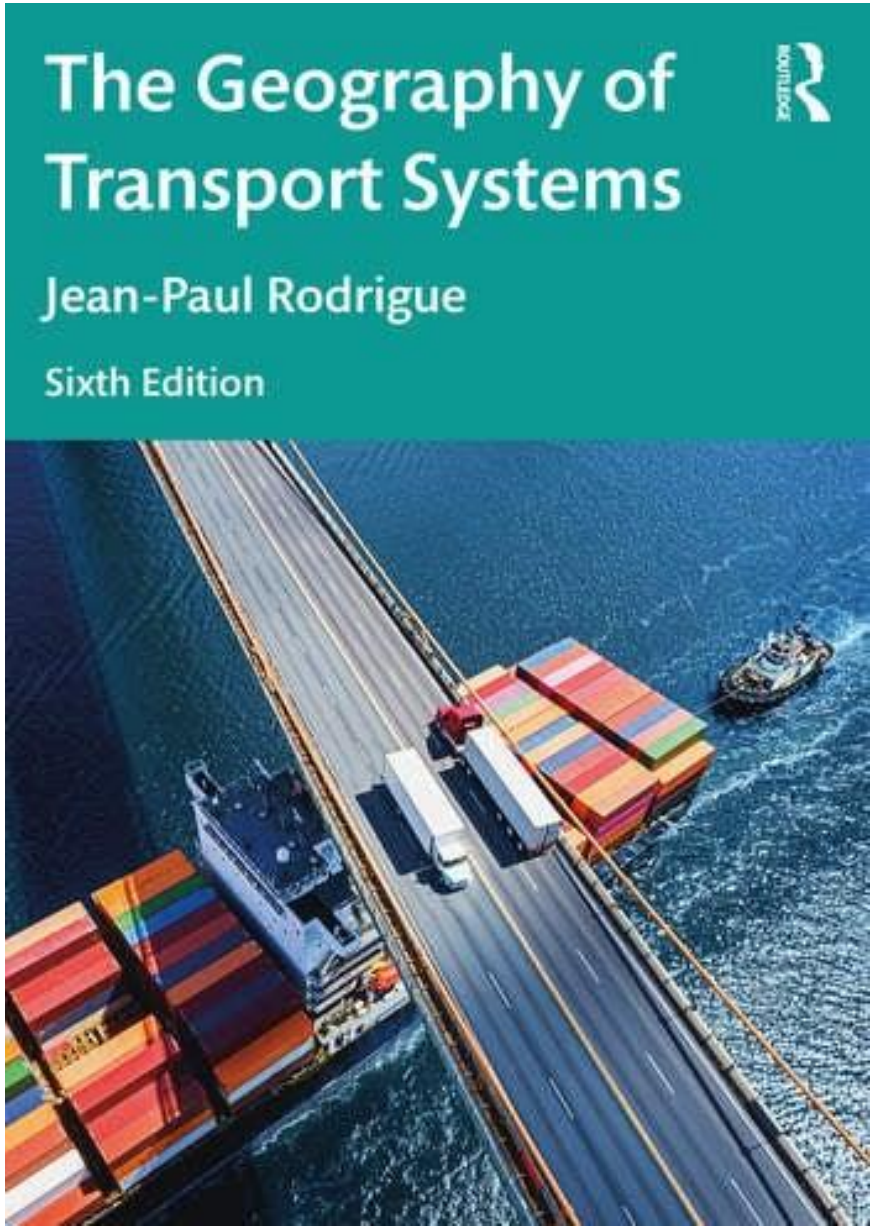


# Transportation and Geography

## CHAPTER 1



ecojpr@gmail.com

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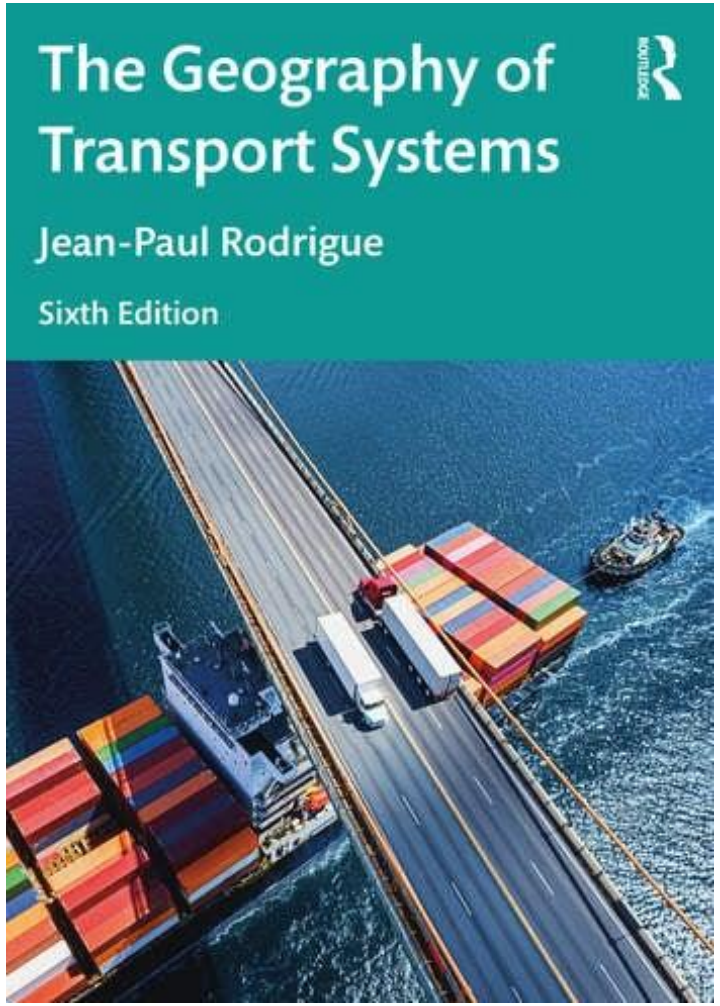
# Table of Contents



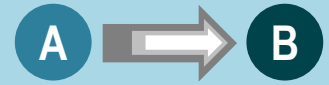

# What is Transport Geography?

Chapter 1.1

# The Core Principles of Transport Geography

1. 

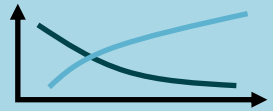
Transportation is the spatial linking of a **derived demand**

2. 

**Distance** is a relative concept involving space, time and effort (cost)

3. 

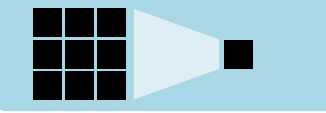
**Space** can be a generator, a support and a constraint for mobility

4. 
The relation between space and time can **converge** or **diverge**

5. 

A **location** can be a central or an intermediate element of mobility

6. 
To overcome **geography**, transportation requires a footprint

7. 
Transportation seeks **massification** but is constrained by **atomization**

8. 
**Velocity** is a modal, intermodal and managerial effort

# The Scales of Transport Geography

| | NETWORK | FLOWS | SPATIAL CONSTRUCTS |
|---|---|---|---|
| LOCAL | • Transit systems<br>• Street networks | • Commuting<br>• Personal and social trips<br>• Deliveries | • Activity space<br>• District / Neighborhood<br>• Terminal / Development zone<br>• Town / City |
| REGIONAL | • Commuter rail<br>• Regional air networks<br>• National highway systems<br>• National railway systems<br>• Short sea shipping / feeders | • Intercity passenger flows<br>• Distribution | • Metropolitan area<br>• Market area<br>• Hinterland / Corridor<br>• Urban region |
| GLOBAL | • International air networks<br>• Maritime shipping networks<br>• Telecommunication networks | • Trade<br>• Tourism and business trips<br>• Migration | • Value chains<br>• Landbridge<br>• Trade area |

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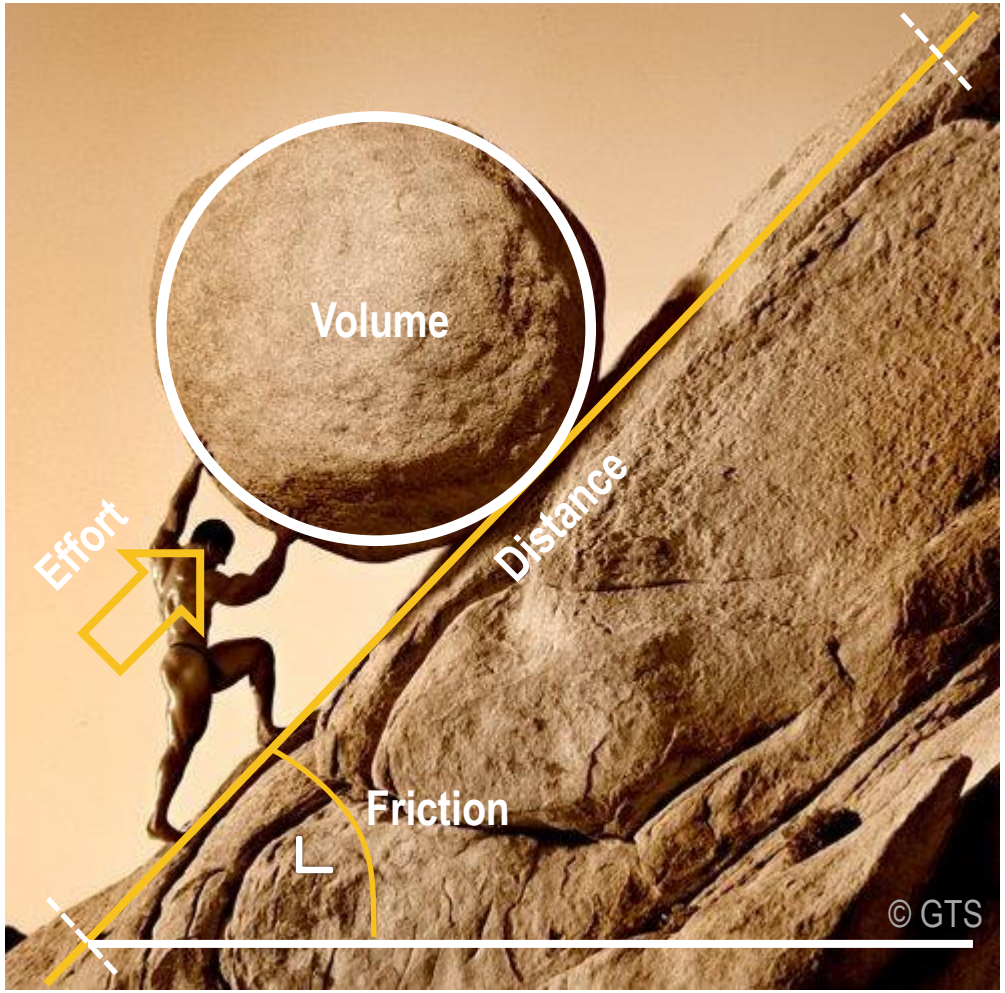
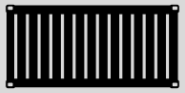
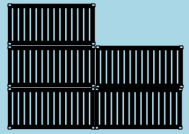
# The Sisyphus Analogy in Transportation

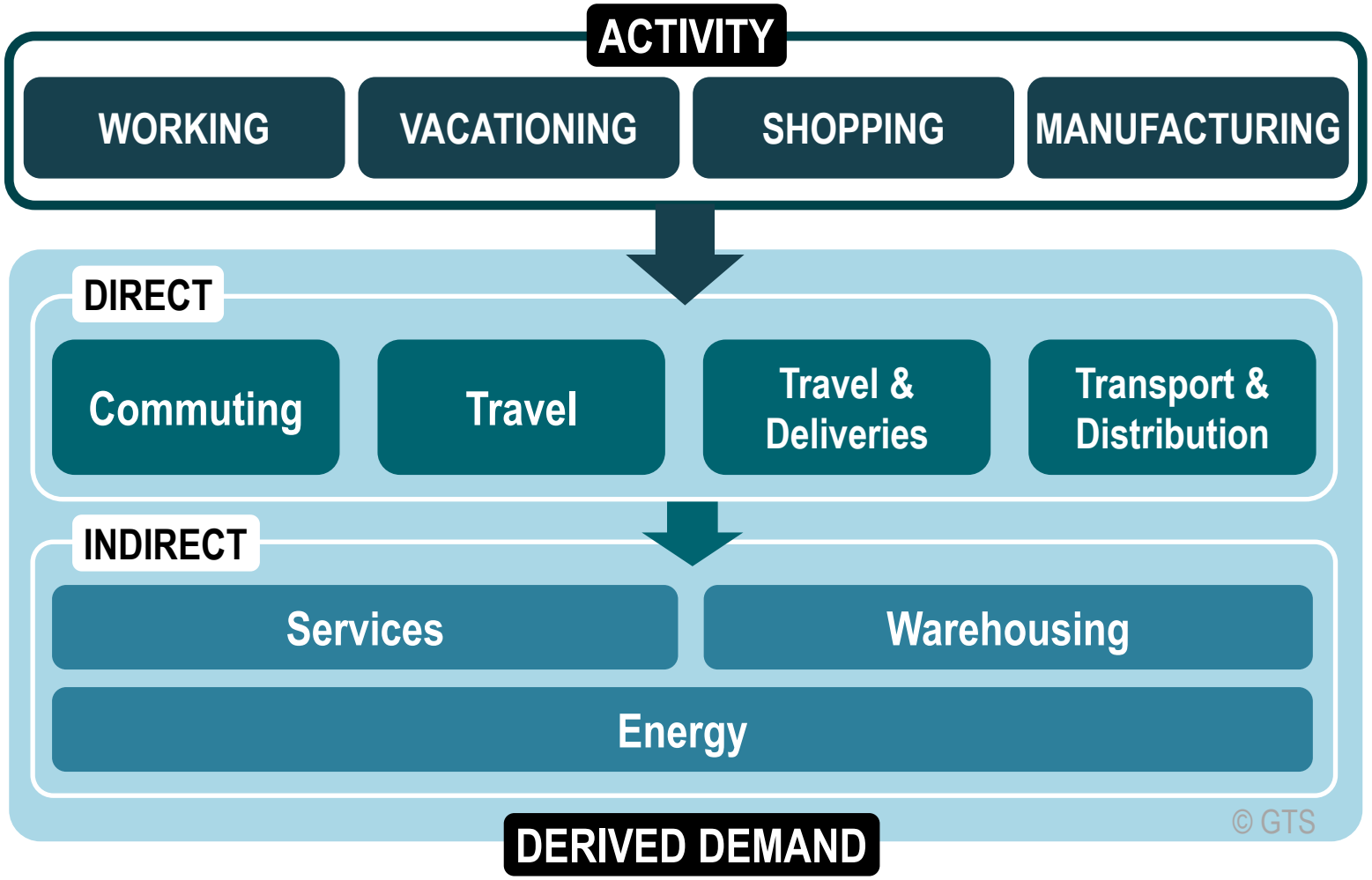


# Mobility of Freight

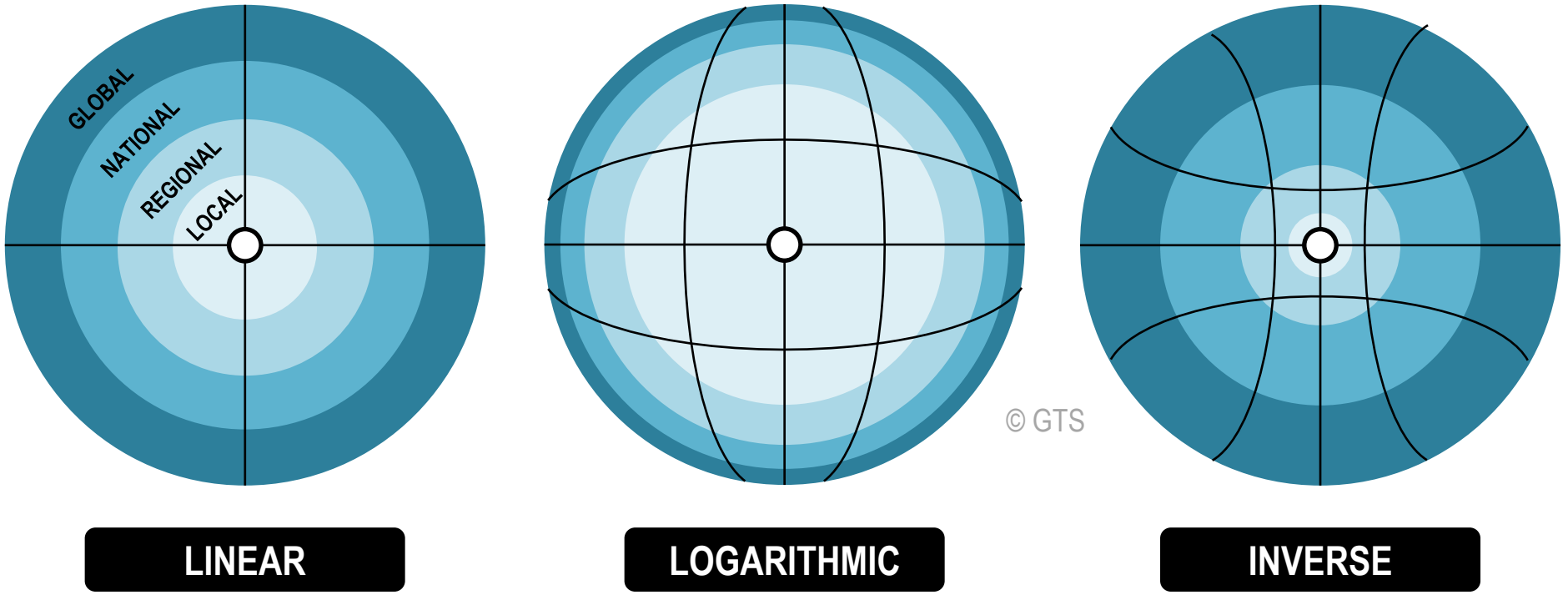
| | Weight | Storage | Fragility | Perishability |
|---|---|---|---|---|
|  | **Ores**<br>Heavy (0.83 g/cc) |  Piling | None | None |
|  | **Grain**<br>Heavy (0.83 g/cc) |  Silos | Low | Low |
|  | **Petroleum**<br>Heavy (0.88 g/cc) |  Tanks | None | None |
|  | **Apparel**<br>Average |  Warehouse | Low | None |
|  | **Fruits & vegetables**<br>Average |  Temperature controlled warehouse | High | High |
|  | **Containers**<br>Average (15-20 tons) |  Stacks | Cargo dependent | Cargo dependent |

© GTS

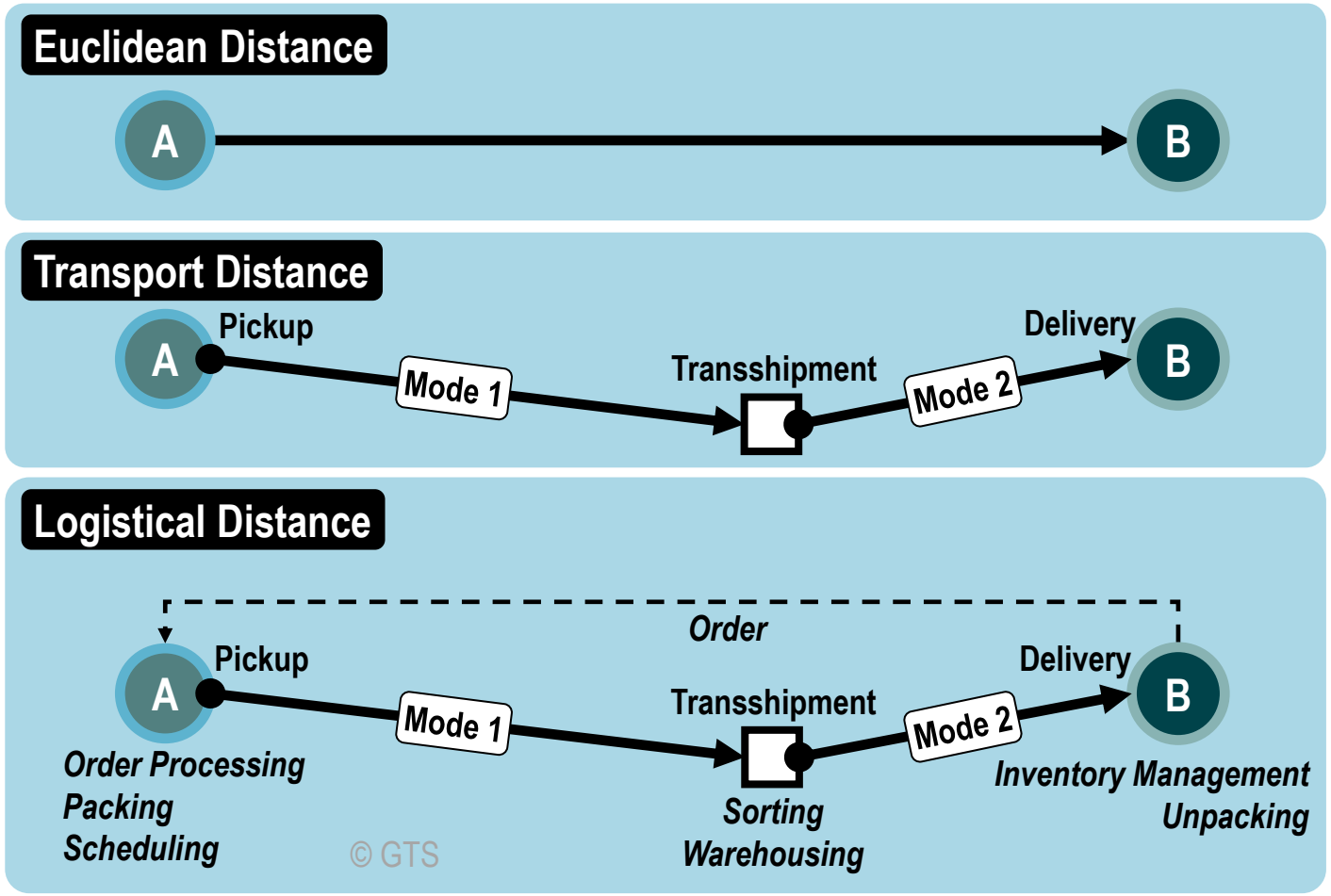
# Transportation as a Derived Demand



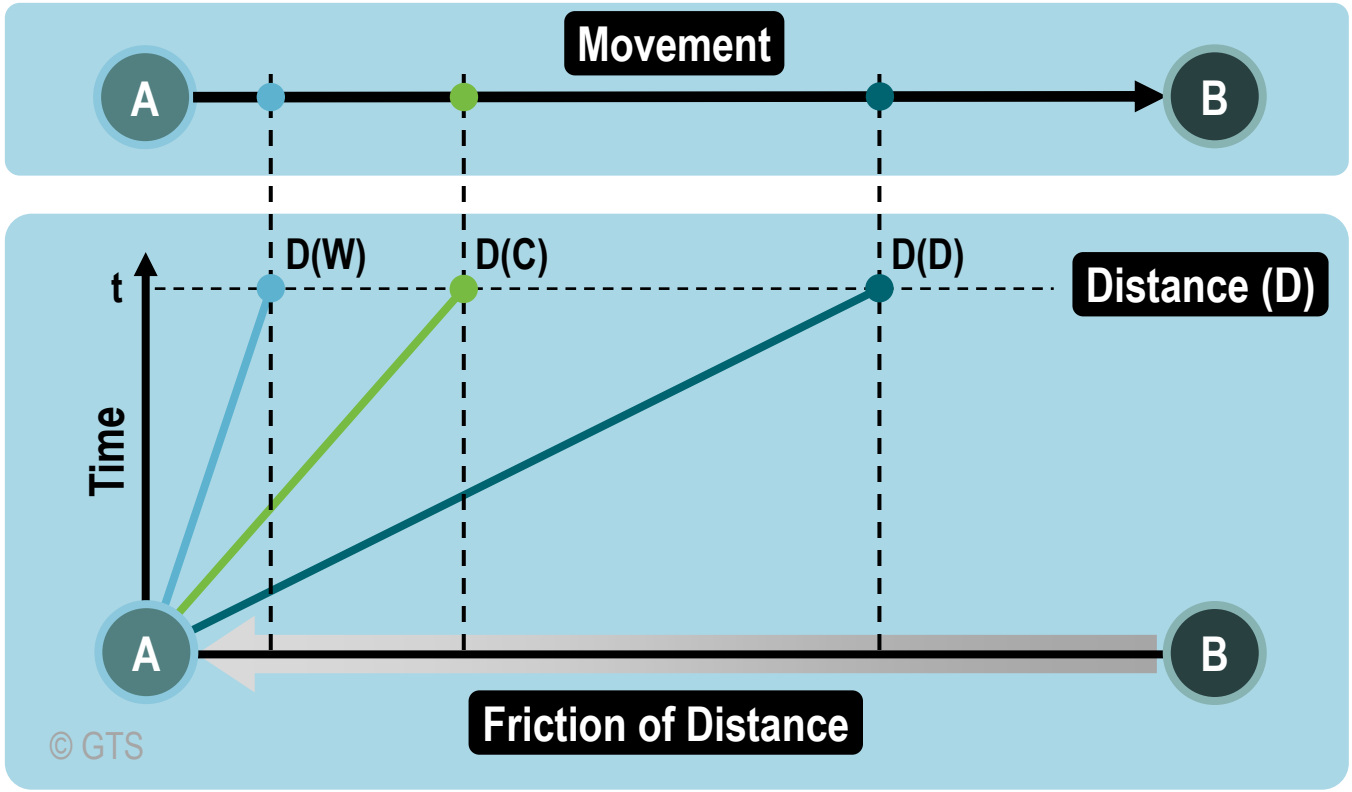
# Representations of the Effects of Distance



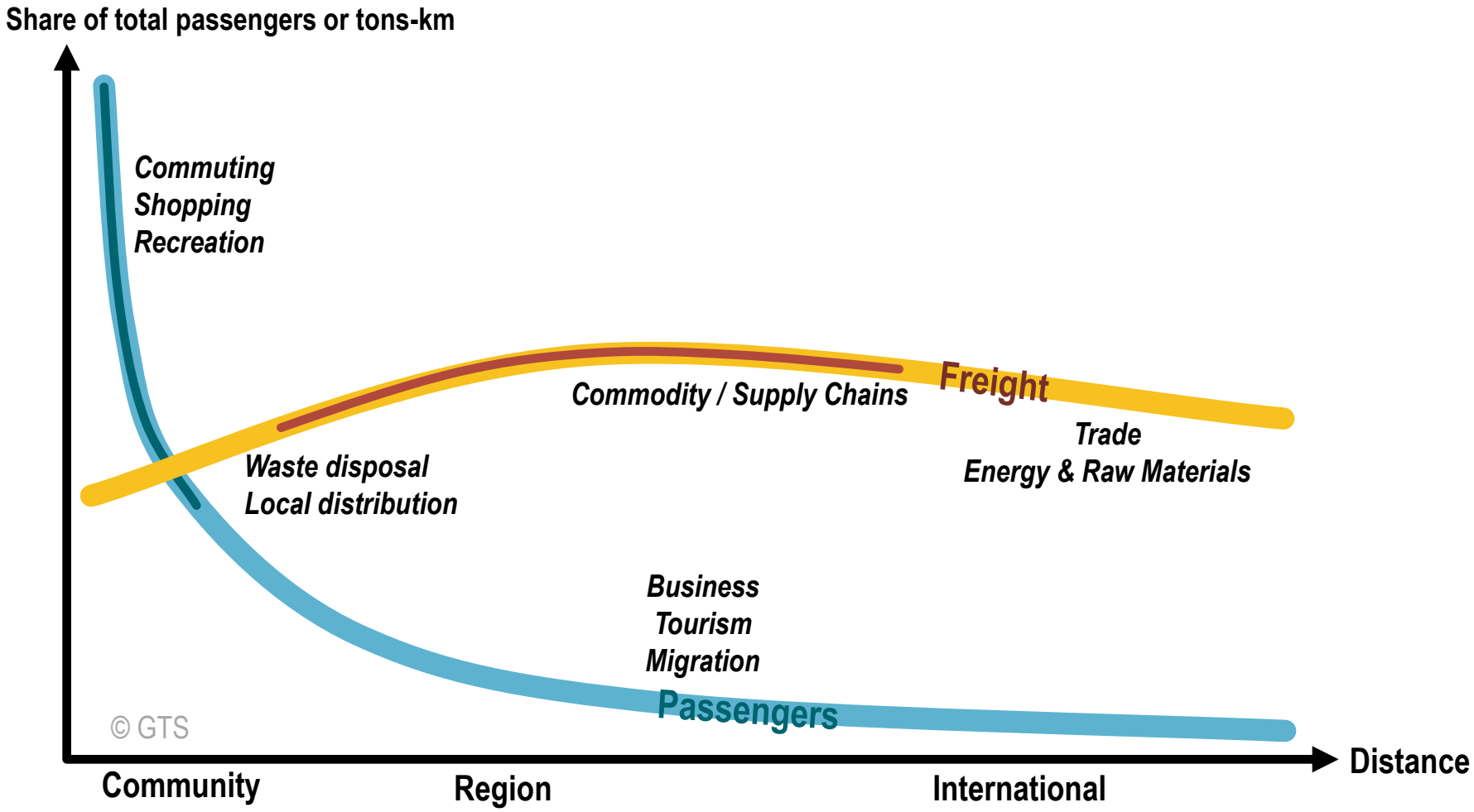
# Different Representations of Distance



# The Spatial Consideration of a Movement



# Transportation and the Mobility of Passengers and Freight

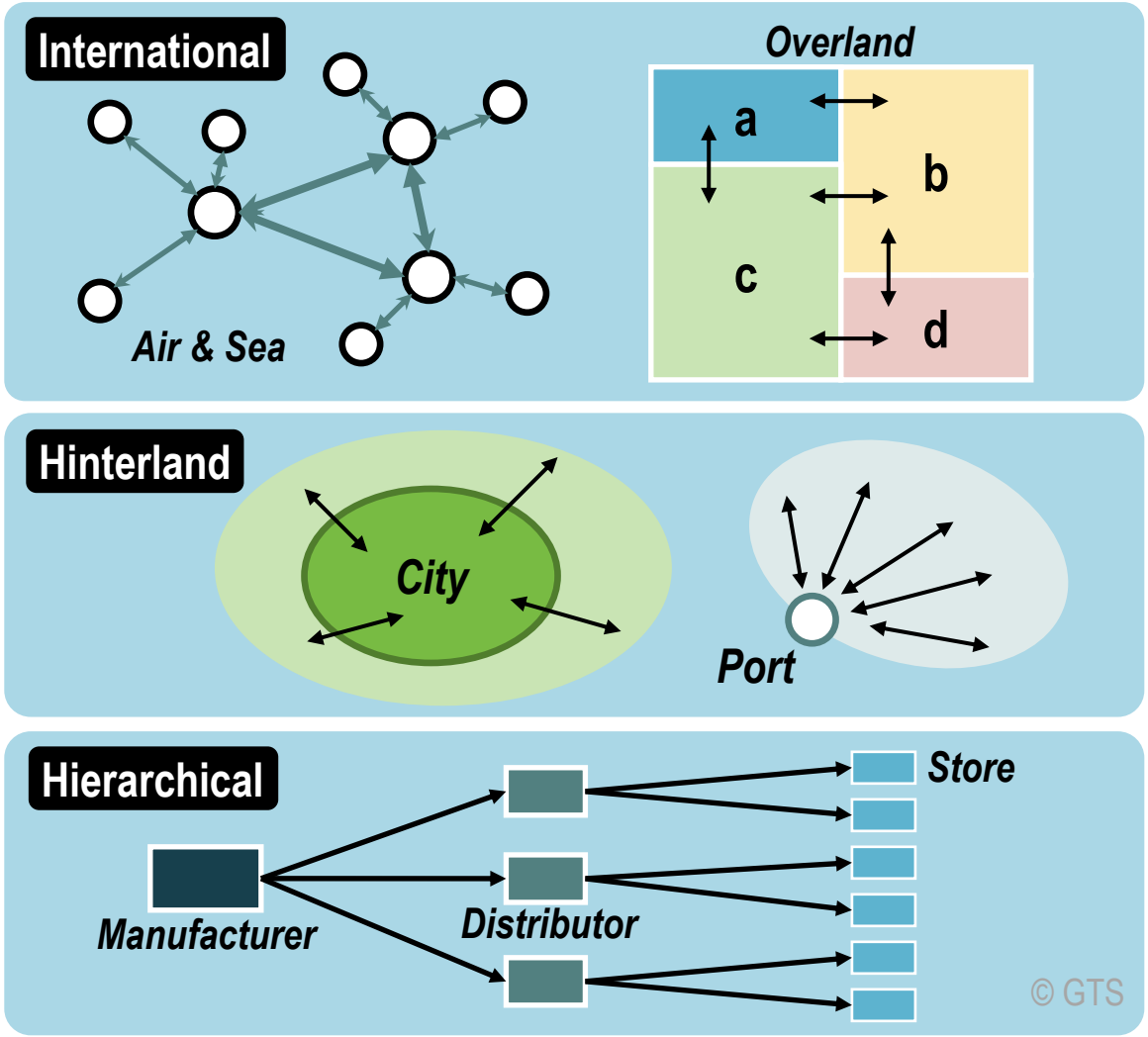


# Operational Differences between Passengers and Freight Transportation

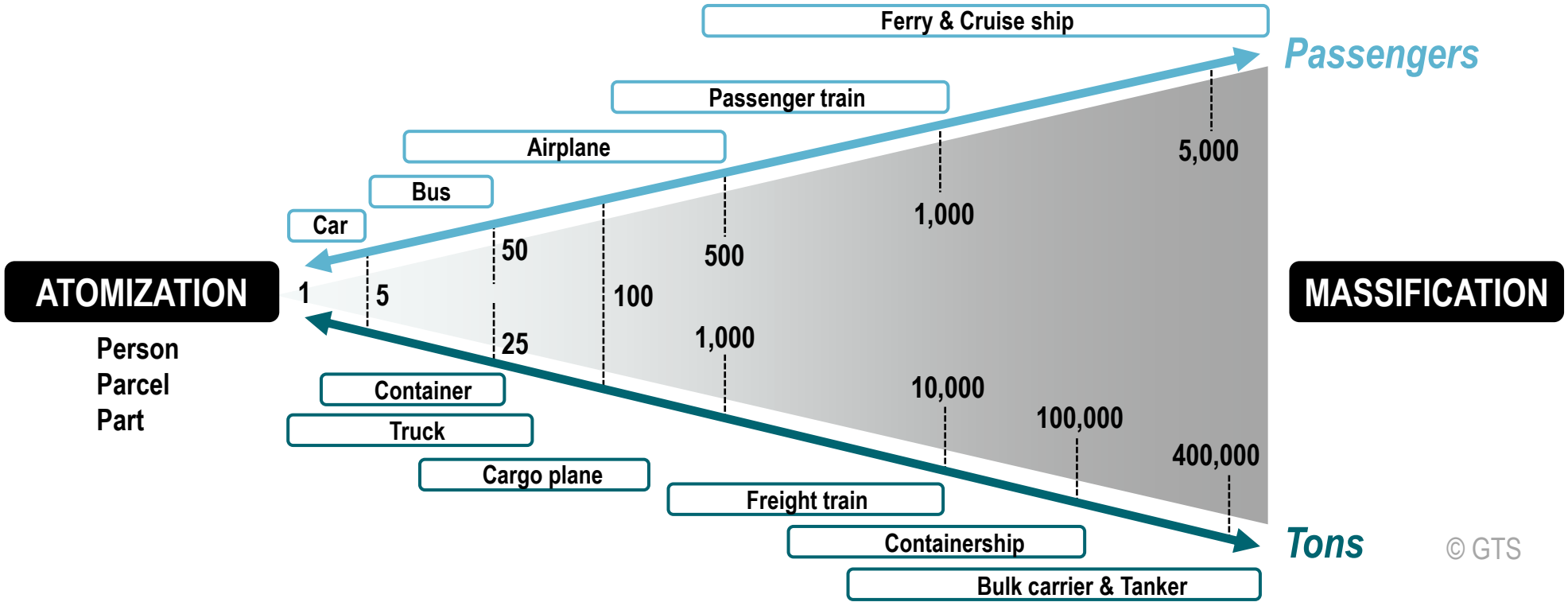

- Board, get off and transfer without assistance.
- Process information and act on it without assistance.
- Make choices between transport modes without assistance but often irrationally.
- Require travel accommodations related to comfort and safety.


- Must be loaded, unloaded and transferred.
- Information must be processed through logistics managers.
- Logistics managers meet choices between transport modes rationally.
- Require accommodations related to storage.

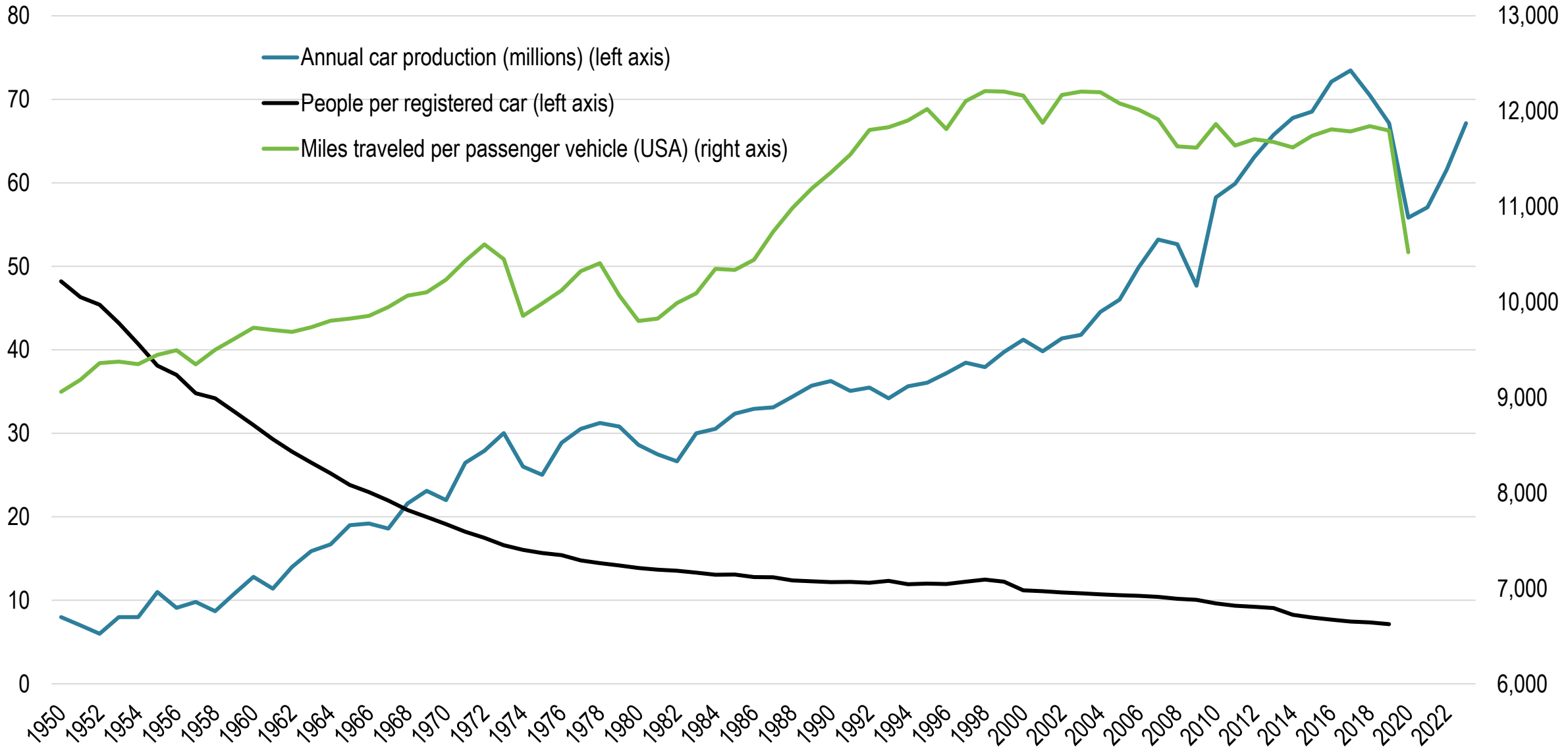
# Spatial Flow Patterns



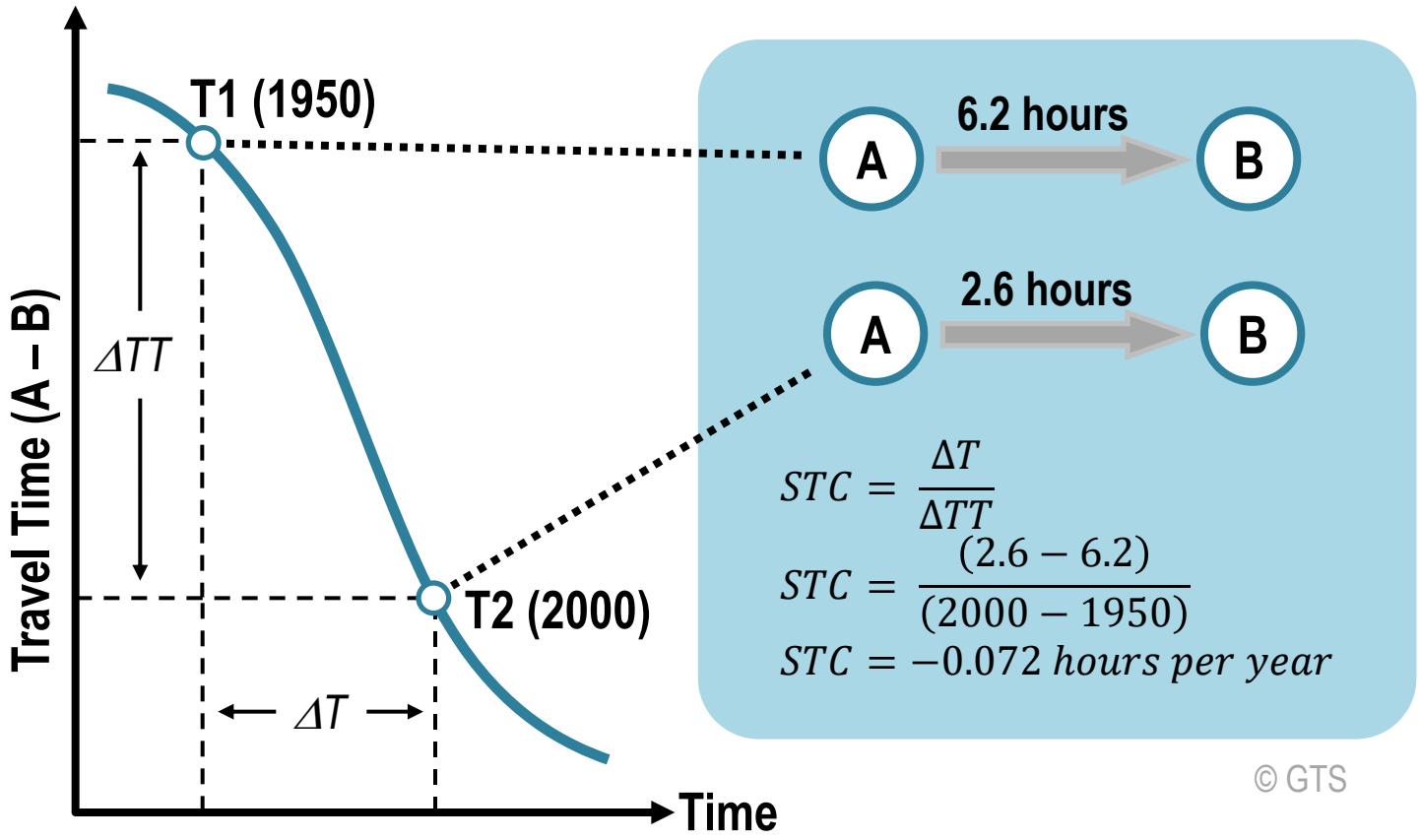
# Atomization versus Massification in Transportation Modes



# Vehicle Use Indicators, World, 1950-2023



# Space / Time Convergence

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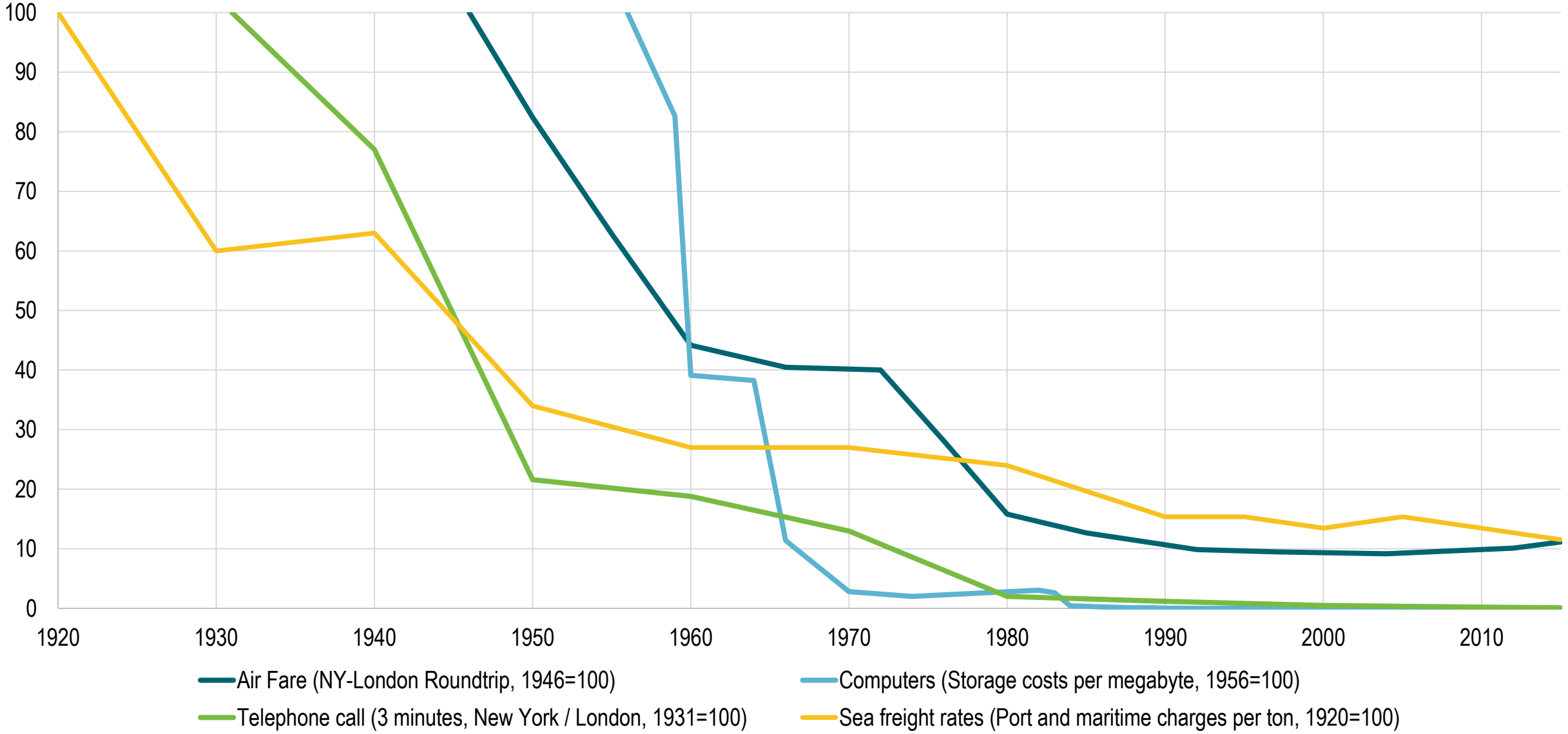
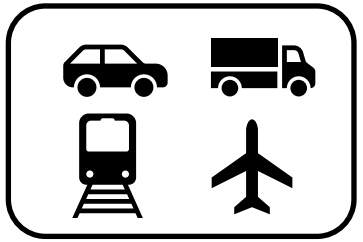
# Transport and Communication Costs Indexes, 1920-2015



# Key Dimensions of Transportation

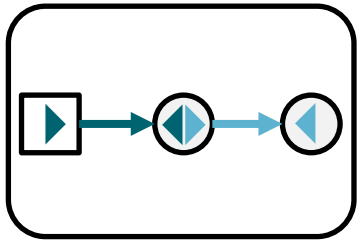
| | | |
|---|---|---|
| **HISTORICAL**<br>*Processes* |  | Changes brought by transport technologies. Rise of civilizations. Development of modern nation states. Globalization. |
| **ECONOMIC**<br>*Multipliers* |  | Transport and economic development. Factor in the production and added-value of goods and services. Economies of scale. Influences land (real estate) value. Contributes to the specialization of regions. |
| **SOCIAL**<br>*Cohesion* |  | Access to healthcare, welfare, and cultural events. Shape social interactions. |
| **POLITICAL**<br>*Governance* |  | Nation building and national unity. National defense. Rules and regulations. Subsidizing mobility (e.g. public transit or highways). |
| **ENVIRONMENTAL**<br>*Externalities* |  | Environmental impact. Emissions. Use of natural resources. Climate change. |

# Core Components of Transportation



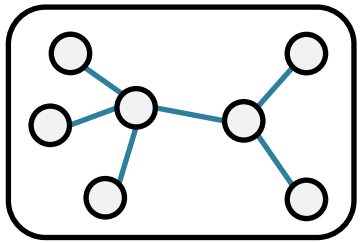
## MODES

- Conveyances used for the mobility of passengers and freight.
- Mobile elements of transportation.



## INFRASTRUCTURES

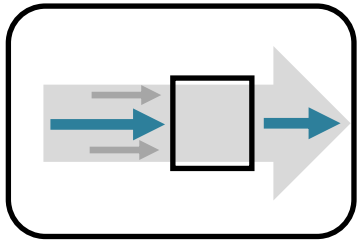
- Physical support of transport modes, such as routes and terminals.
- Fixed elements of transportation including superstructures.



## NETWORKS

- System of linked locations (nodes).
- Functional and spatial organization of transportation.

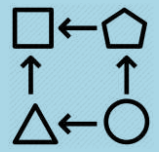
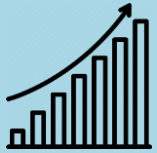




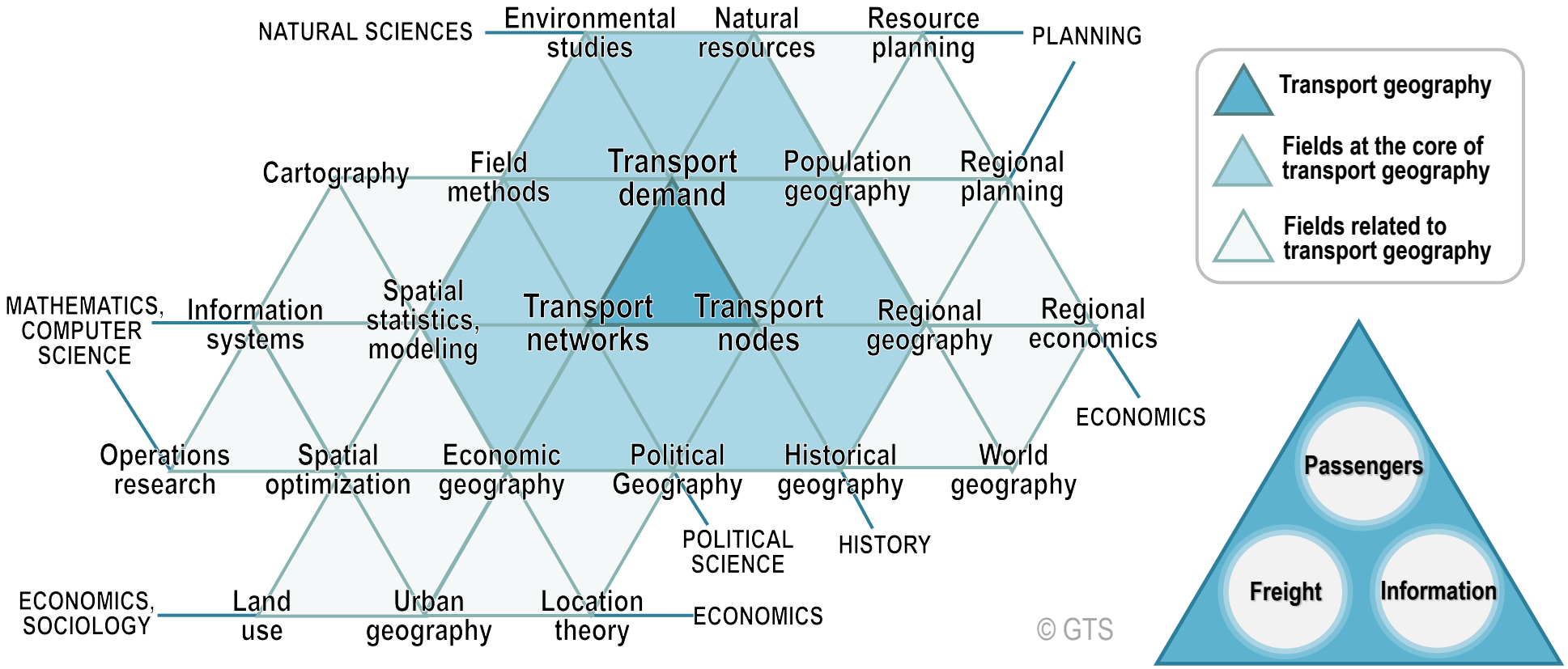
## FLOWS

- Movements of people, freight and information over their network.
- Flows have origins, intermediary locations and destinations.

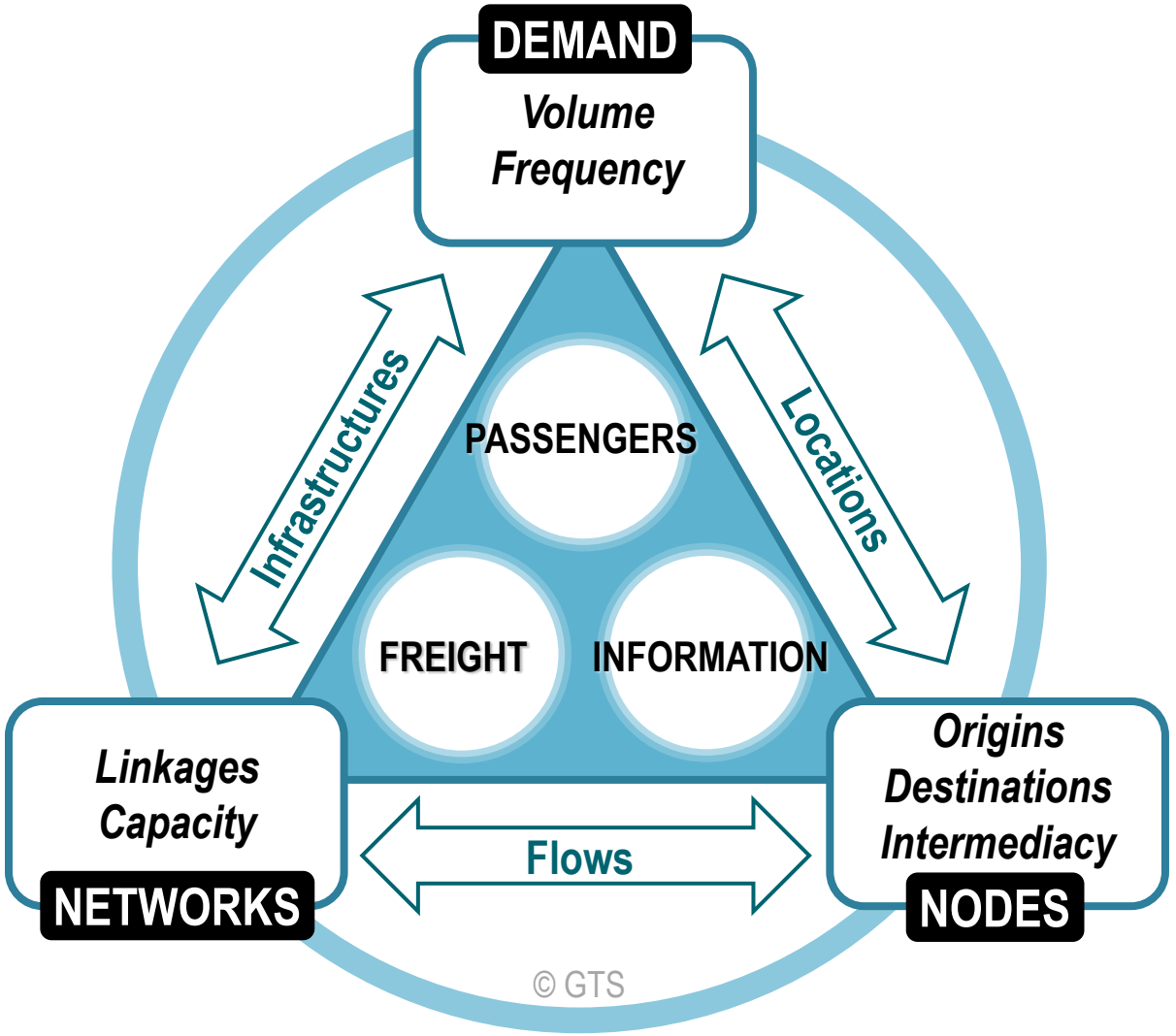
# Complex Systems and Transportation

| | | |
|---|---|---|
| **Adaptability**<br>*Competition* |  | Adaptation to the actions of other components.<br>Adaptation to social, economic and technological changes. |
| **Self-Organization**<br>*Routing* |  | Autonomous adaptation to changing conditions as a result of the adaptability of the individual components. |
| **Stability**<br>*Land use* |  | A recognizable dynamic state of a system that may continuously reappear. |
| **Cumulative**<br>*Congestion* |  | Changes in one property or component may have a disproportionately large effect on another property or component. |
| **Transition**<br>*Containerization* |  | A system's behavior may change radically, and sometimes irreversibly, when a tipping point is reached. |

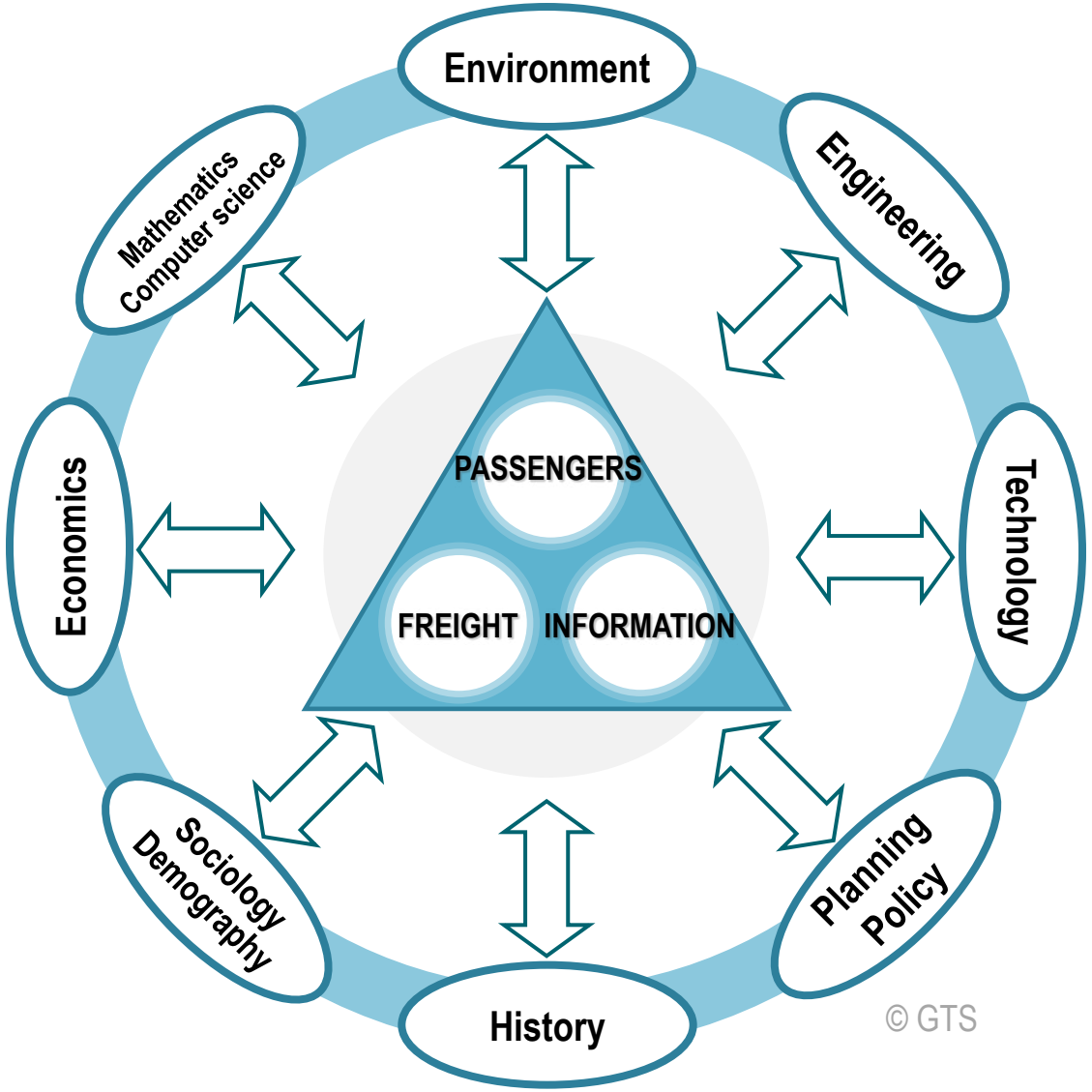
# Fields of Transport Geography



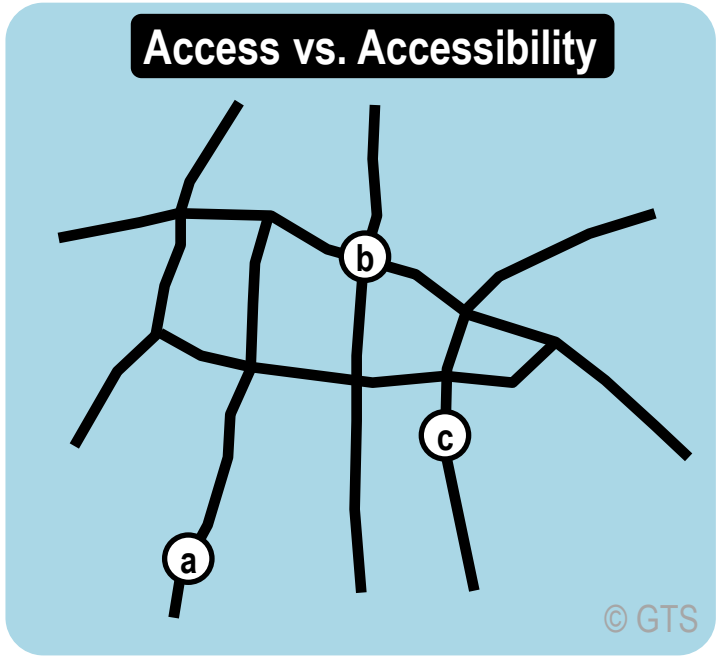
# The Transport System

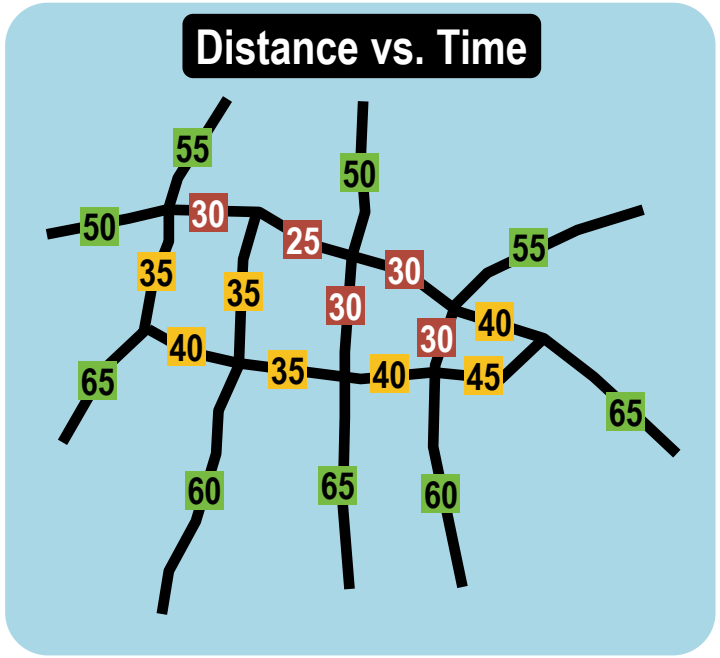


# Dimensions of Transport Geography

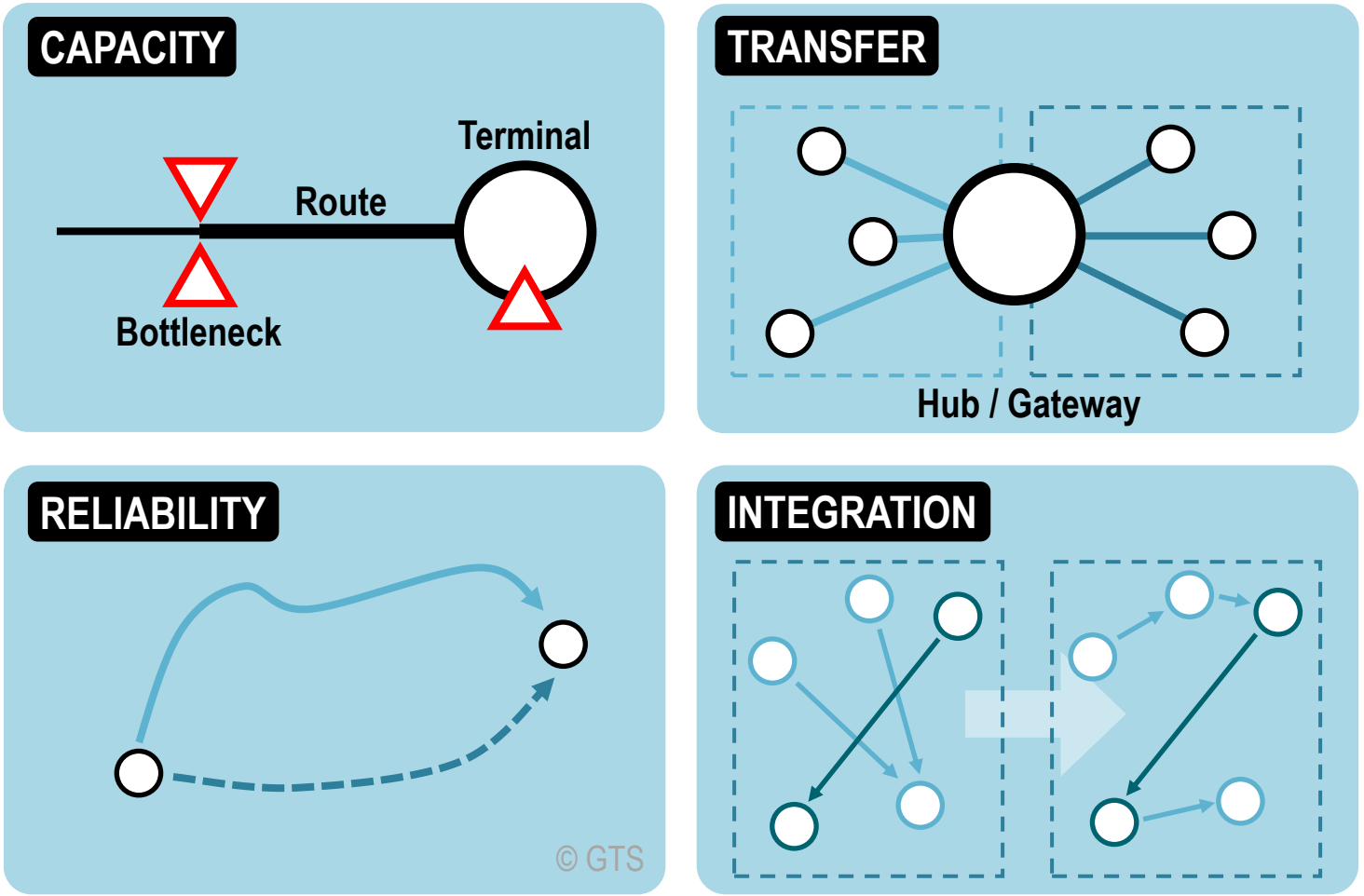


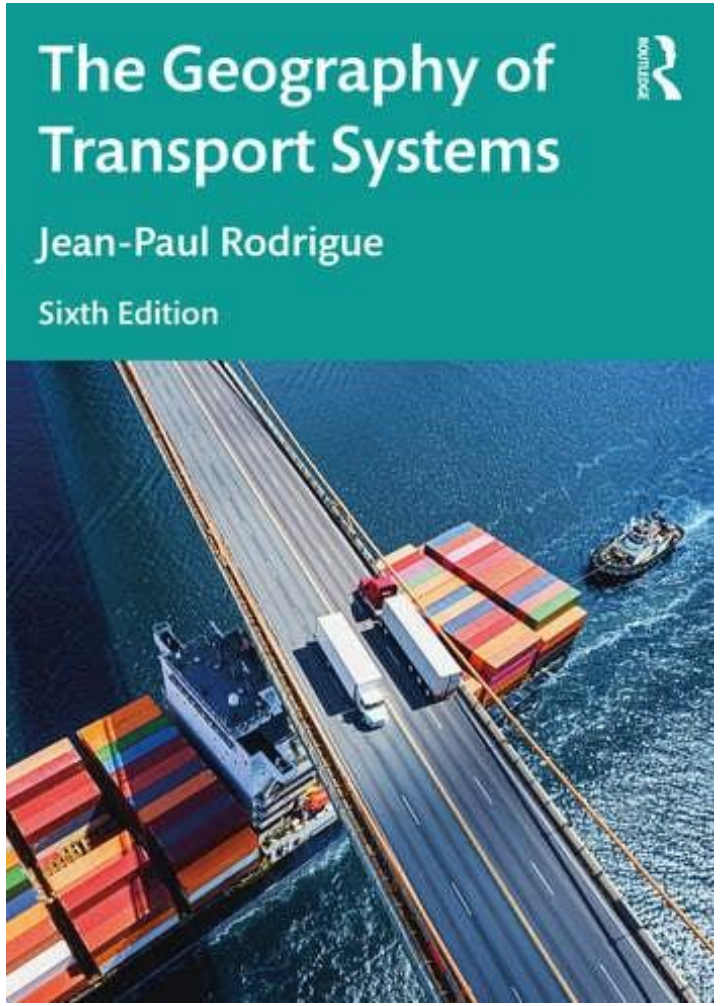
# Two Common Fallacies in Transport Geography



# Common Problems for Transport Systems

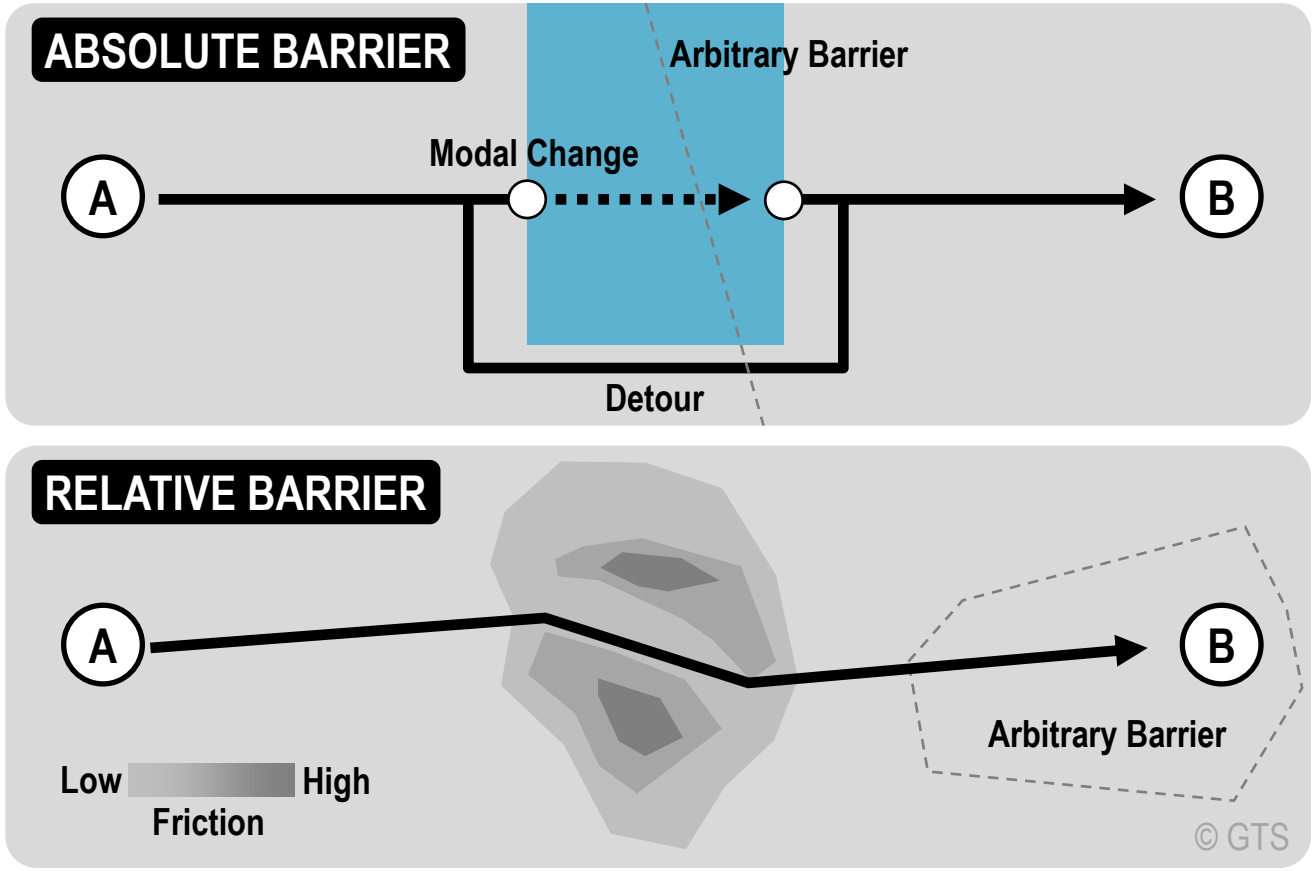





# Transportation and the Physical Environment

Chapter 1.2

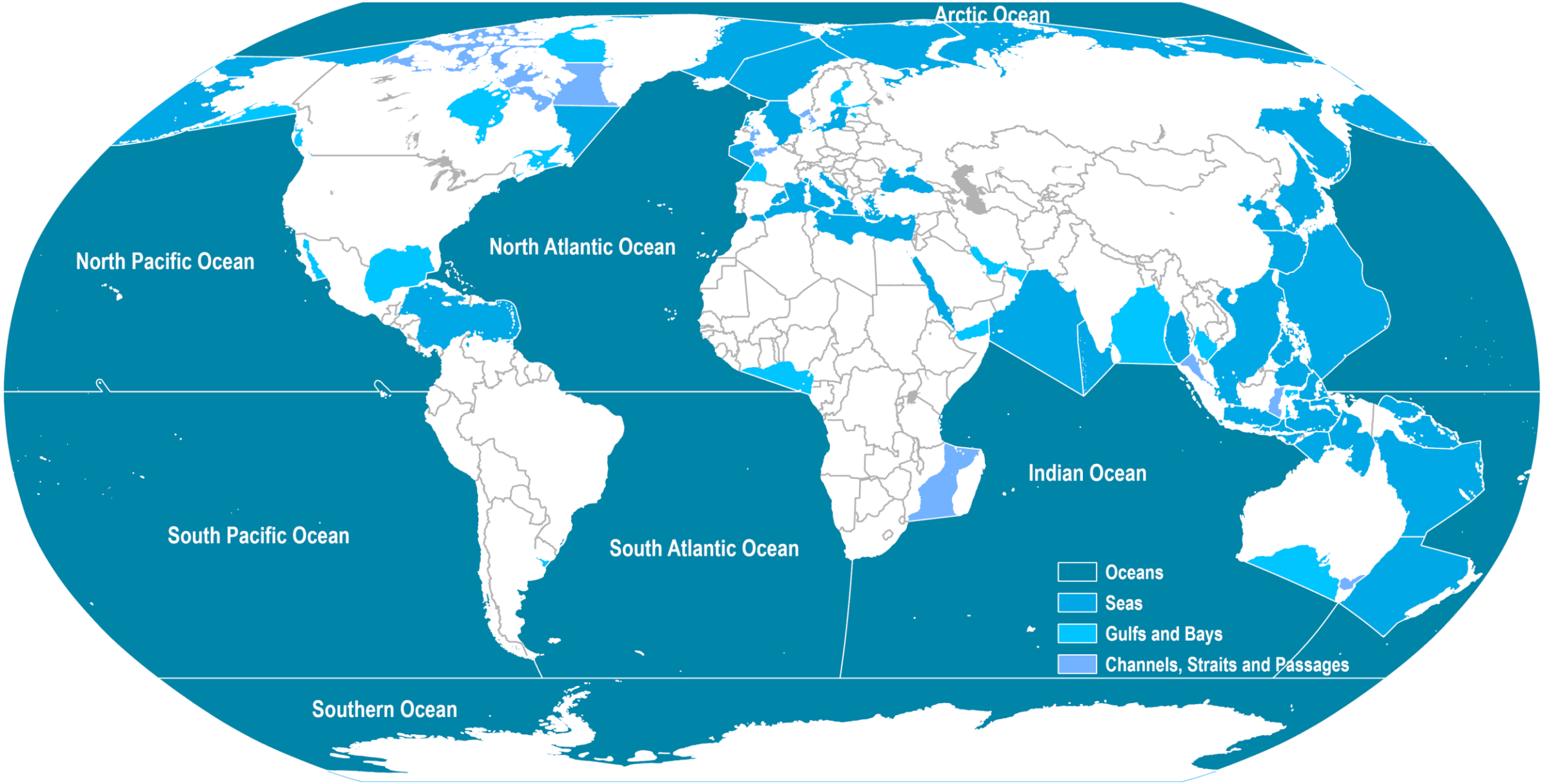
# Absolute, Relative and Arbitrary Barriers



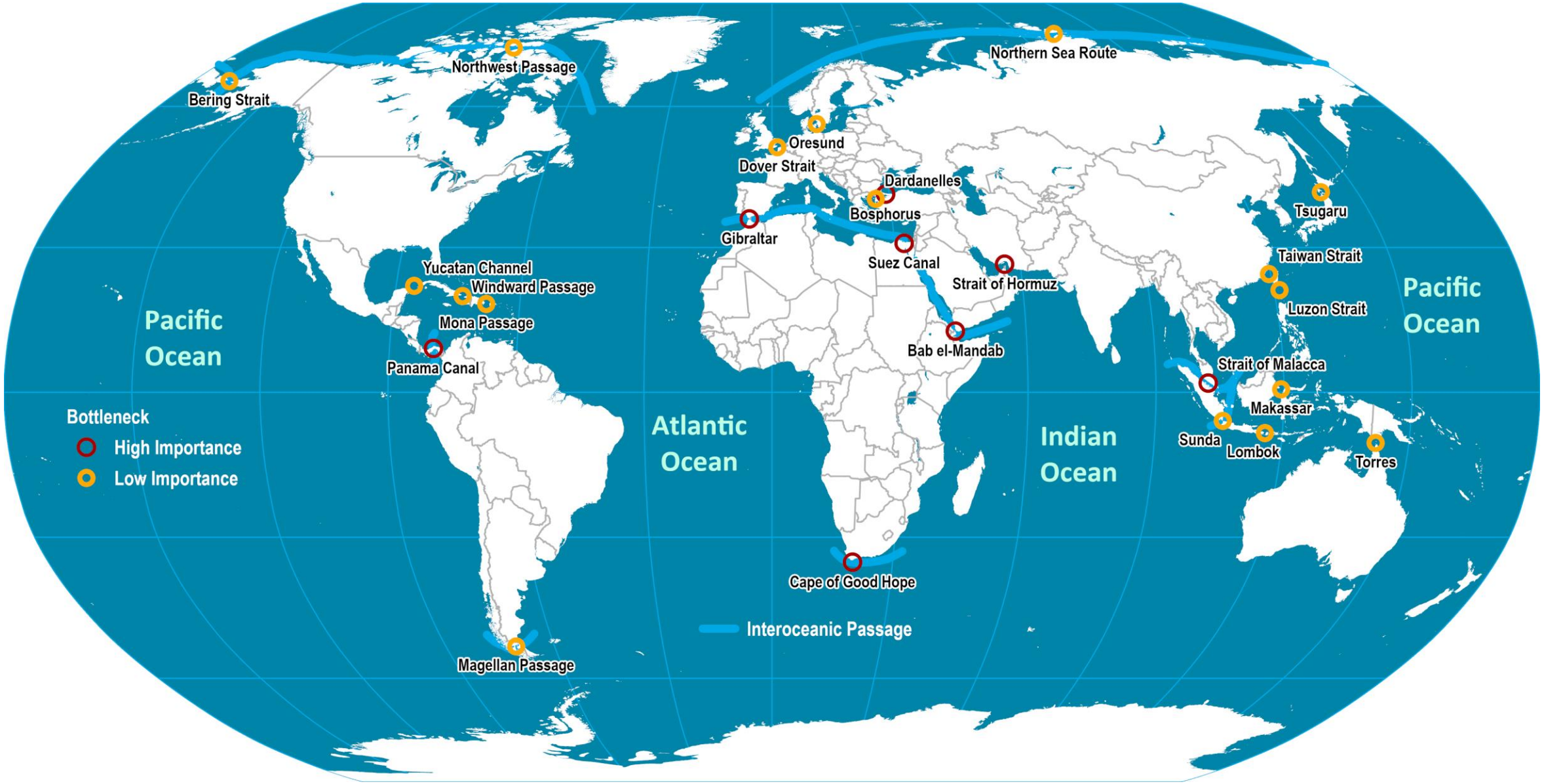
# World's Longest Tunnels Used for Transportation

| Name | Location | Traffic | Opening | Length |
|---|---|---|---|---|
| Gotthard Base Tunnel | Swiss Alps | Rail | 2017 | 57.1 km |
| Seikan Tunnel | Strait of Tsugaru, Japan | Rail | 1988 | 53.8 km |
| Channel Tunnel | English Channel (UK-France) | Rail (High speed) | 1994 | 50.4 km |
| Lötschberg Base Tunnel | Swiss Alps | Rail | 2007 | 34.6 km |
| Guadarrama Tunnel | Sierra de Guadarrama, Spain | Rail (High speed) | 2007 | 28.4 km |
| Taihang Tunnel | Taihang Mountains, China | Rail (High speed) | 2008 | 27.8 km |
| Iwate-Ichinohe Tunnel | Ōu Mountains, Japan | Rail (High speed) | 2002 | 25.8 km |
| Lærdal Tunnel | Lærdal - Aurland, Norway | Road | 2000 | 24.5 km |
| Daishimizu Tunnel | Mount Tanigawa, Japan | Rail (High speed) | 1982 | 22.2 km |
| Wushaoling Tunnel | Wuwei, China | Rail | 2006 | 21.0 km |

# Main Water Masses of the World

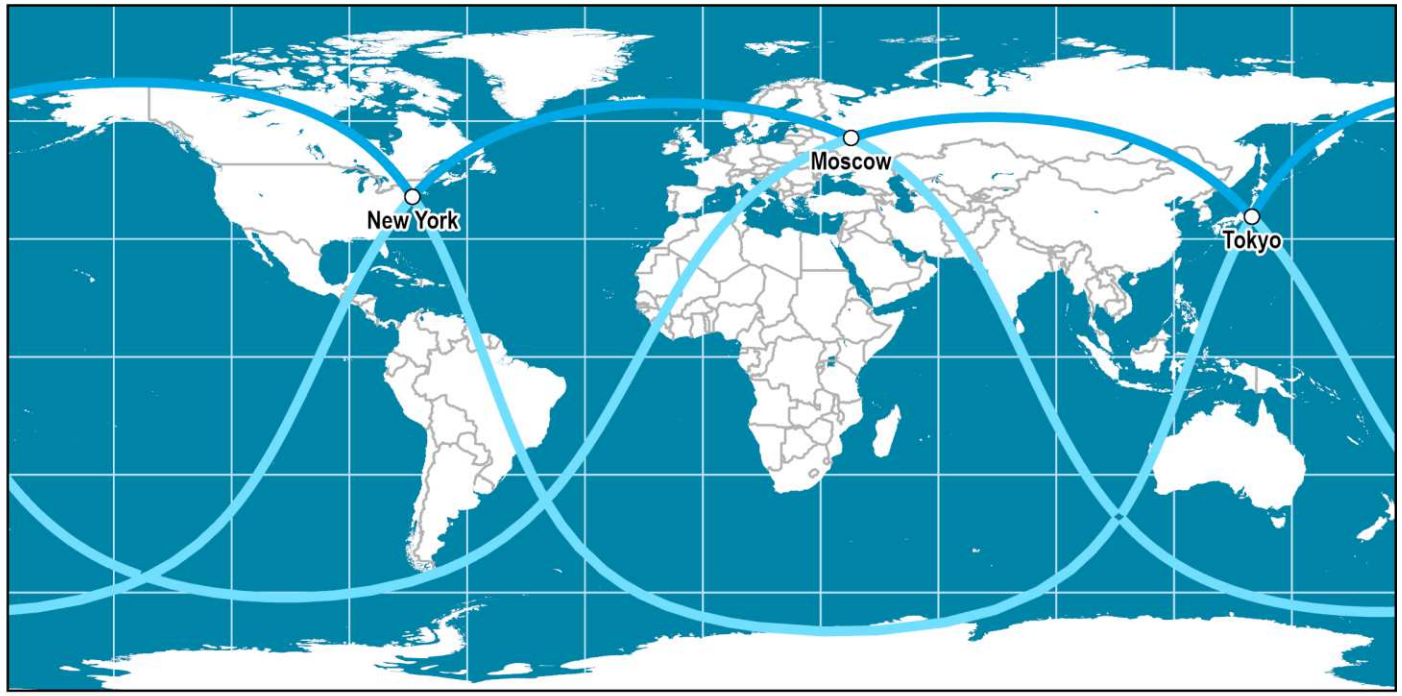


# The Geographical Space of Maritime Transportation

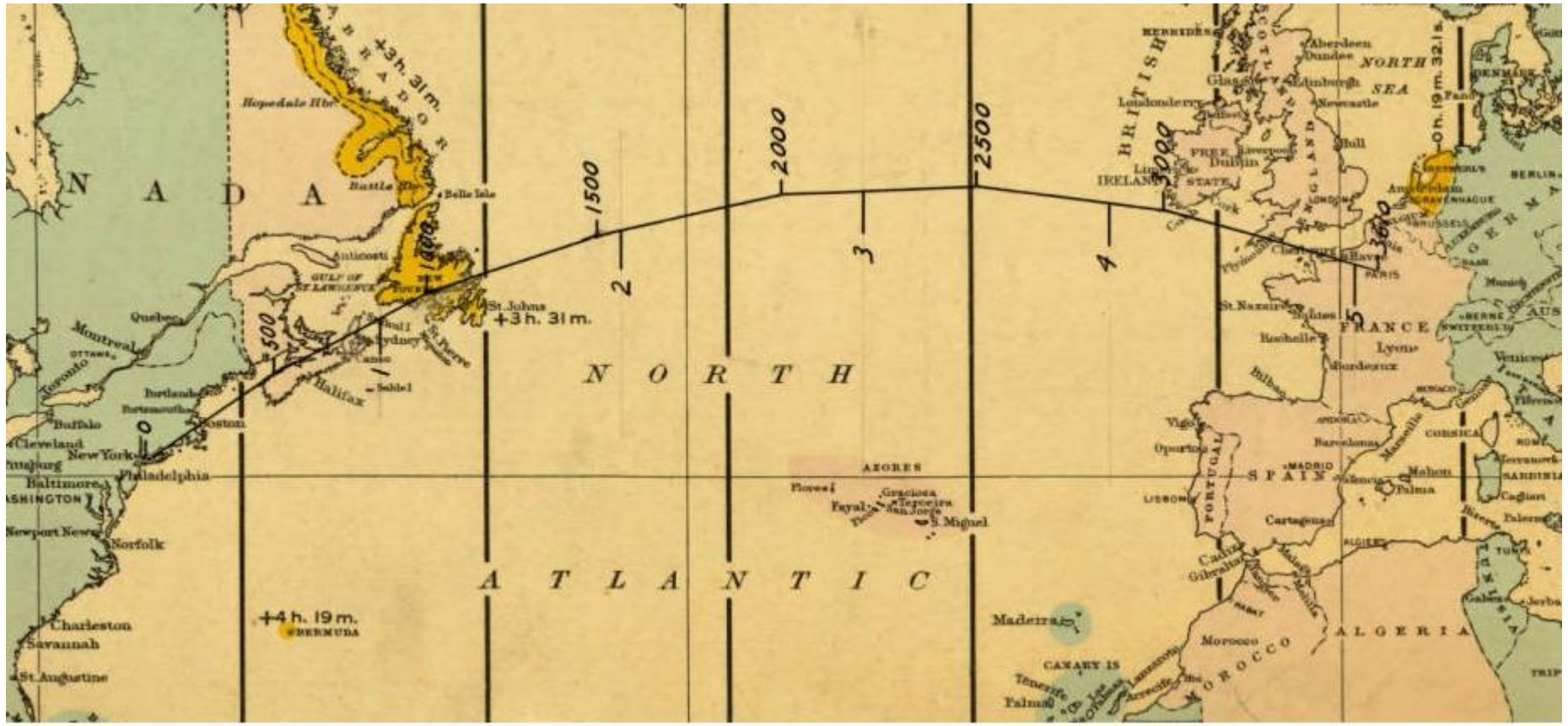


# Polar Shipping Routes

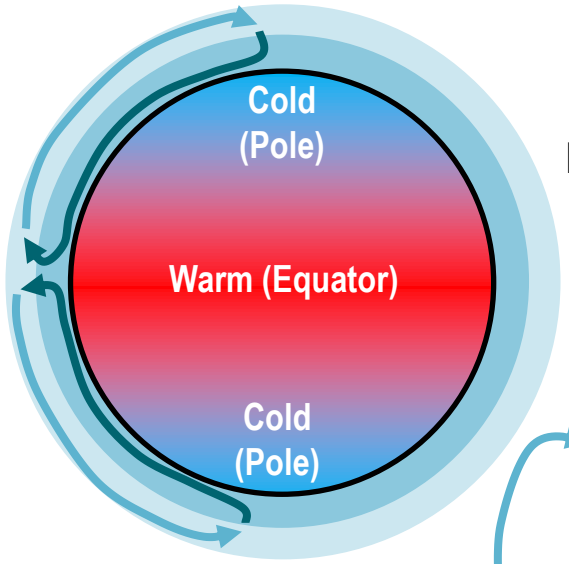
# Great Circle Distance between New York, Moscow and Tokyo

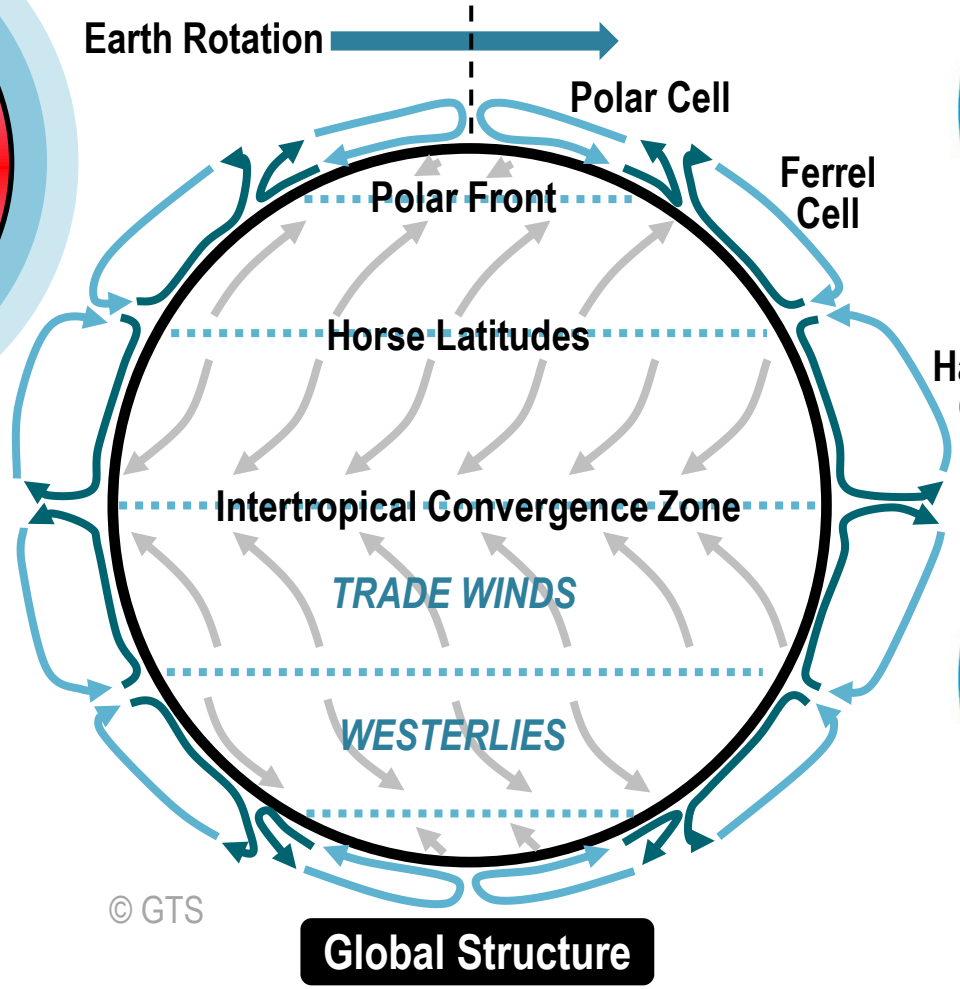
# Lindbergh Great Circle Path, First Transatlantic Flight, 1927



# Global Wind Patterns and their Seasonal Variation

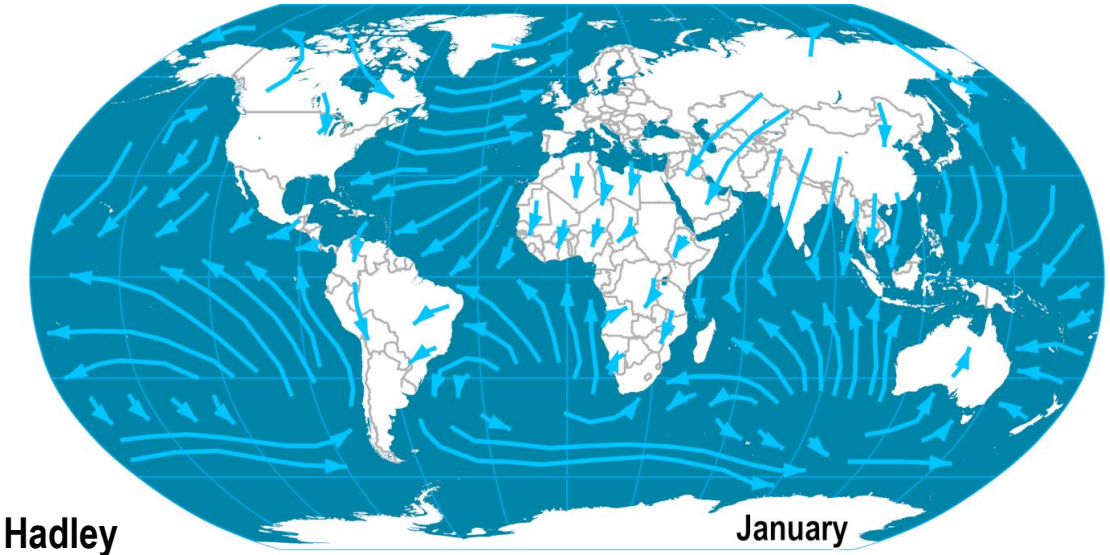


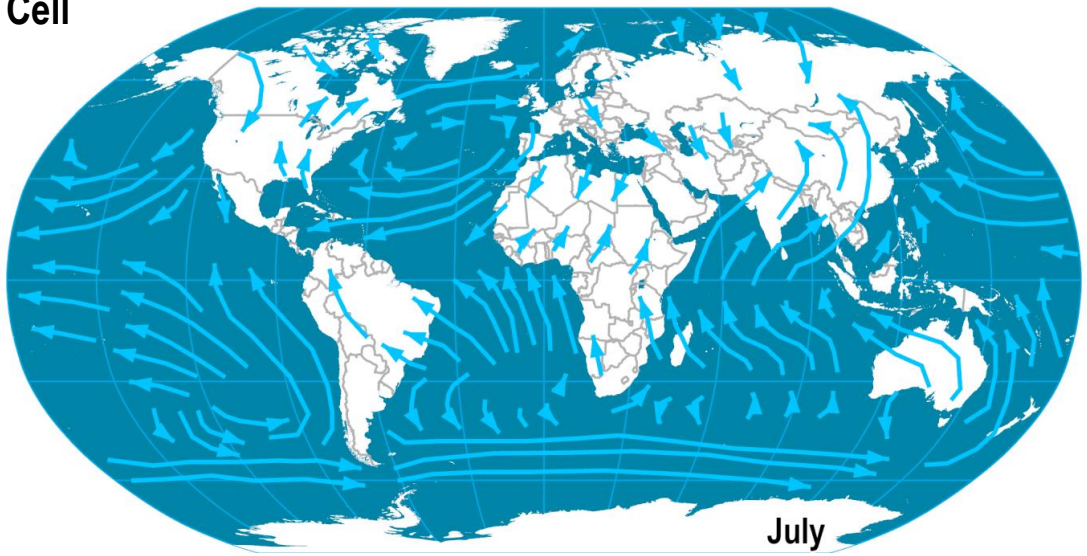

Principle



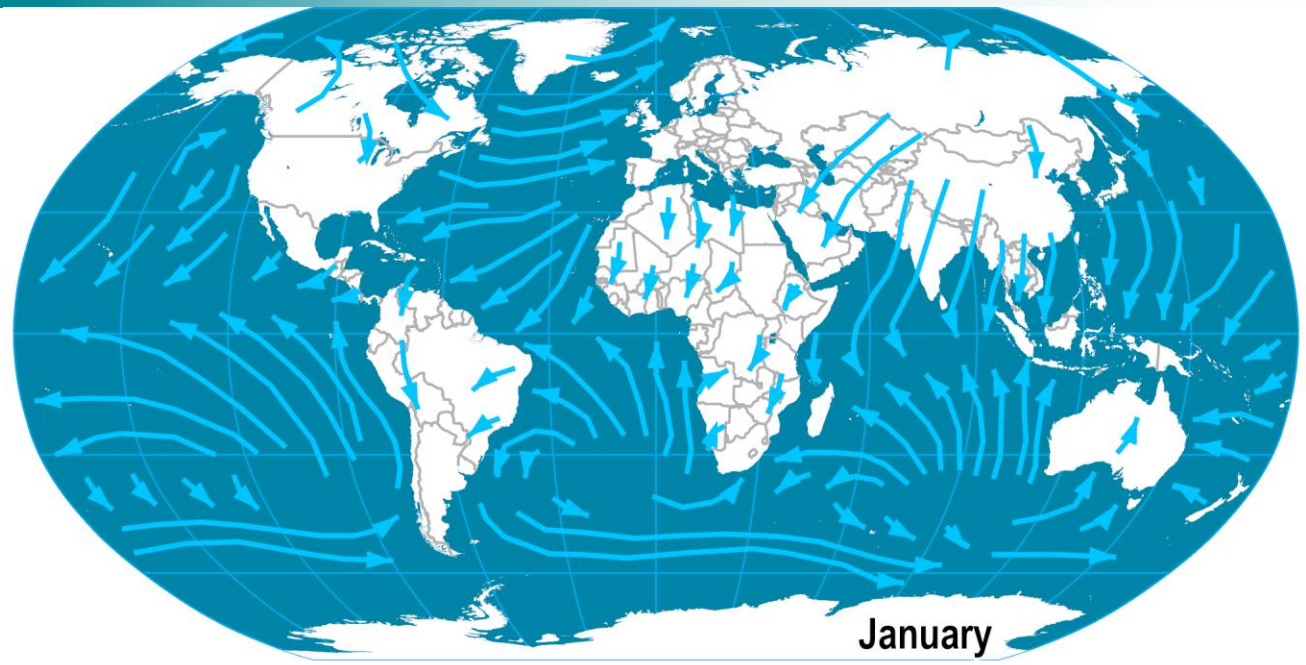


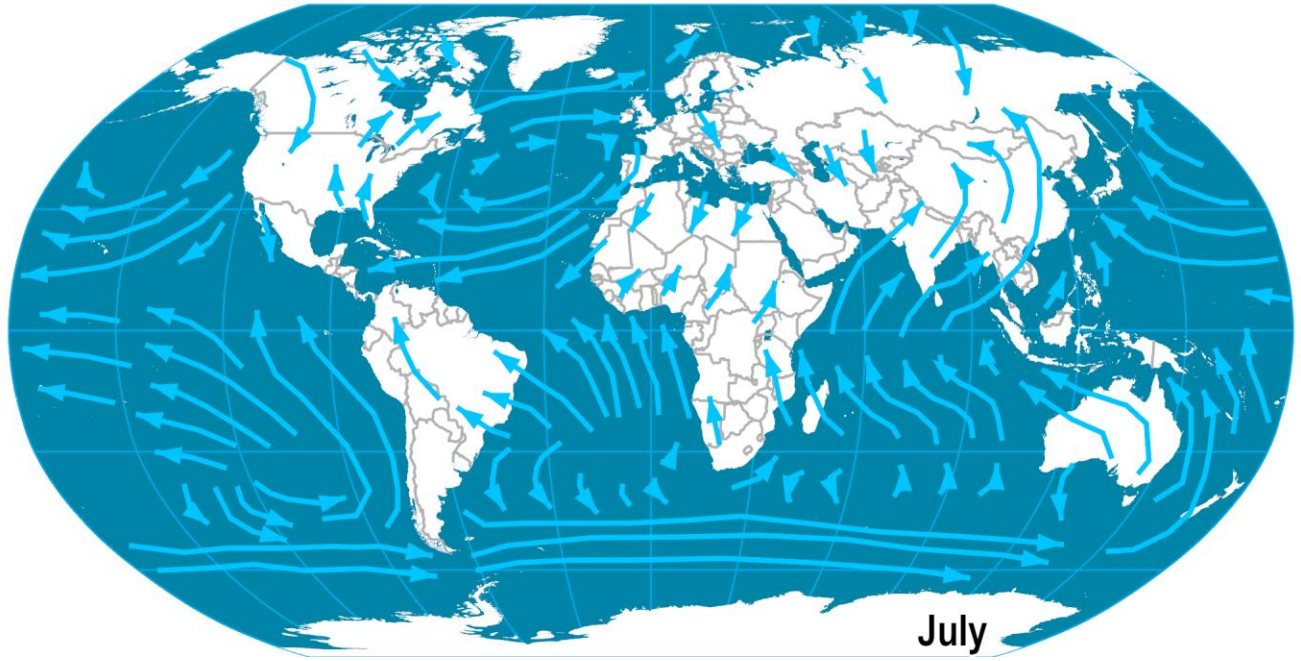

Global Structure



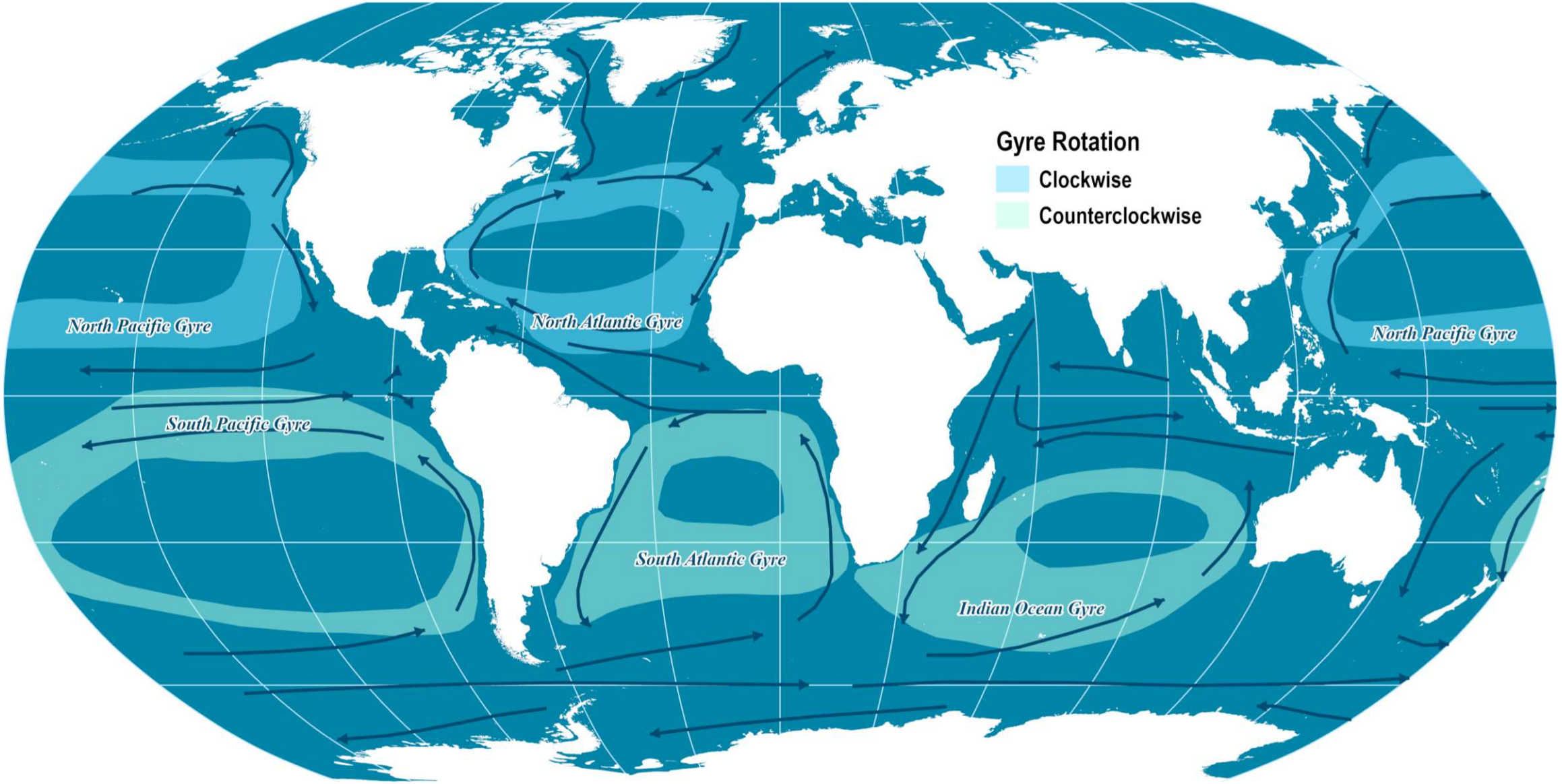



# Seasonal Variation of Global Wind Patterns

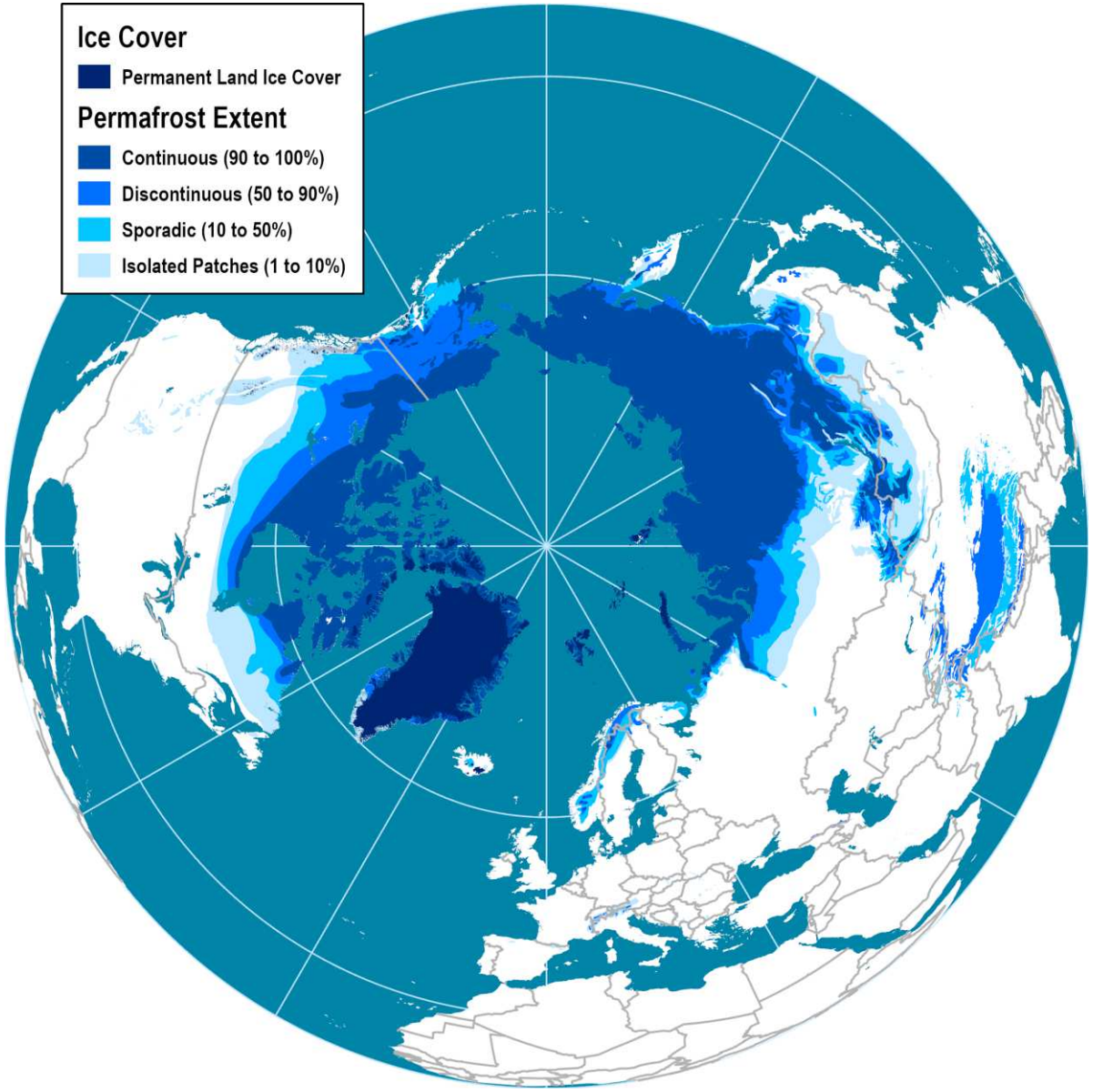


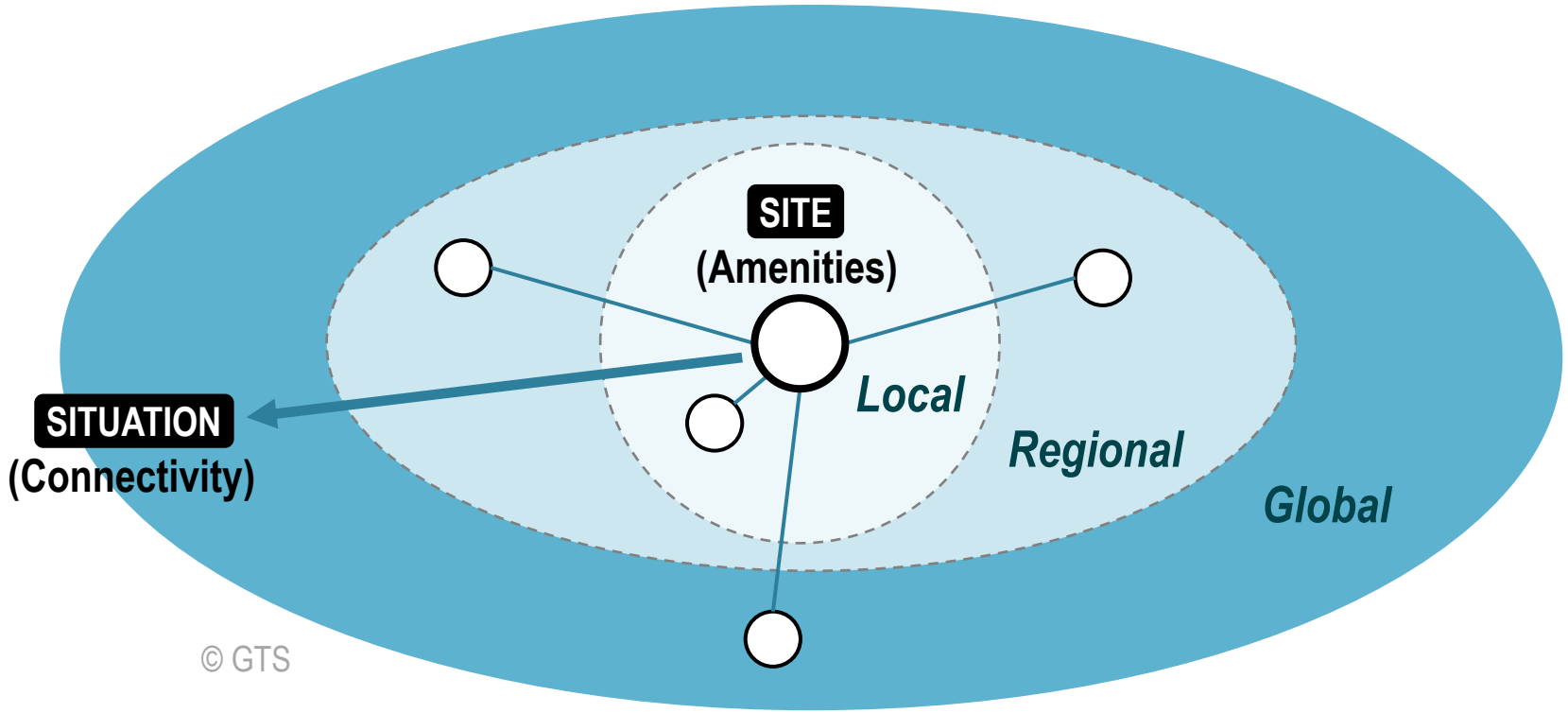
# Major Oceanic Gyres and Sea Currents



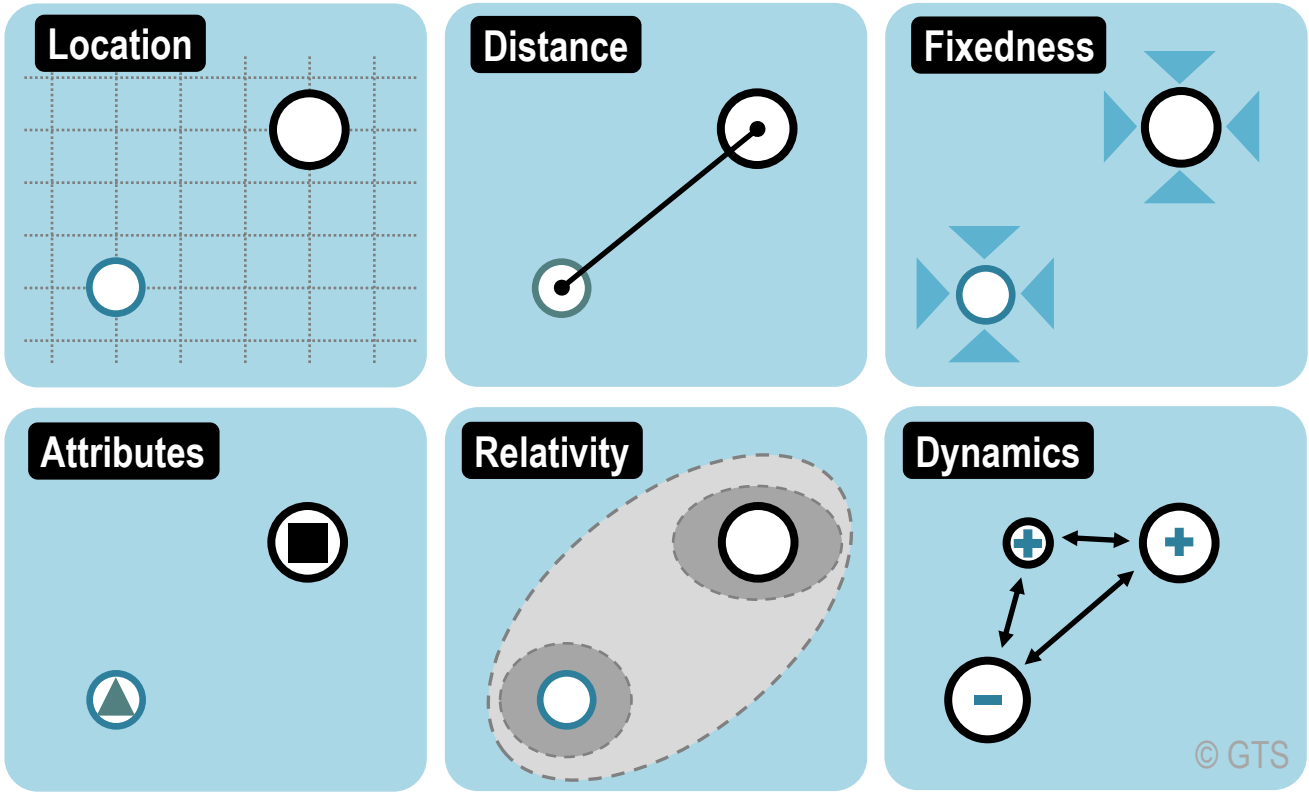
# Land Covered by Permafrost



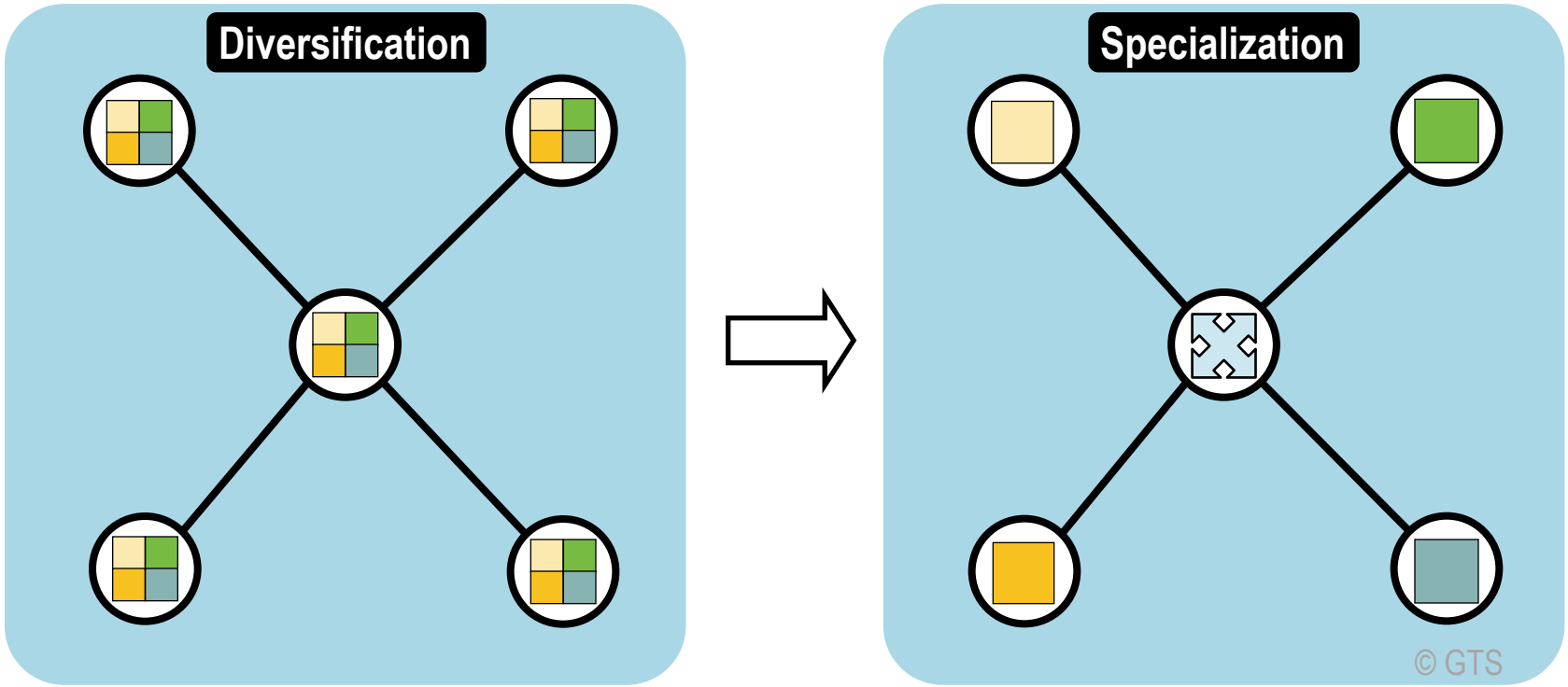
# Transport, Site and Situation



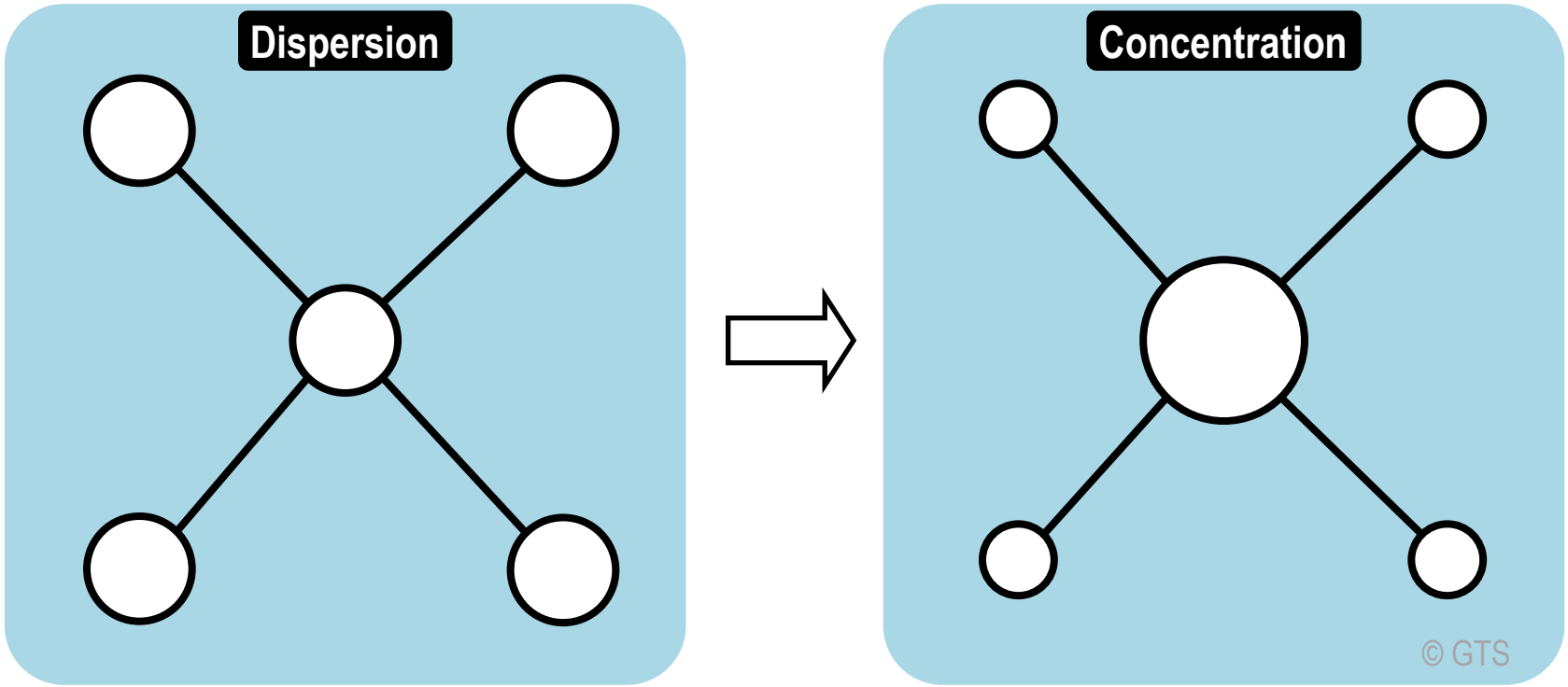
# The Spatial Structure and Transportation



# Transportation Networks and Geographical Specialization

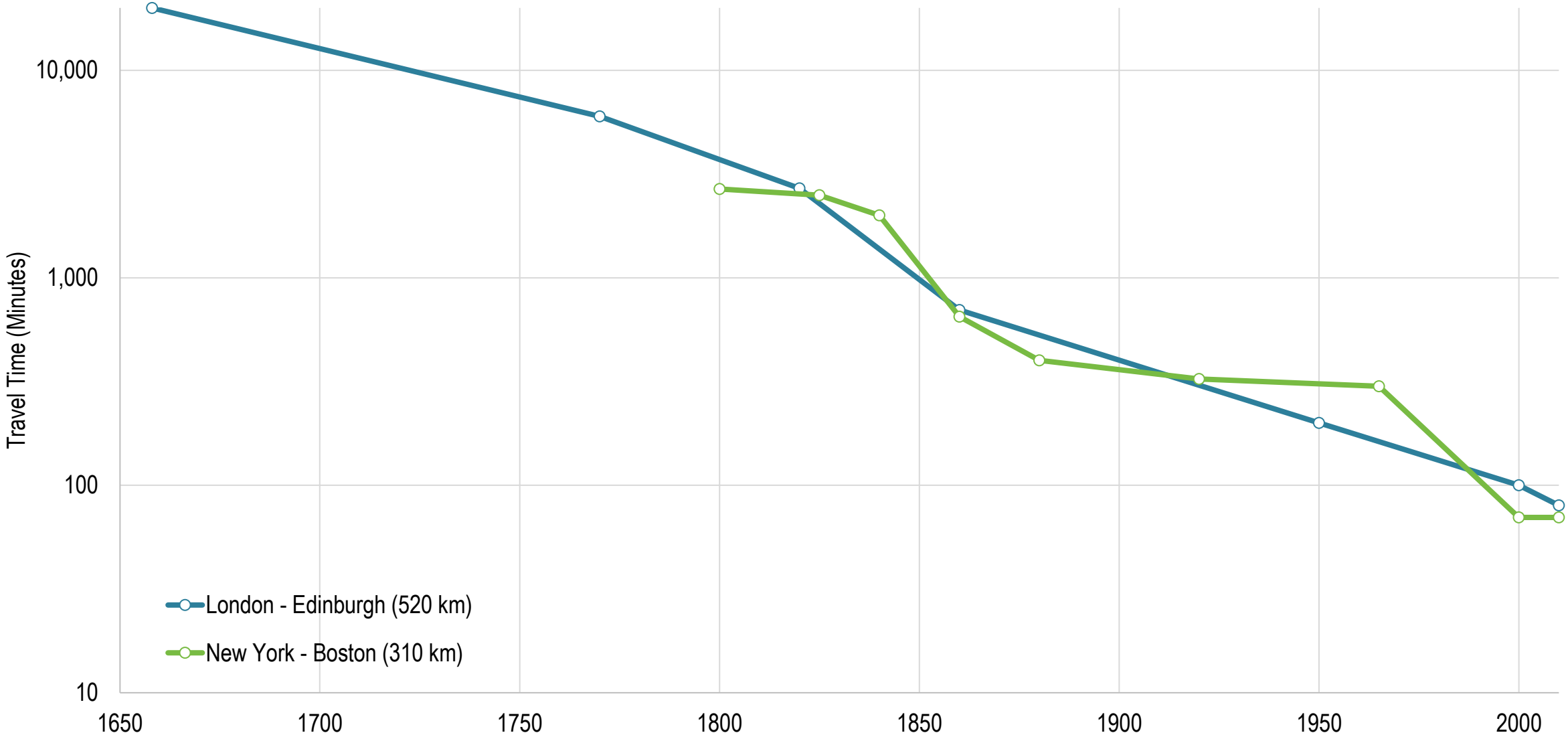


# Transportation Networks and Geographical Concentration

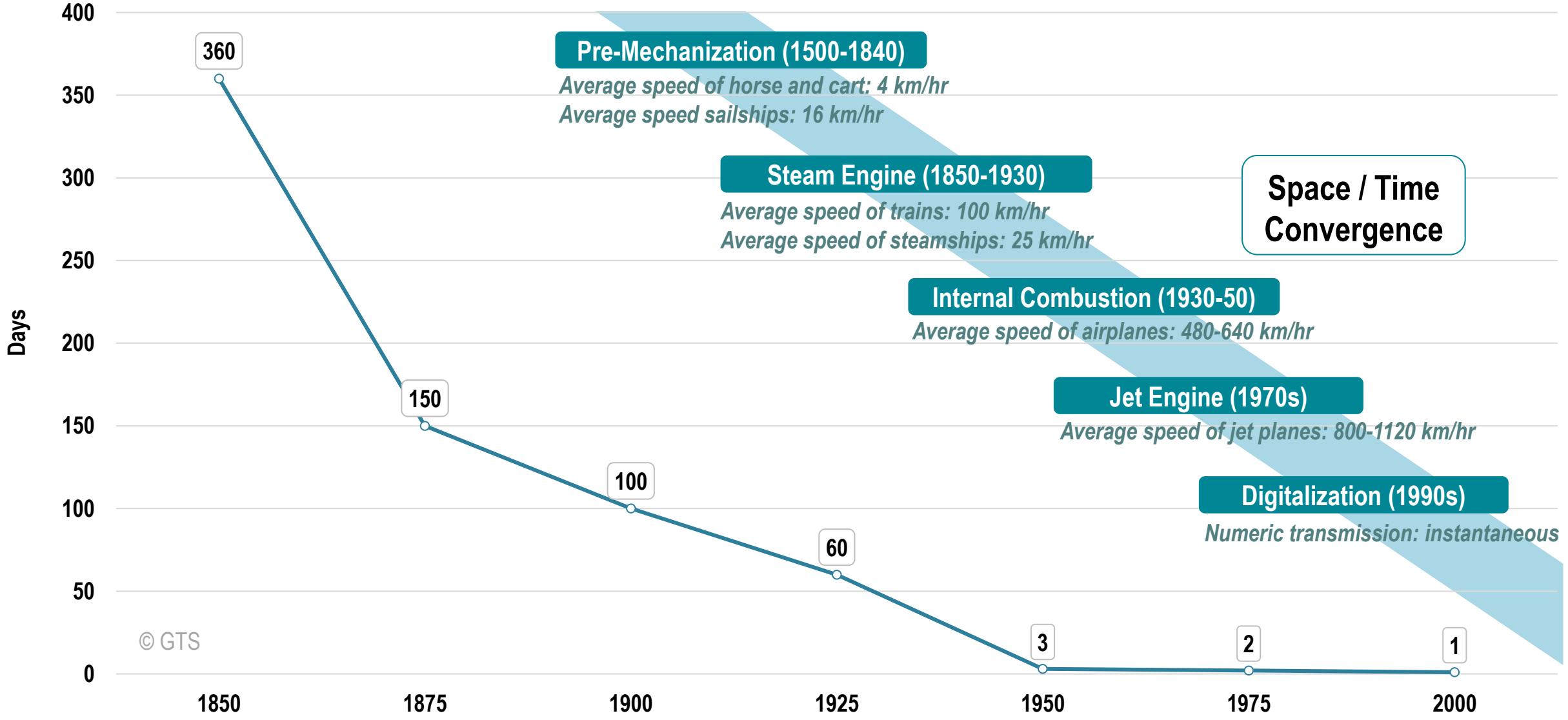


# Transport as a Centralizing and Decentralizing Force (under construction)

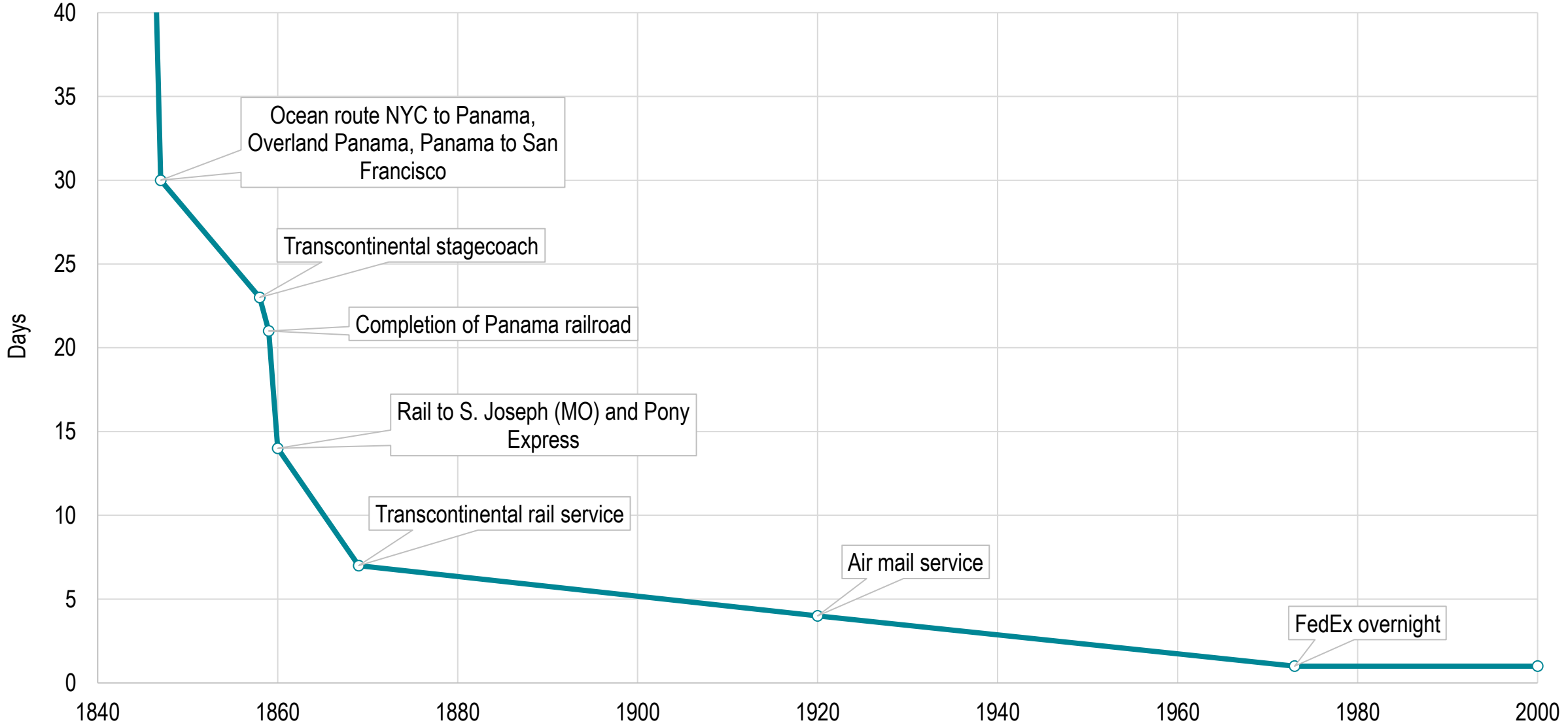
# Regional Space / Time Convergence, (London – Edinburgh, New York – Boston)



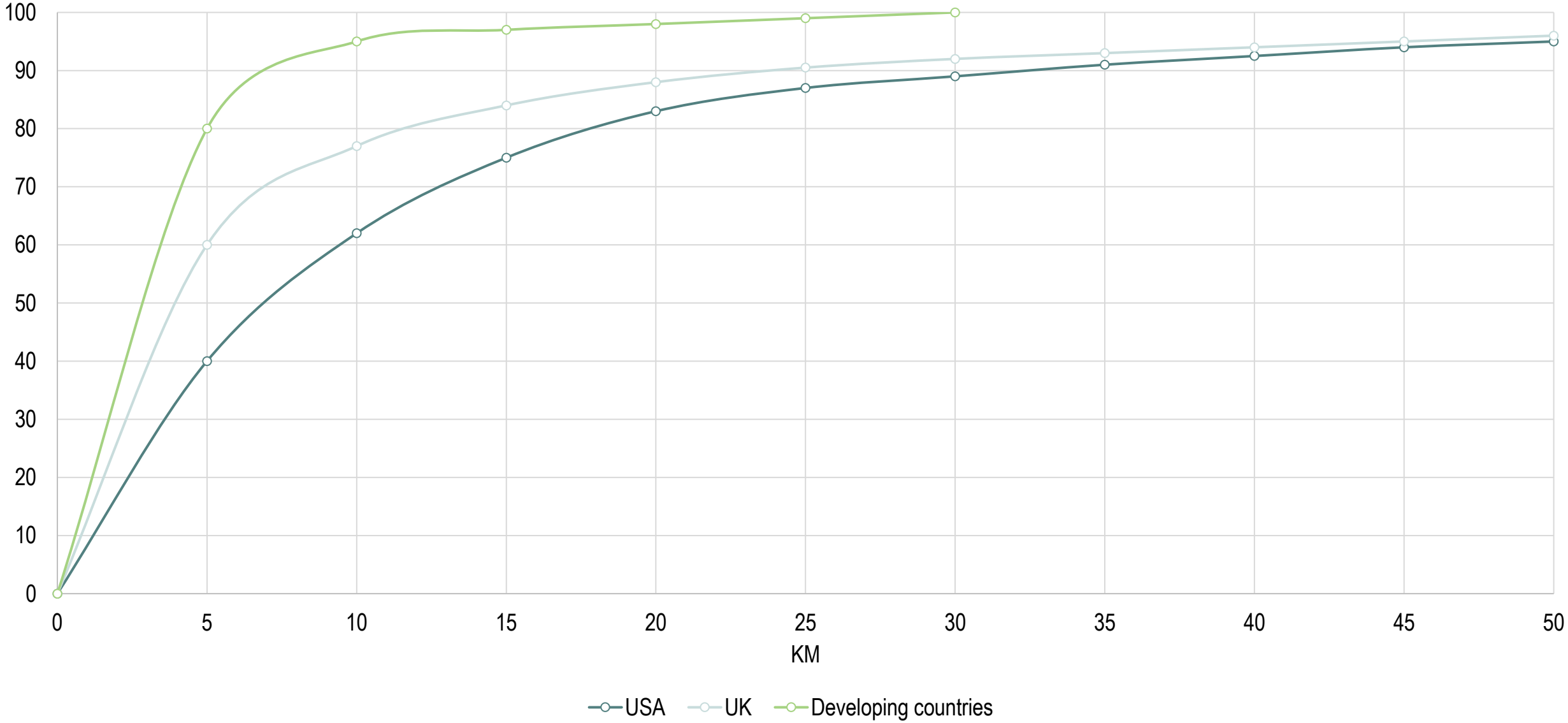
# Global Space / Time Convergence: Days Required to Circumnavigate the Globe



# Mail Delivery Times between New York and San Francisco, 1840-2000



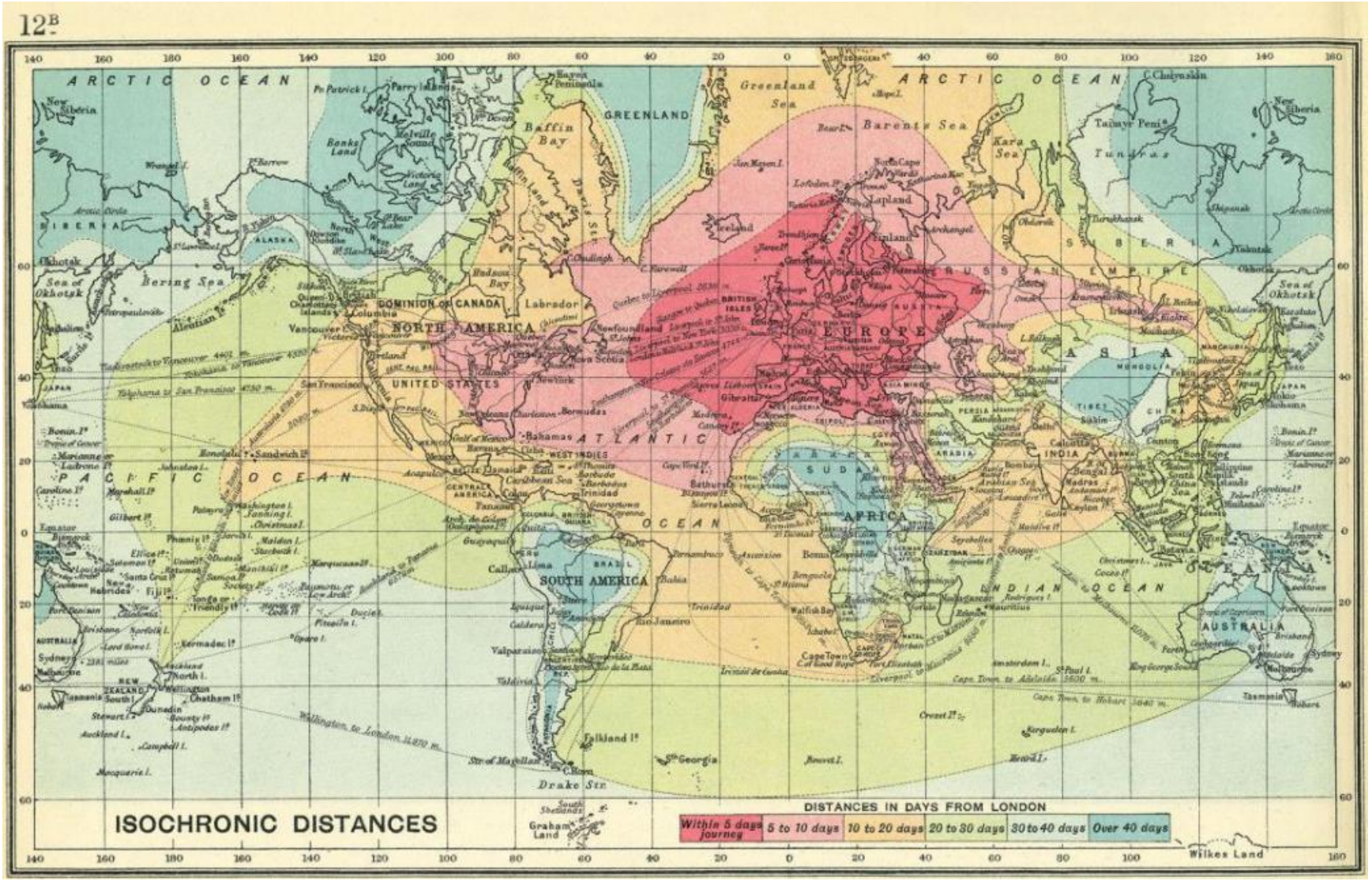
# Cumulative Distribution of per Capita Trip Rate for all Modes by Trip Distance, 1995



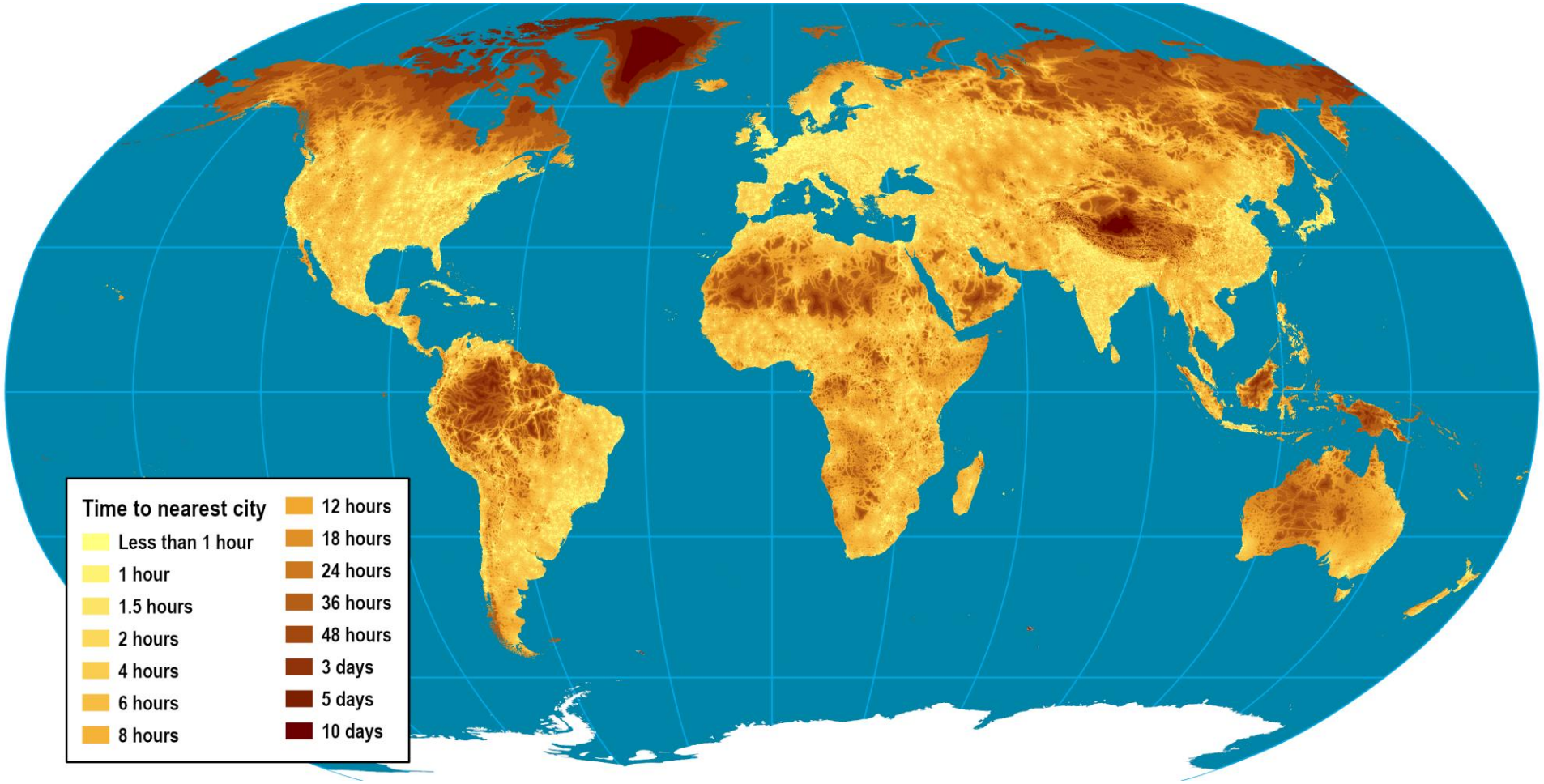
# Speed Improvement Potential by Transport Mode

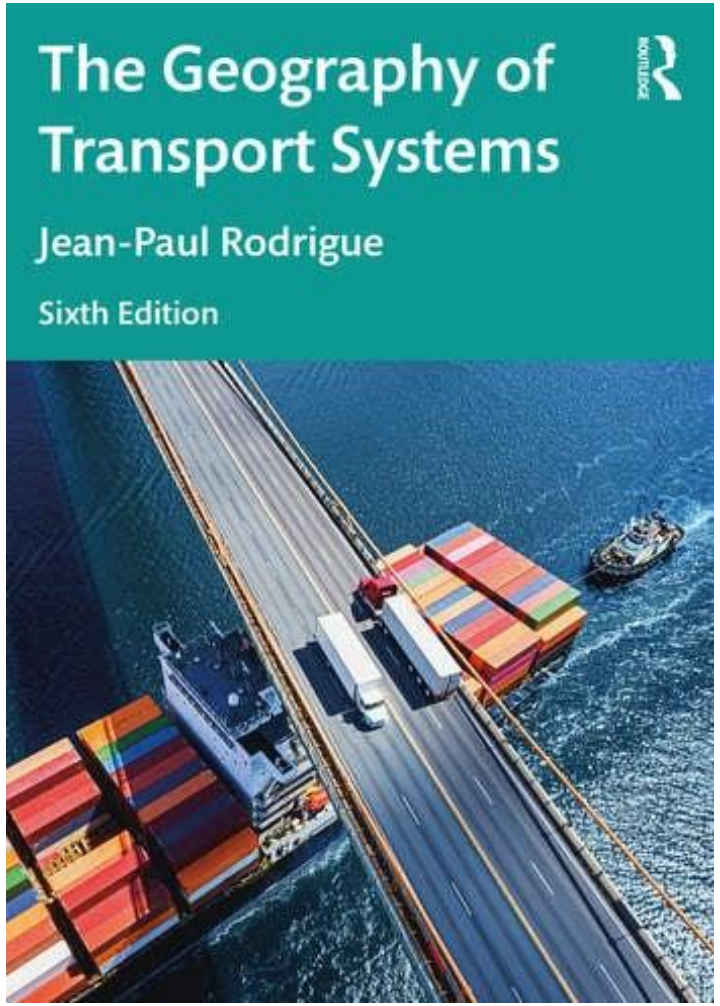
| | | |
|---|---|---|
| **ROAD** | • None to limited.  | **Main Issues**<br>• Congestion.<br>• Operational safety (speed limits).<br>• Limited access highways. |
| **RAIL (FREIGHT)** | • Limited.  | **Main Issues**<br>• Operational safety (grade crossings).<br>• Availability of train slots.<br>• Terminal capacity. |
| **RAIL (PASSENGERS)** | • Good to significant.  | **Main Issues**<br>• Development of high-speed rail systems.<br>• Long term potential of new technologies (e.g. Vacuum tube; Maglev). |
| **AIR** | • None to limited.  | **Main Issues**<br>• Energy consumption.<br>• Airport congestion.<br>• Potential resurgence of supersonic services. |
| **MARITIME** | • None to limited.  | **Main Issues**<br>• Energy consumption (slow steaming). Fast ferries. |

# Travel Time between London and the Rest of the World, 1914



# Global Accessibility: Time to the Nearest Large City






# The Emergence of Mechanized Transportation Systems

Chapter 1.3

# The Genesis of Globalization

| | ANTIQUITY | MODERN ERA | POST-MODERN |
|---|---|---|---|
| Time Frame | • Since the beginning of history | • Nineteenth century | • After World War II |
| Economic System | • Imperialism / Mercantilism | • Imperialism / Capitalism | • Capitalism / Corporatism |
| Foundation | • Exploration, war (expansion) and trade | • Mass production and consumption | • Trade liberalization |
| Acceleration | • Age of exploration of colonialism (15-16th century) | • Berlin Conference (1884) | • Fall of the Soviet Union<br>• Entry of China in world trade |
| Form | • Empires | • Nation-states | • Economic blocs |
| Mobility | • Trails and sailships | • Mechanized (steamship and rail) | • Air transport, containerization and telecommunications |

# Transport Revolutions in Human History

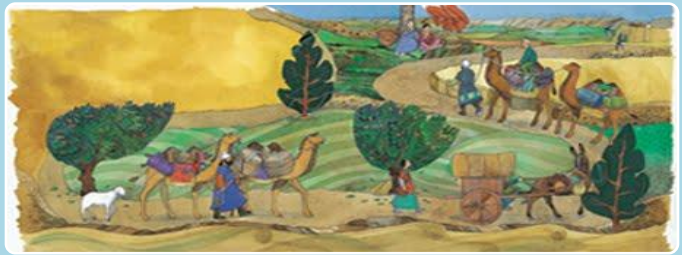

| ERA | DATE | MOBILITY |
|---|---|---|
| PALEOLITHIC | c. 700,000 years ago | First migrations from Africa |
| | c. 35,000 years ago | First migrations by sea to Australasia |
| | c. 18,000 years ago | First migrations to the Americas |
| AGRARIAN | c. 4,000 BCE | Animal-powered transport |
| | c. 3,500 BCE | Wheeled transport |
| | c. 1,000 BCE | Long distance navigation in Polynesia |
| MODERN | From 15th century | Improvements in shipbuilding and navigation |
| | From early 19th century | Railways and steamships |
| | From late 19th century | Internal combustion engines |
| | From early 20th century | Air travel |
| | From mid 20th century | Space travel |

# Main Technological Advances in Transportation and Telecommunication

| | TRANSPORTATION | TELECOMMUNICATION |
|---|---|---|
| 3000 BCE | Horses; Sailing ships; Wheeled carts; Aqueducts | Writing systems; Mail services |
| 300 BCE – 500 CE | Wheelbarrow; Paved roads; Stirrups; Canals | Paper |
| 500 – 1000 CE | Horse collars; Compass | Moveable type |
| 1000 – 1500 CE | Rudder, Locks; Three-mast ships | Printing press (1456); Paper currency |
| 1500 – 1800 CE | Steam engine (1712); Steam car (1769); Balloons (1783) | Newspapers and magazines |
| 1800 – 1850 CE | Steamboat (1807); Bicycles (1816); Surfaced roads (1816); Steam rail (1825); Electric streetcars (1834); Iron hulls (1843) | Photographs (1830); Telegraph (1844) |
| 1850 – 1875 CE | Airships (1852); Compound steam engine (1854); Subway (1863); Pipelines (1864); Internal combustion engine (1866); Asphalt roads (1872) | Transoceanic telegraph cable (1858); Typewriters (1867) |
| 1875 – 1900 CE | Steam turbine (1884); Gasoline engine (1885); Pneumatic tires (1888); Diesel engine (1895); Trucks (1886) | Telephones (1876); Wireless radio (1895) |
| 1900 – 1925 CE | Airplanes (1903); Helicopters (1907); Ford Model T (1908); Dirigibles (1910); Diesel locomotives (1917); Air passenger services (1919) | Transatlantic radio (1900); Commercial radio (1920); Facsimile (1925) |
| 1925 – 1950 CE | Rockets (1926); Highways (1933); Jet engine (1940); Passenger jet (1949) | RADAR (1940); Commercial television (1940); Electronic computers (1946); Transistor (1947) |
| 1950 – 1975 CE | Intermodal containers (1957); Space travel (1957); Jumbo jets (1966); Supersonic passenger jets (1969); Maglev (1969) | Integrated circuits (1958); Xerox copier (1959); Telecom satellites (1962); Internet (1970); Cell phones (1973) |
| 1975 – 2000 CE | Double-stacked rail services (1984); Drones (1991); Hybrid cars (1997) | Laser printer (1977); Fiberoptic cable (1978); GPS (1978); Personal computers (1981); WWW (1991); Search engine (1994); E-commerce (1997) |
| 2000 – 2025 CE | Ride-sharing (2011); Self-driving vehicles (2014) | Smartphones (2002); Blockchain (2008); ChatGPT public (2022) |

# Ancient Trade Issues

## Nature of Trade



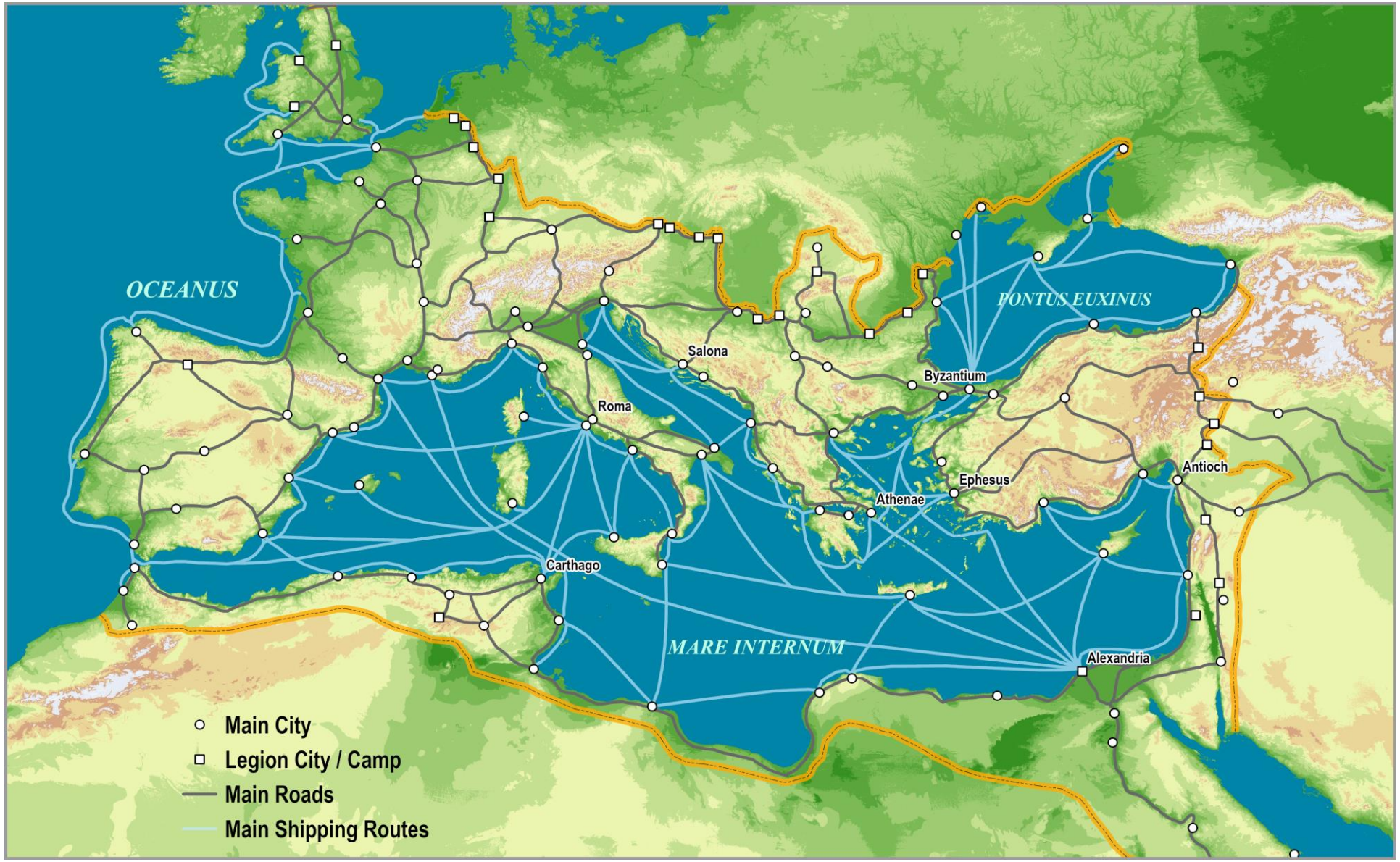
- Limited market size geared to the elite.
- High-value commodities (silk, spices, perfumes, gems, gold, silver, ivory).
- Bulk commodities could be traded when maritime transport was available (grain, wine, olive oil).
- Many intermediaries.

## Limiting Factors

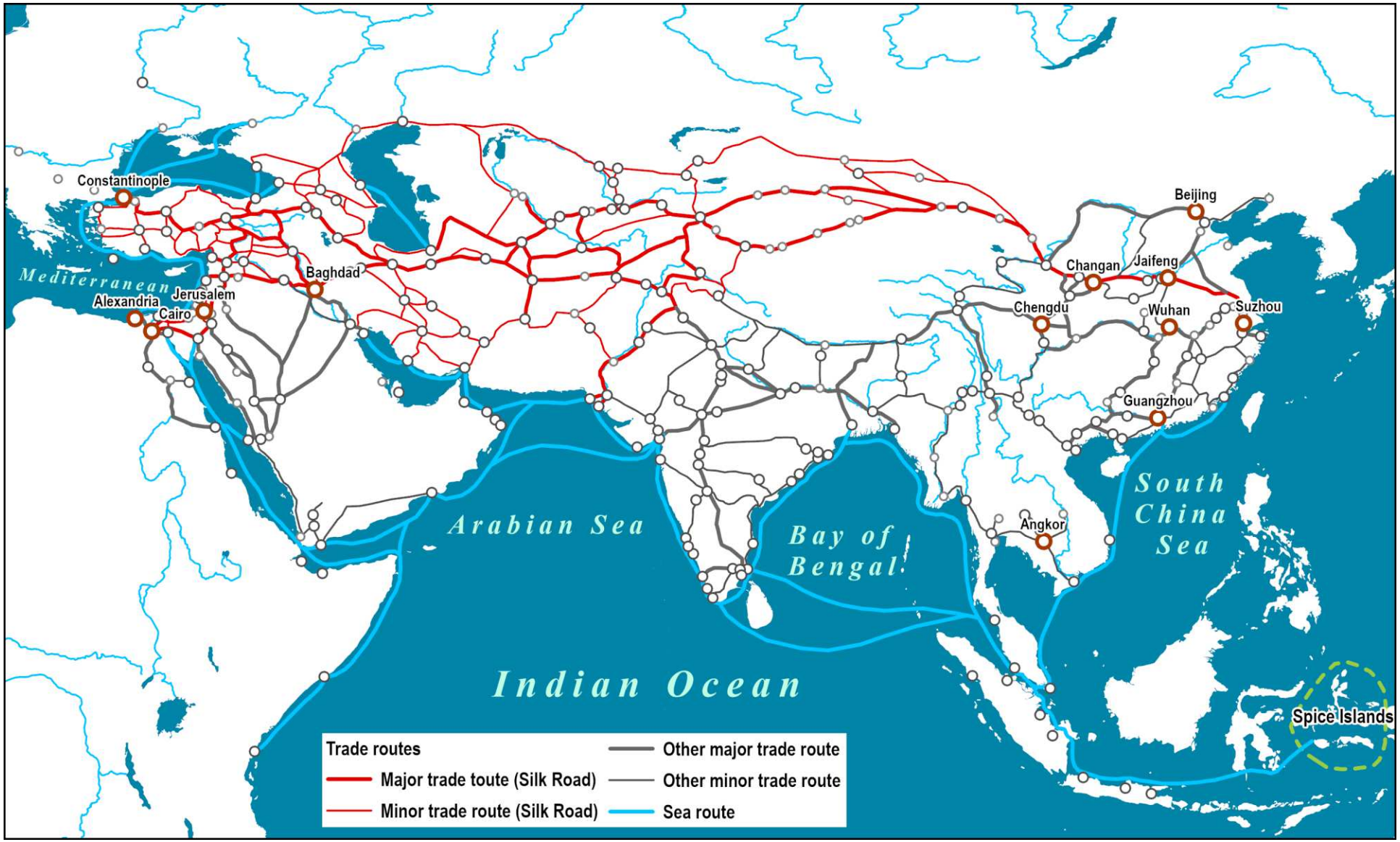
- Limited capacity and speed of inland transportation.
- Diversity of currencies and units of measure.
- High tariffs.
- Unreliable navigation.
- Insecurity / piracy.

© GTS

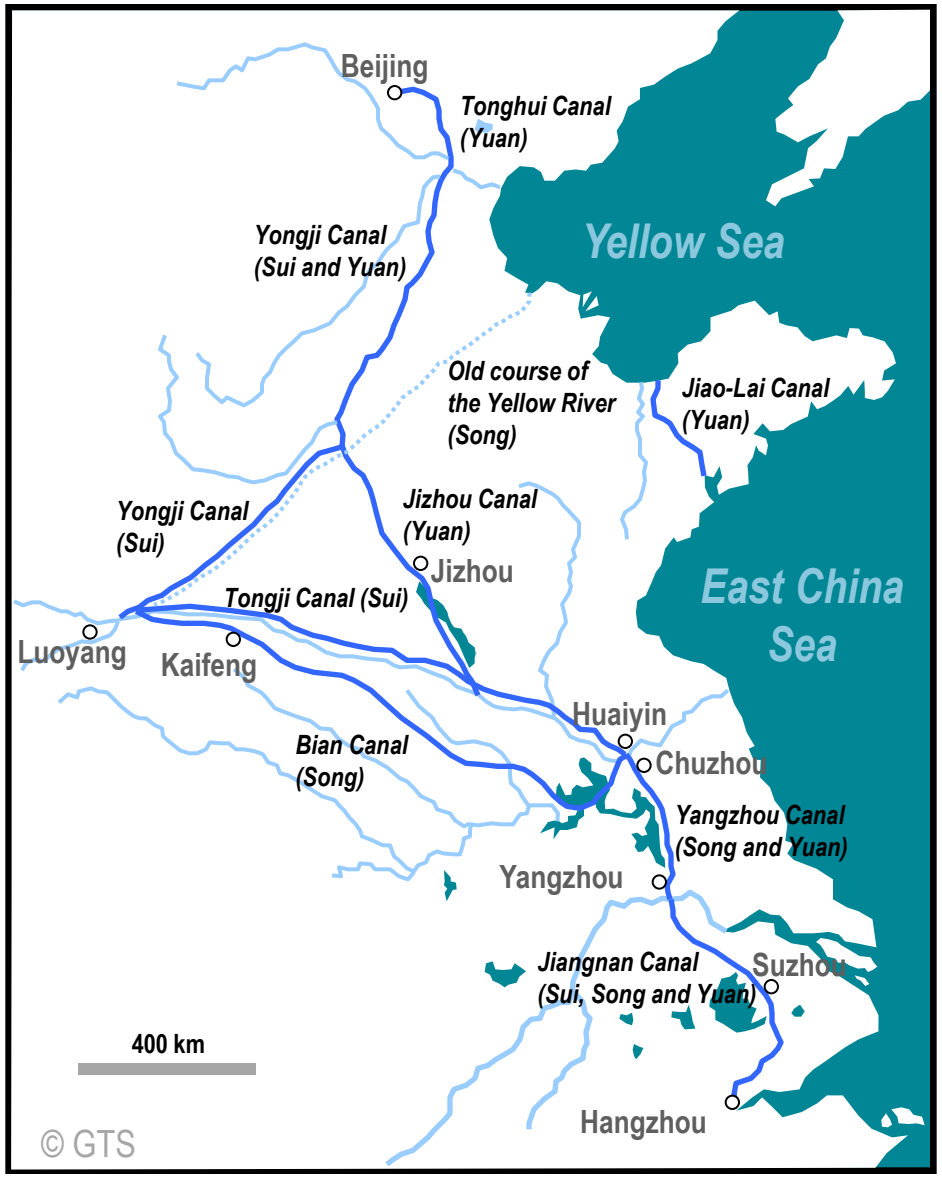
# Roman Empire, c125AD



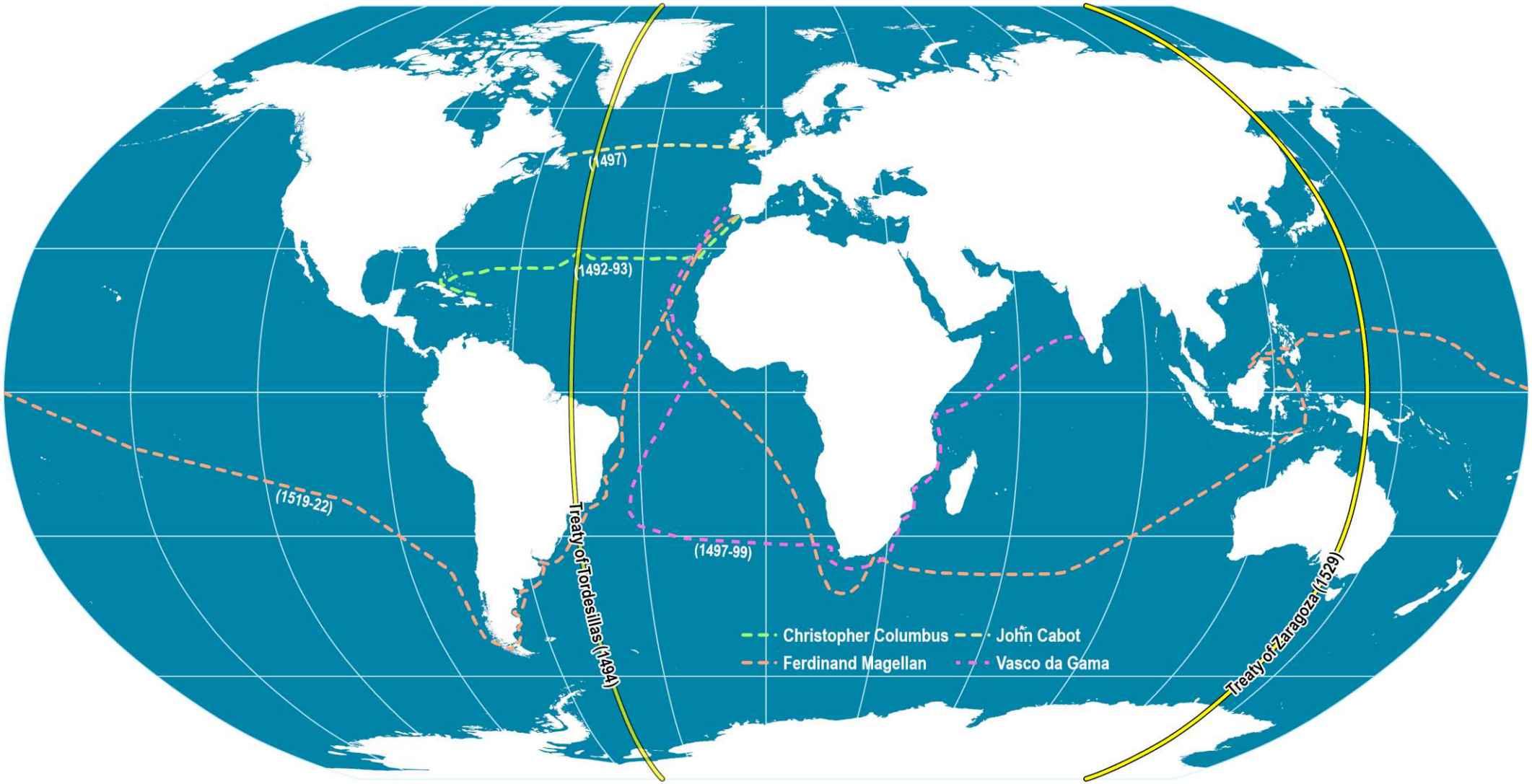
# The Silk Road and Arab Sea Routes (11th and 12th Centuries)

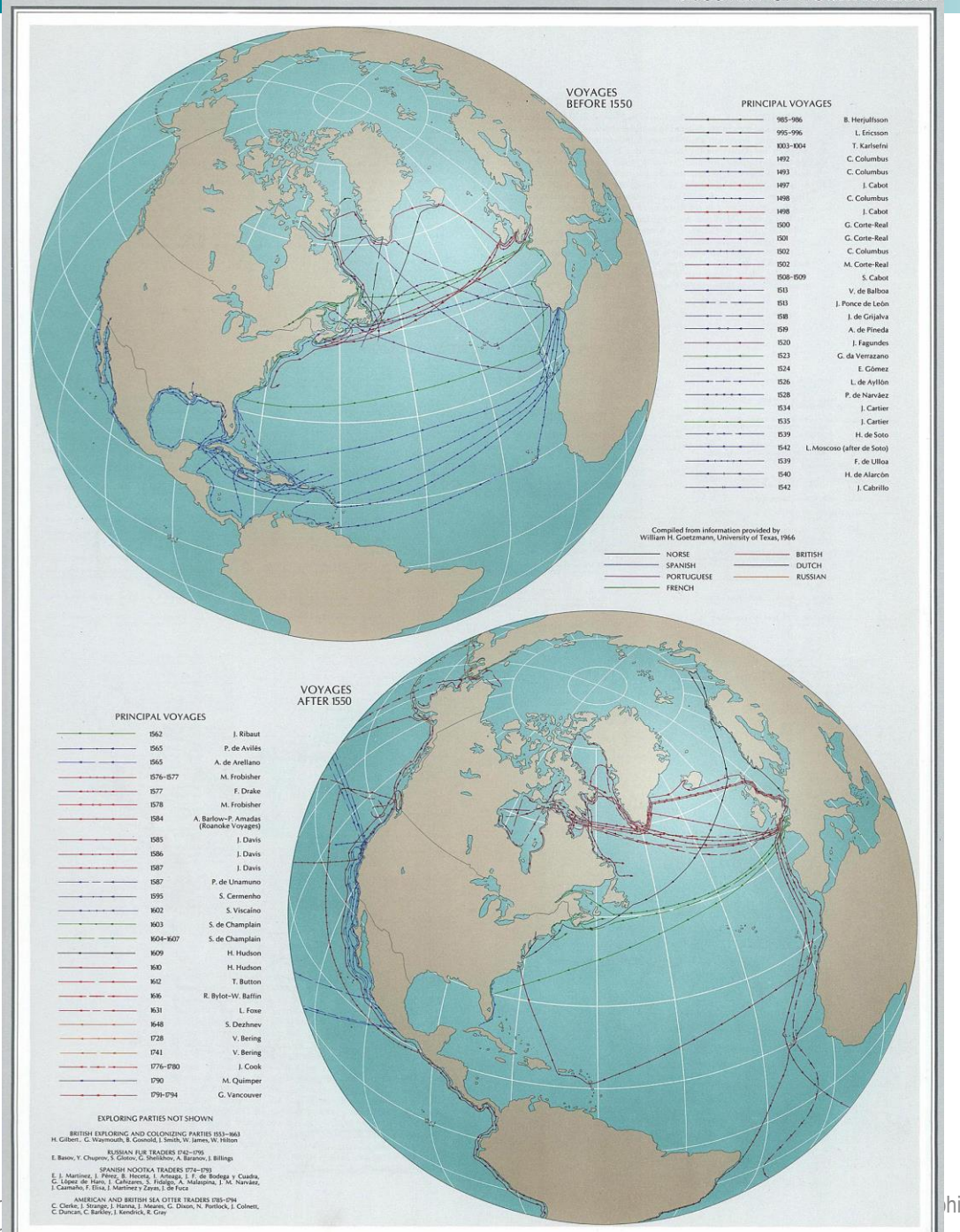


# Grand Canal System

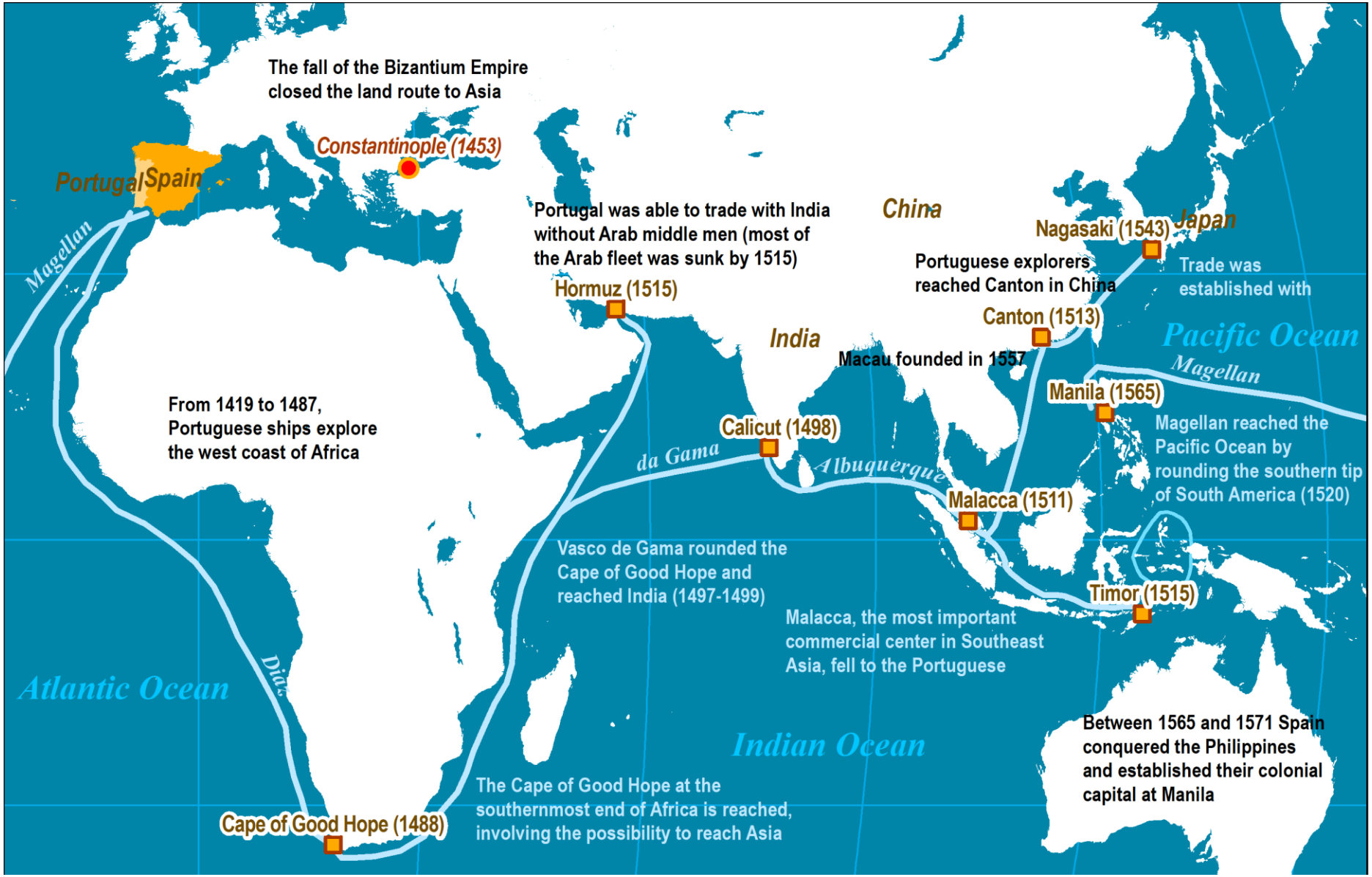


# Early European Maritime Expeditions, 1492-1522



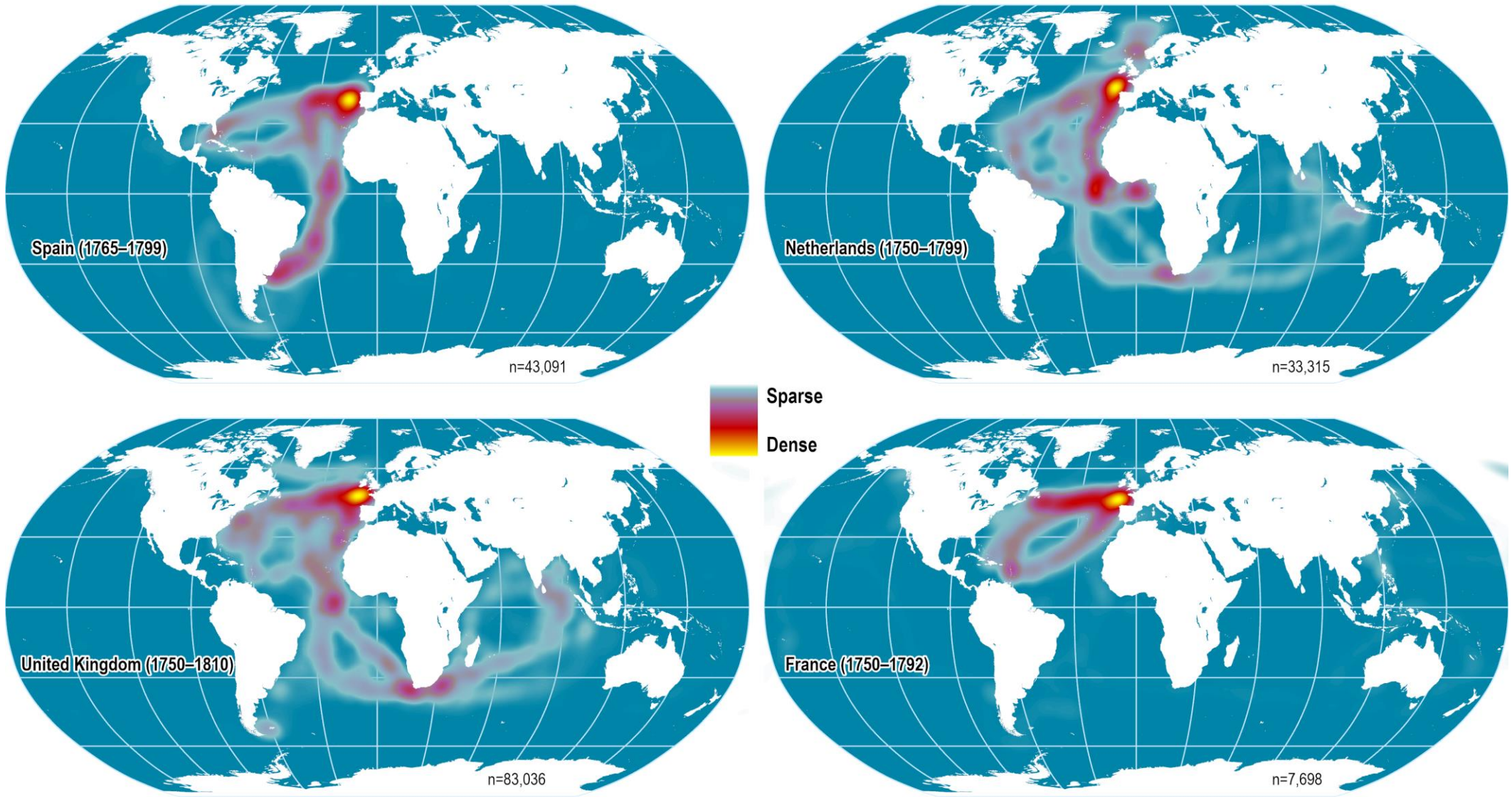


# The Eastern and Western Maritime Routes to Asia

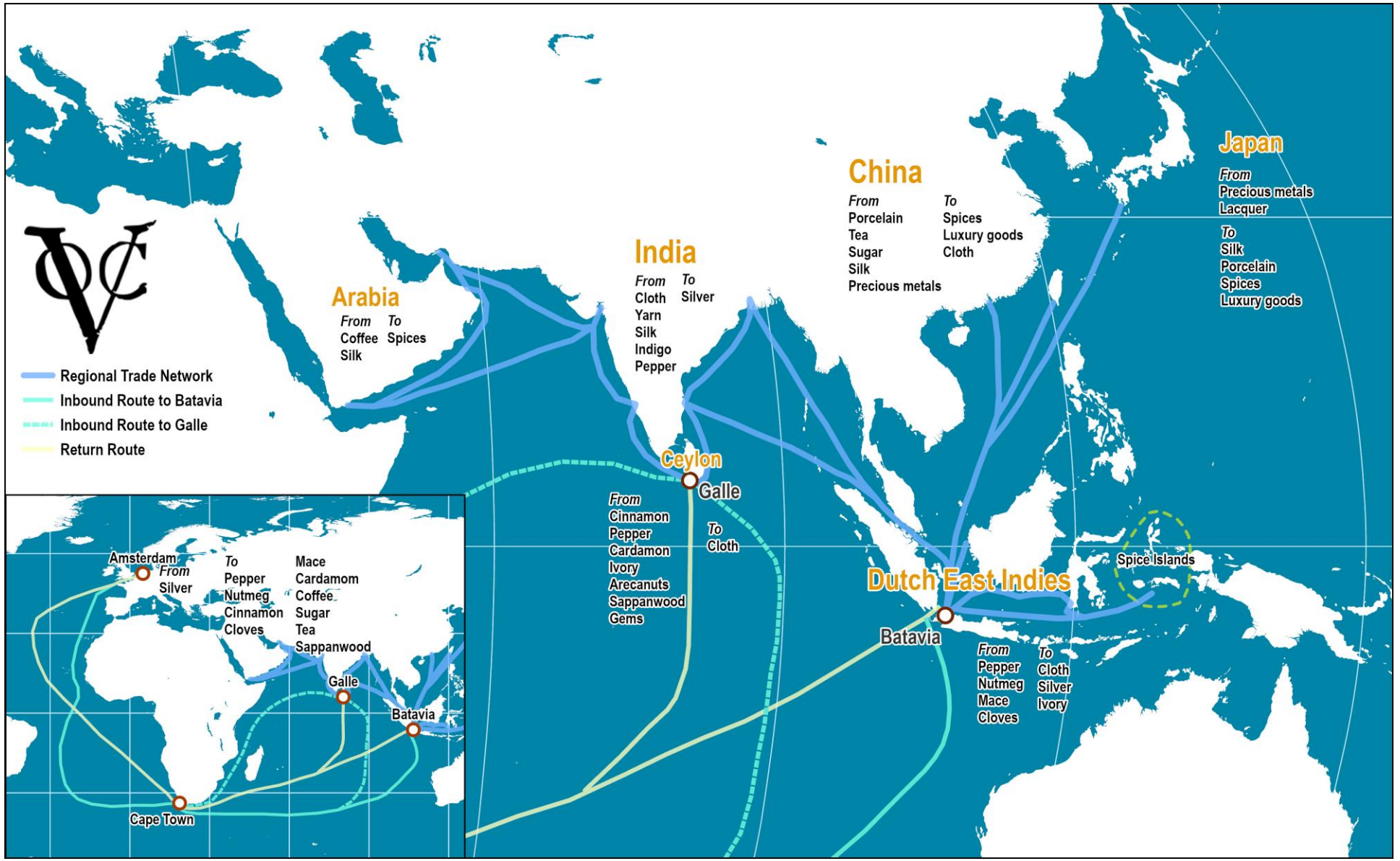


# Spanish and Portuguese Empires (1581–1640)

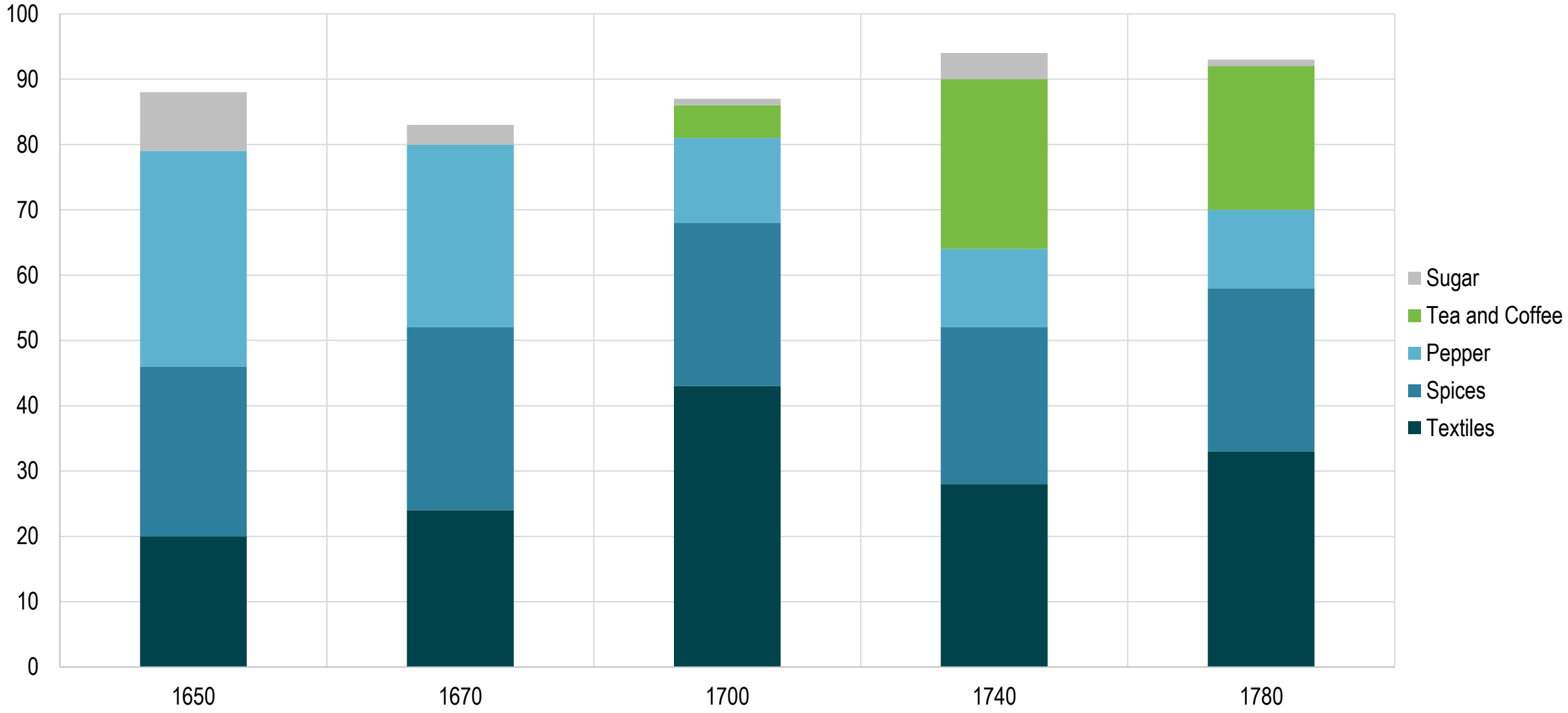
# Density of Ship Log Entries, 1750–1810



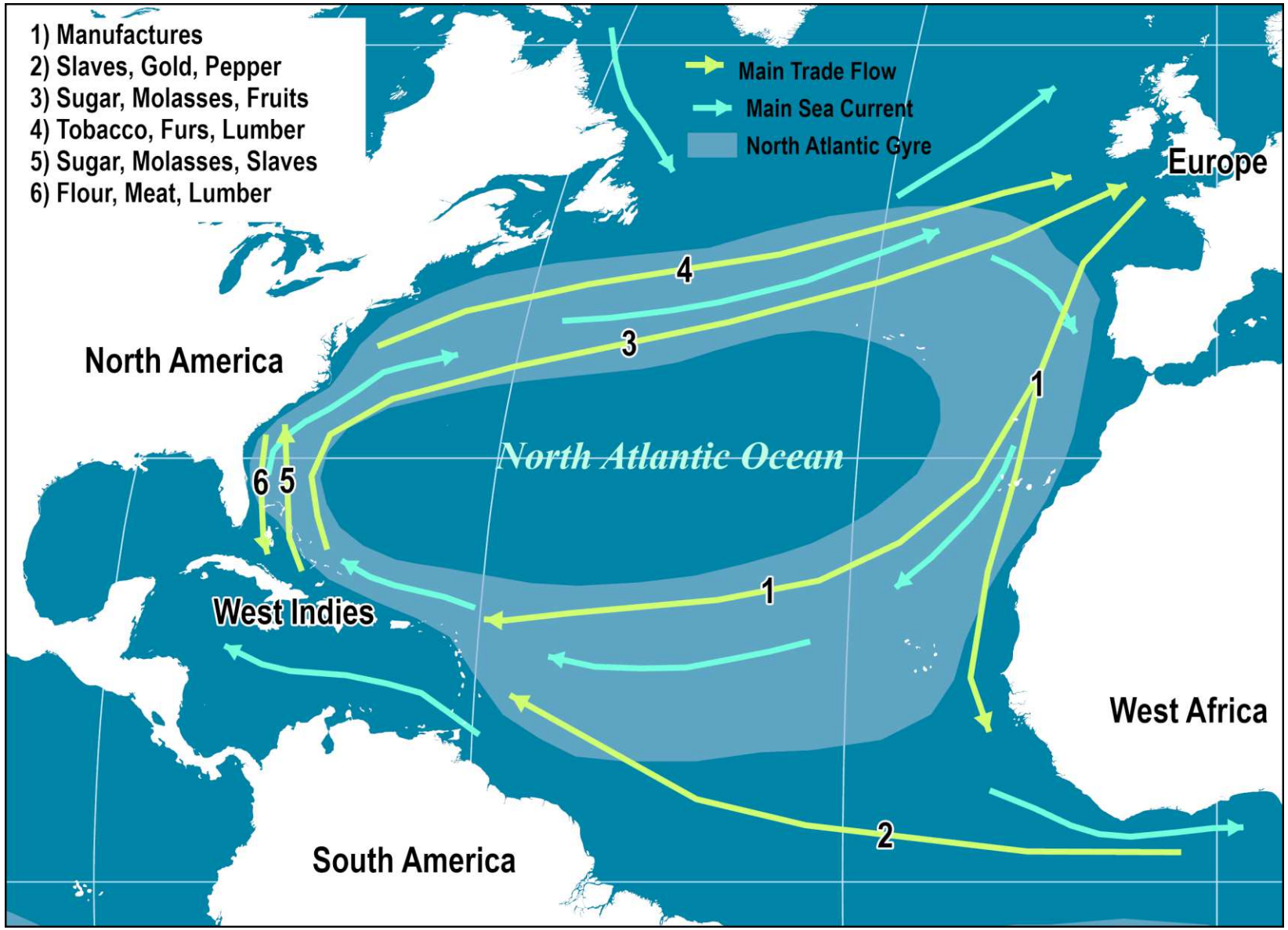
# Dutch East India Company, Trade Network, 17th Century



# Imports from the Dutch East India Company at Amsterdam, 17th and 18th Centuries



# Colonial Trade Pattern, North Atlantic, 18th Century



# North American Coastal Trade System, 18th Century

# The Performance of Pre-industrial Means of Transportation

**Walking**
40 lbs / 18 kg
5 km/hr
30 km/day

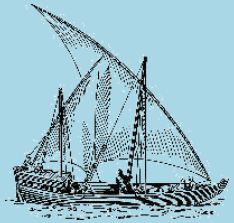
**Horse Riding**
275 lbs / 125 kg
8 km/hr
60 km/day

**Camel**
350 lbs / 160 kg
5 km/hr
40 km/day

**Horse & cart**
1 ton
3 km/hr
25 km/day

**Barge pulled by horse**
50-100 tons
4 km/hr
35 km/day





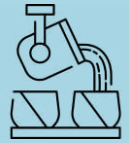
**Dhow**
15-300 tons
13 km/hr
150 km/day

**Carrack (15th century)**
500-1500 tons
10 km/hr
130 km/day

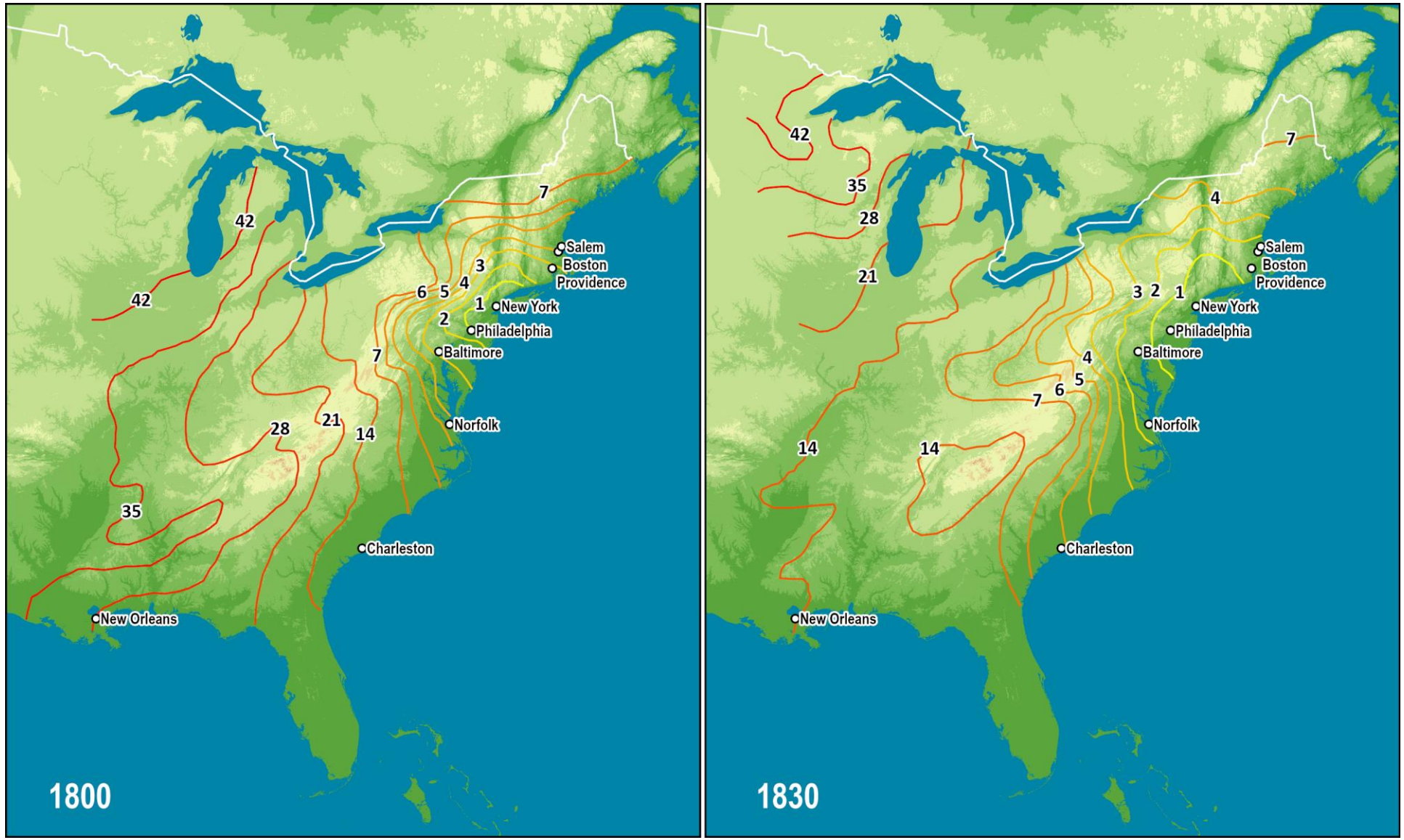
**Galleon (17th century)**
500-800 tons
15 km/hr
300 km/day

**Clipper (19th century)**
500-1500 tons
30 km/hr
700 km/day

# Major Technological Innovations of the Industrial Revolution

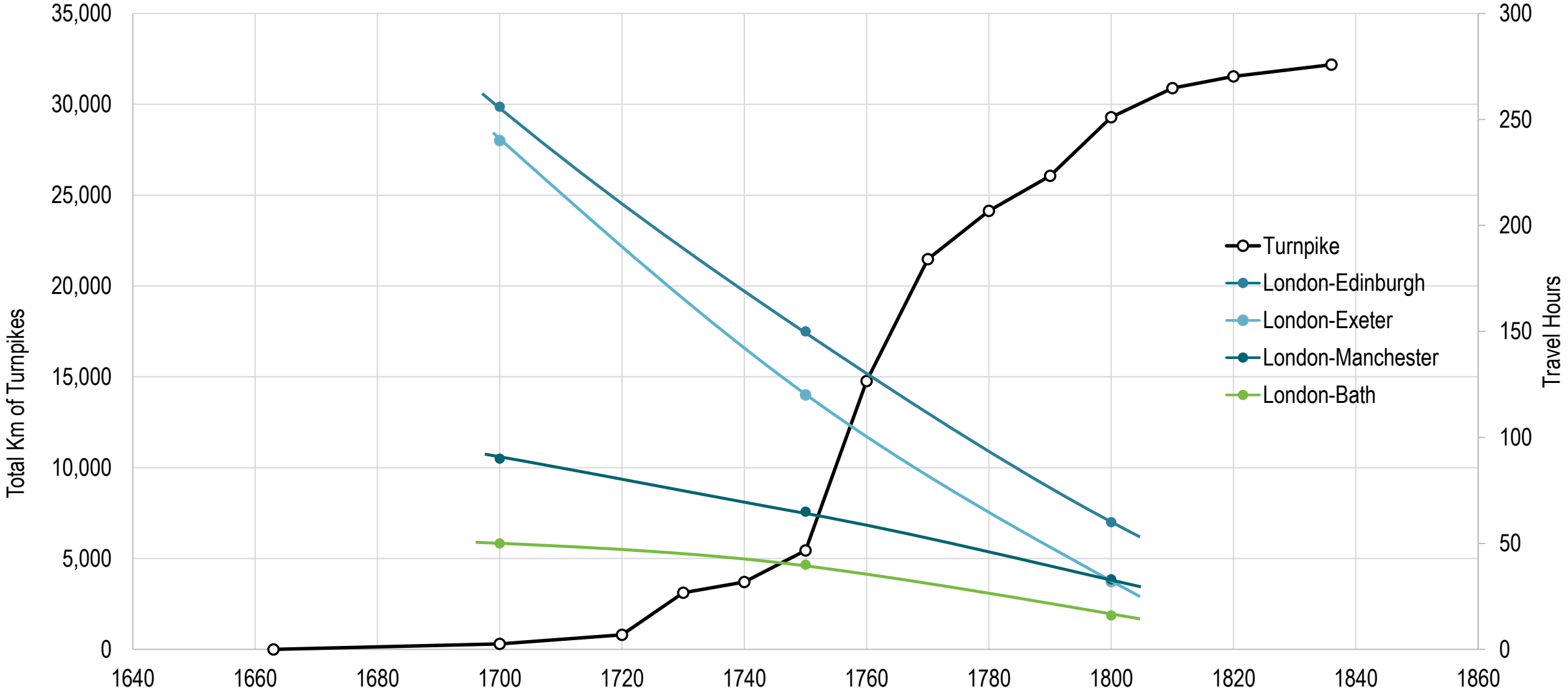
| POWER GENERATION | TEXTILES | METALLURGY | TRANSPORTATION |
|---|---|---|---|
| **Thermal energy used for mechanical energy** | **Mechanization of spinning and weaving** | **Mass production of steel** | **Modern transport and telecommunication systems** |
|  |  |  |  |
| • First water pump (1712) in mines.<br>• Watt (1769); significant improvements.<br>• Steam locomotive (1824).<br>• Electric generator (1831).<br>• Steam turbine (1884). | • "Flying shuttle" (1733) doubled weaving productivity.<br>• "Spinning Jenny" (1765).<br>• "Water frame" (1768); hydraulic power.<br>• "Spinning Mule" (1779); steam power.<br>• Sewing machine (1846). | • Coke instead of coal for iron production (1709).<br>• Bessemer process (1855). | • Railroads (1825).<br>• Telegraph (1834).<br>• Steamship (1838).<br>• Telephone (1876). |

# Inland Travel Time from New York, 1800 – 1830 (in Days)



# American Rail Network, 1861

# Turnpikes in Great Britain and Travel Hours from London, Late 18th and Early 19th Century

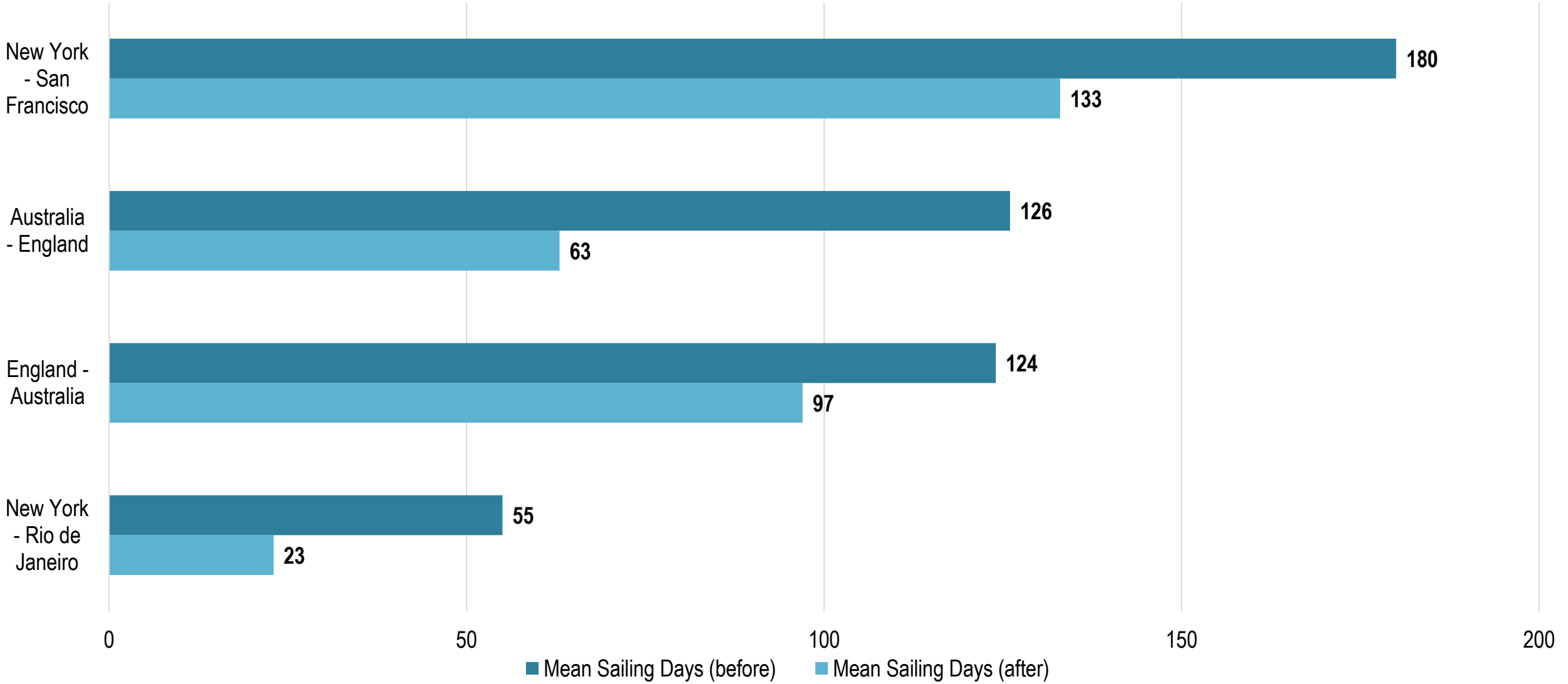


# Major Canals Built

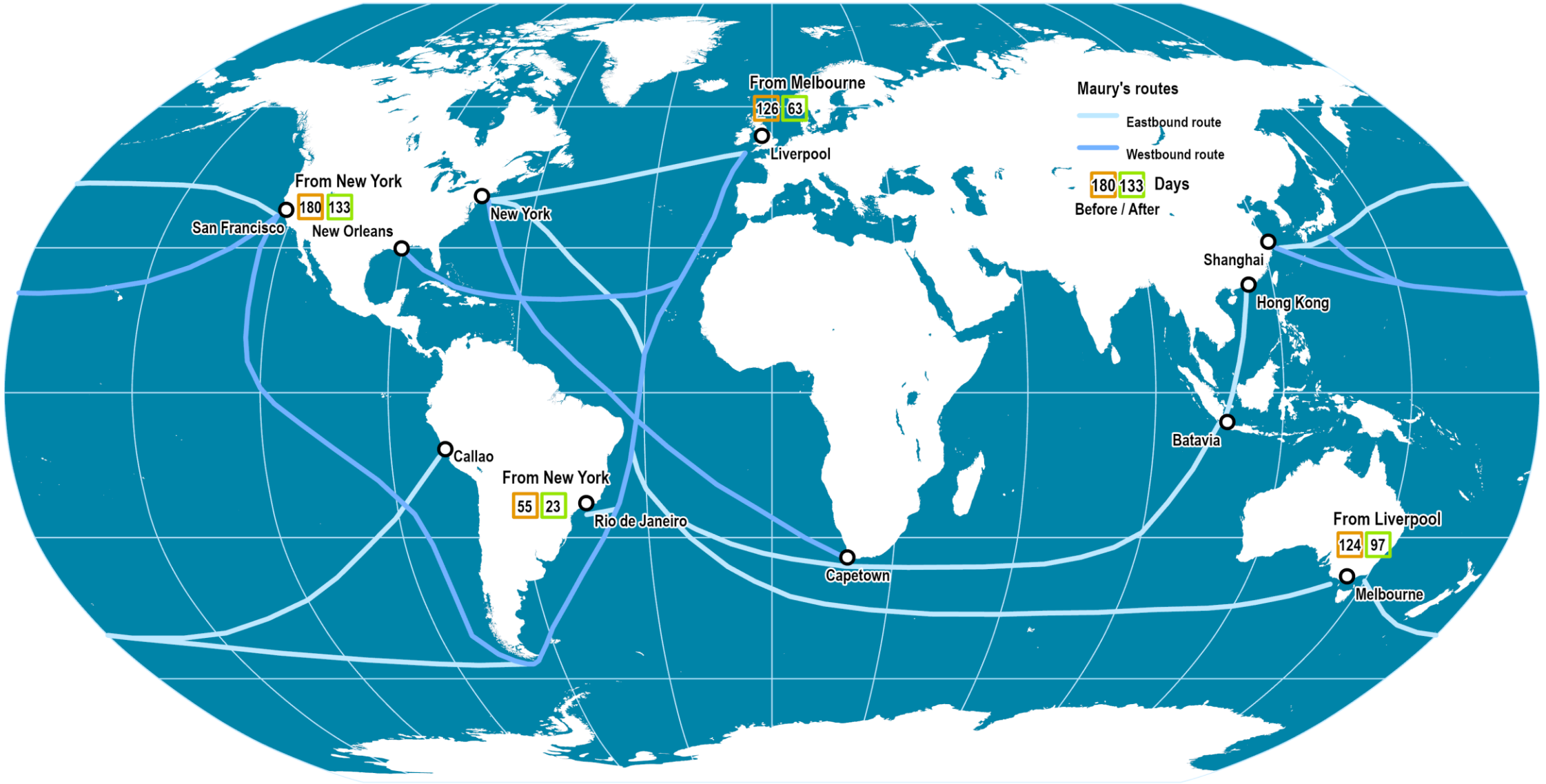
| | | |
|---|---|---|
| 540-1320 | Grand Canal | Beijing – Hangzhou (2,500 km) |
| 11th Century | Naviglio Grande | Milan – Adriatic (30 km) |
| 1390-97 | Stecknitz Canal | Elbe – Trave (11 km) |
| 1604-42 | Briare Canal | Seine – Loire (58 km) |
| 1667-81 | Canal du Midi | Garonne – Mediterranean (279 km) |
| 1732 | Ladoga canal | St. Petersburg – Volga (110 km) |
| 1759-61 | Bridgewater Canal | Worsley – Manchester (16 km) |
| 1784-1833 | Rhine-Rhone canal | Strasburg-Mulhouse-Burgundy (319 km) |
| 1810-24 | North Sea canal | Amsterdam – North Sea (20 km) |
| 1817-25 | Erie canal | Buffalo – Albany (544 km) |
| 1836-45 | Ludwigskanal | Main – Danube (172 km) |
| 1838-54 | Rhine – Marne canal | Saverne gap (314 km) |
| 1859-69 | Suez canal | Mediterranean – Red Sea (112 km) |
| 1894 | Manchester Ship Canal | Manchester – Liverpool (64 km) |
| 1887-95 | Kiel canal | Baltic Sea – North Sea (99 km) |
| 1906-14 | Panama canal | Atlantic Ocean – Pacific Ocean (80 km) |
| 1905-38 | Mittellandkanal | Rhine – Elbe (320 km) |

# Major Canals Built in the 19th Century, American Northeast

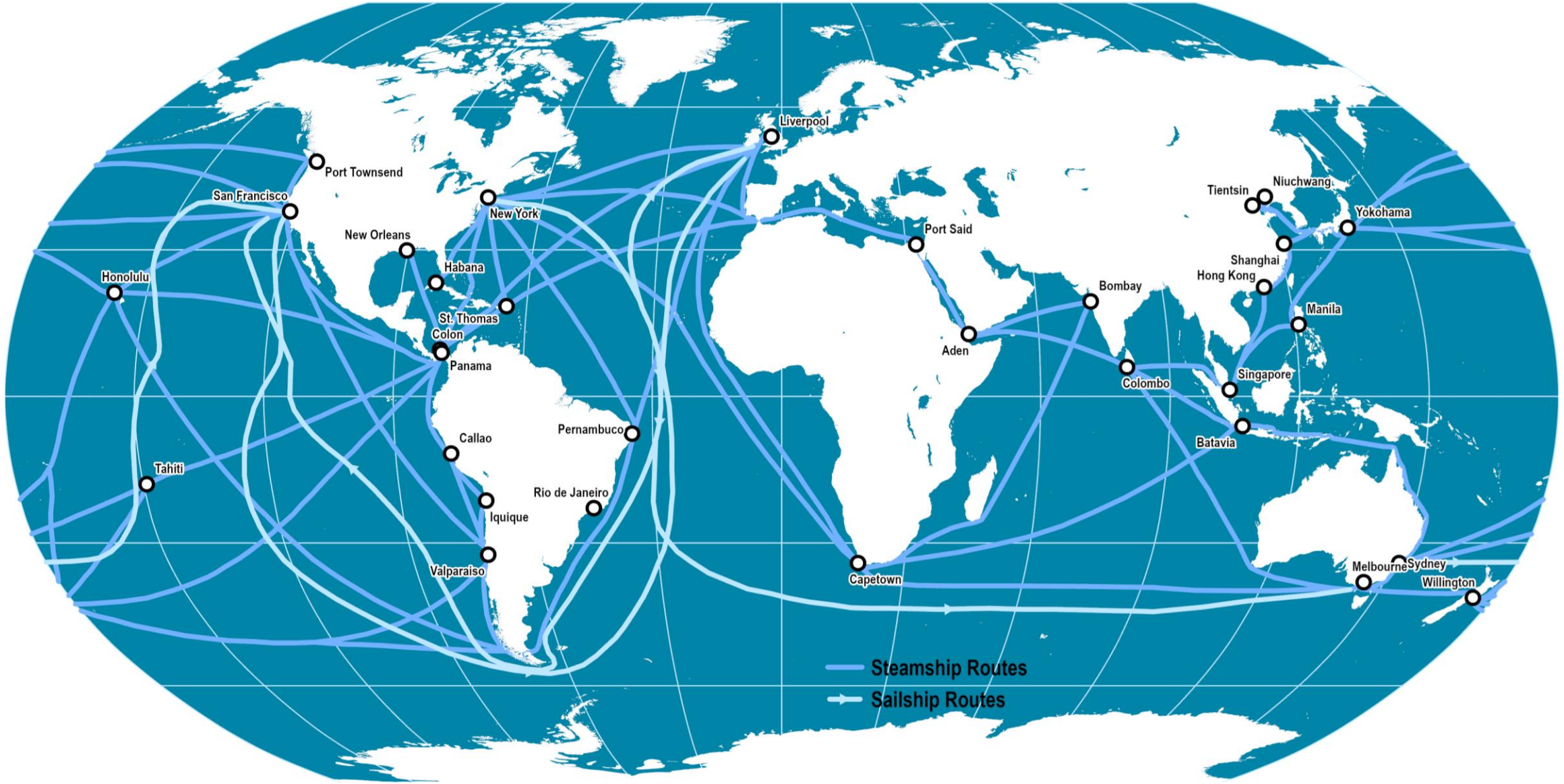
# Impacts of Maury's Navigation Charts on Sailing Time, 1850s



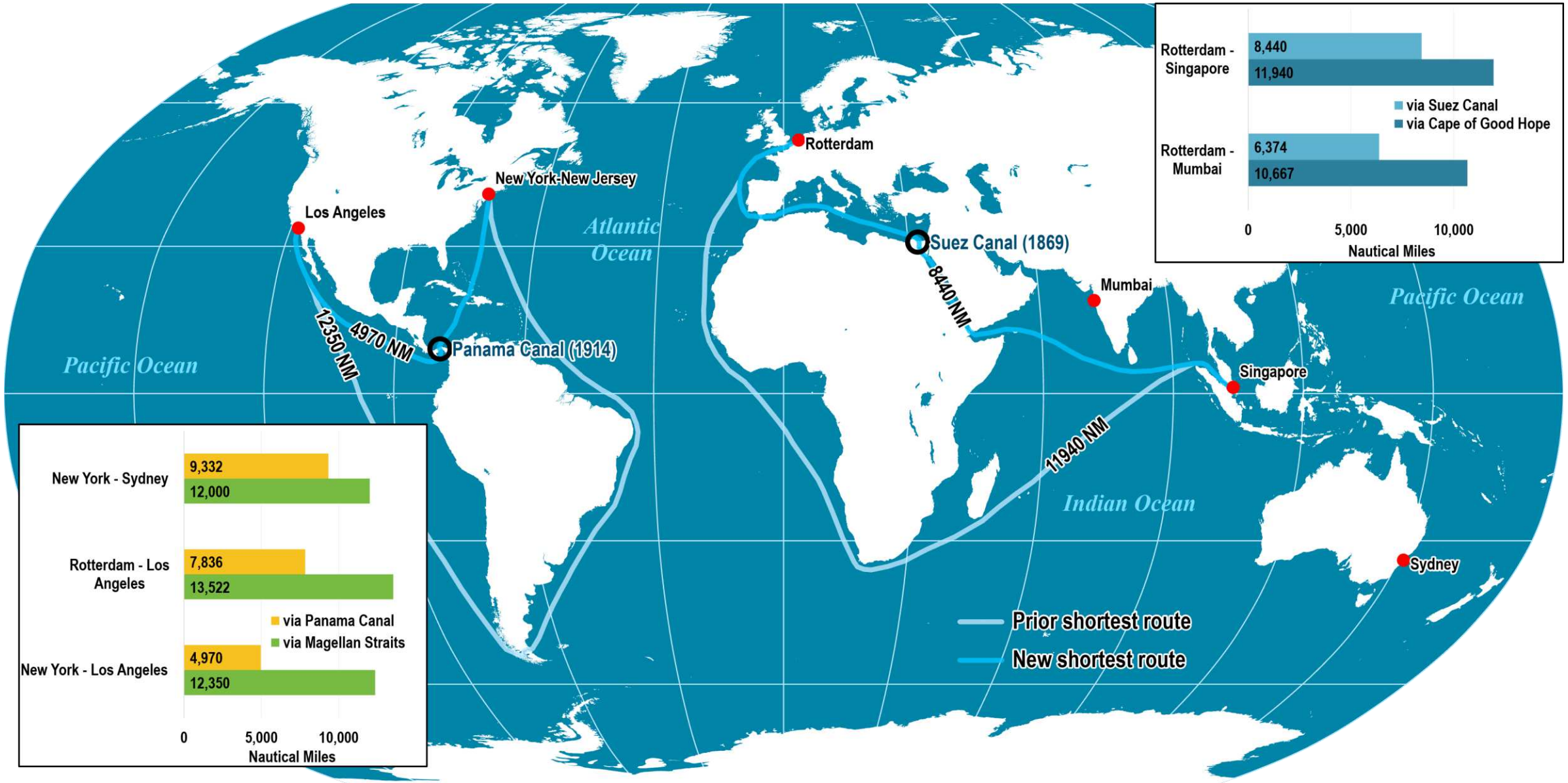
# Impacts of Maury's Navigation Charts on Sailing Time, 1850s



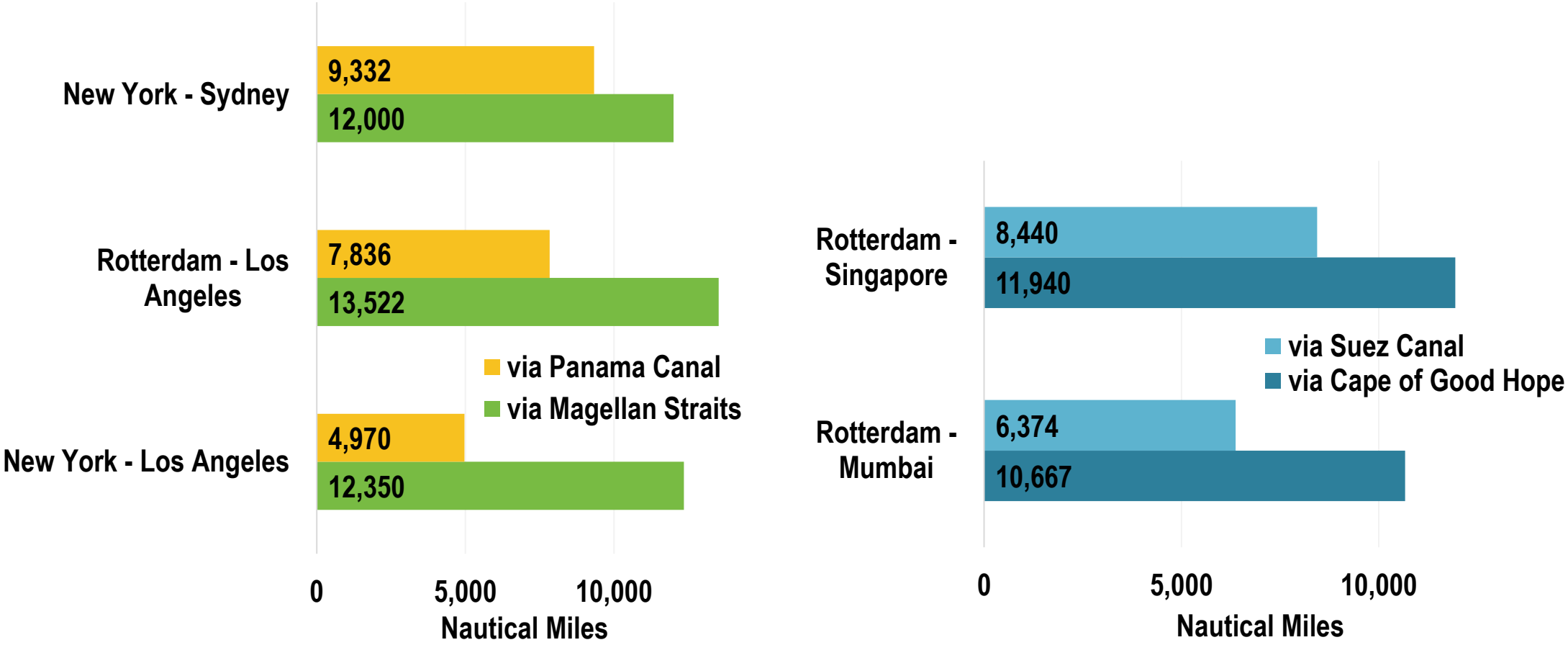
# World Maritime Trade Routes, 1912



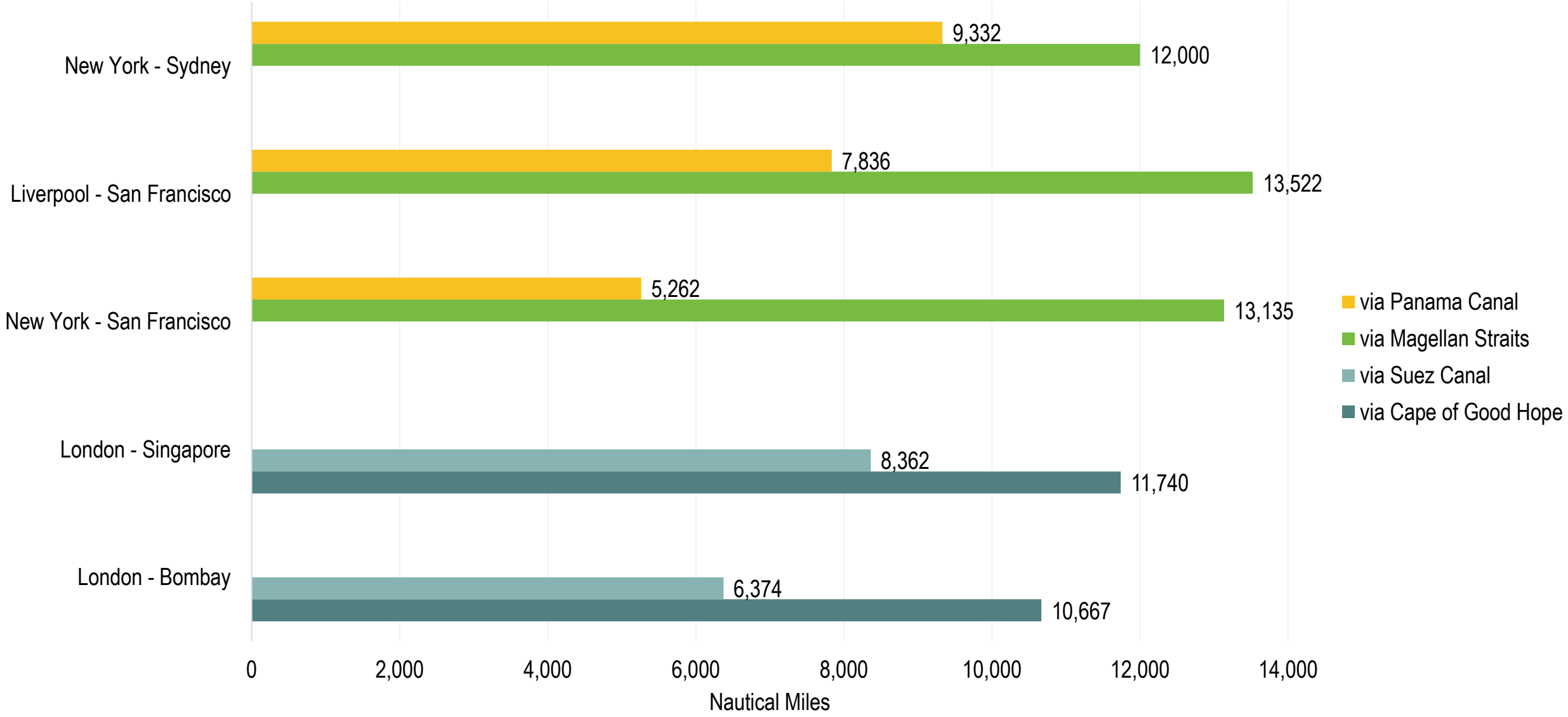
# Geographical Impacts of the Suez and Panama Canals



# Effects of the Suez and Panama Canals on Travel Distances

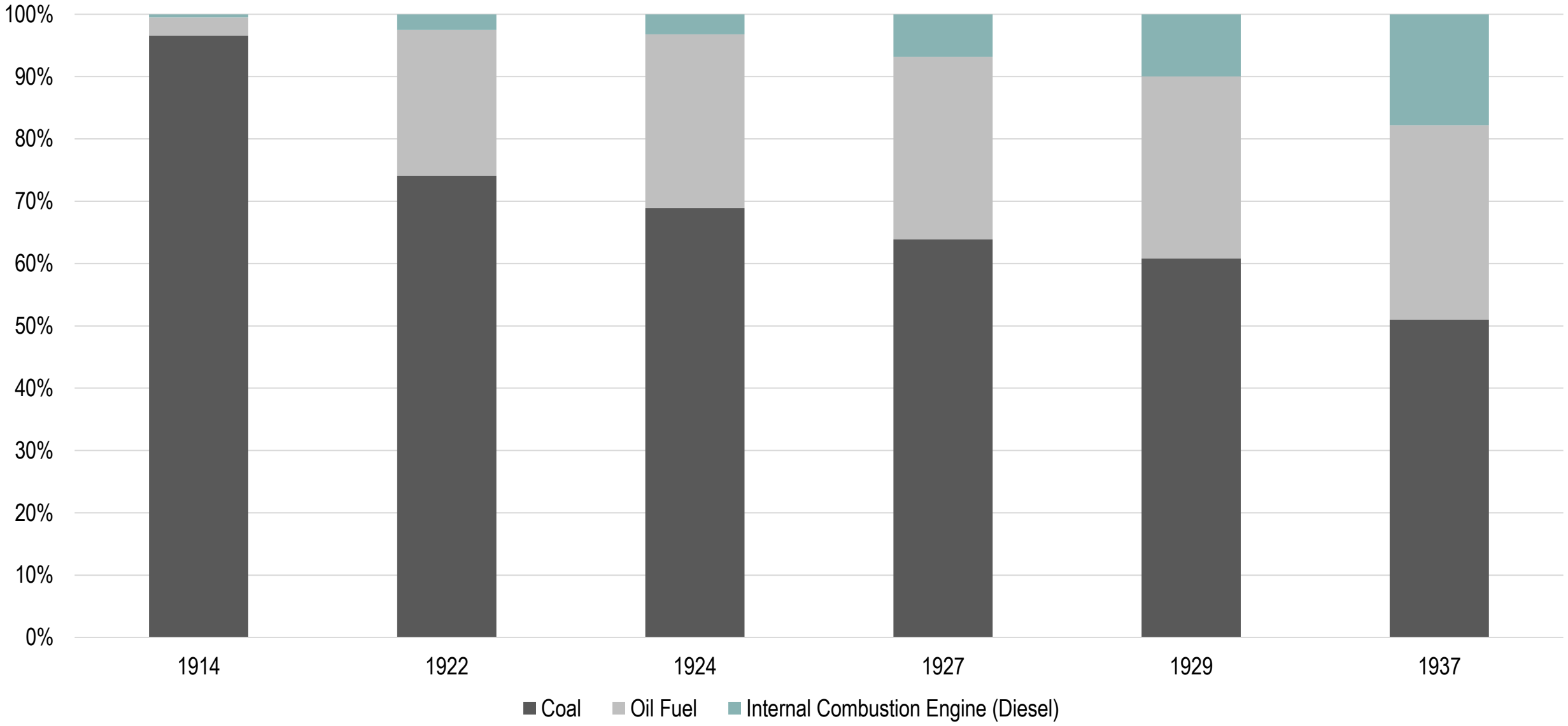


# Effects of the Suez and Panama Canals on Travel Distances

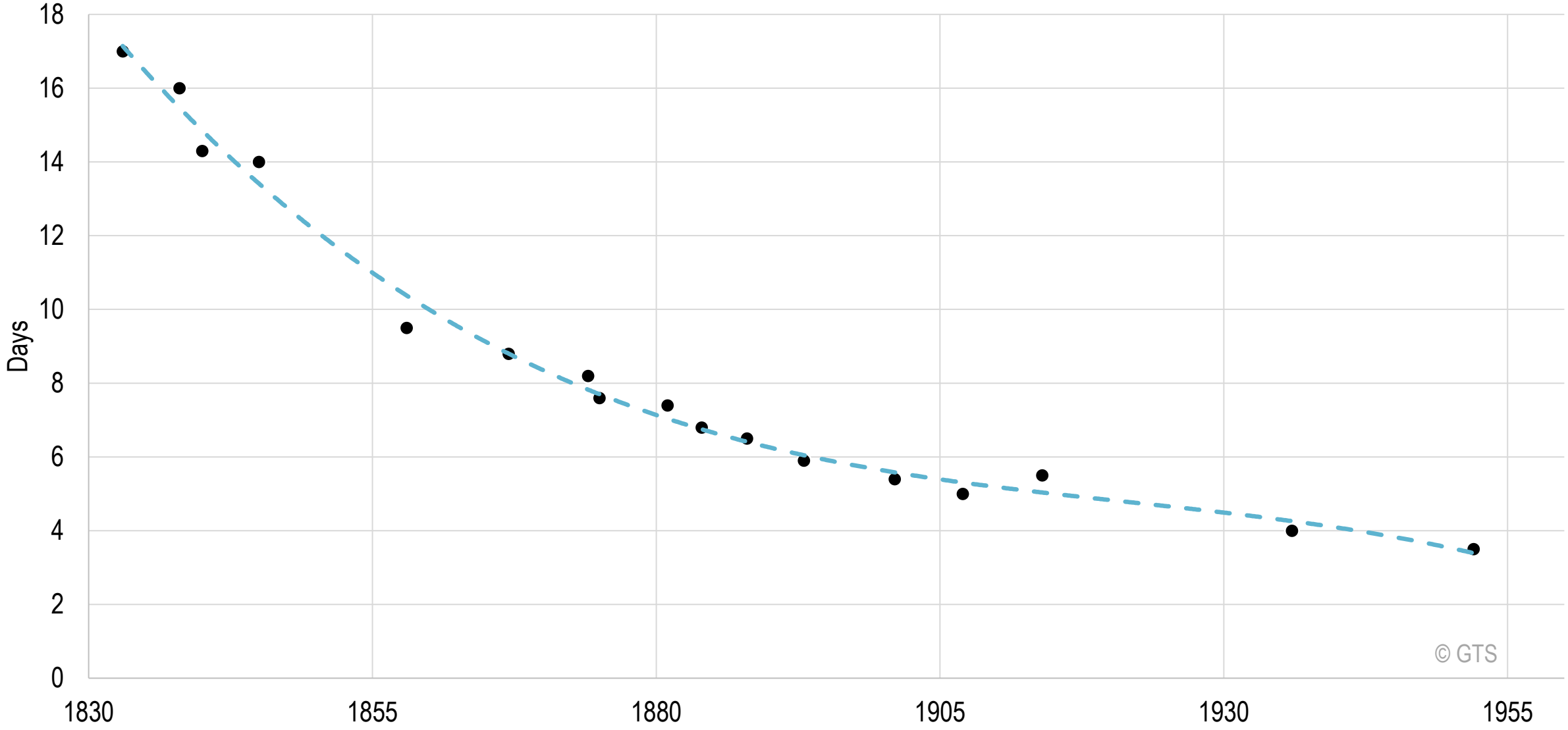


# Break-Even Distance between Sail and Steam, 1850-1890

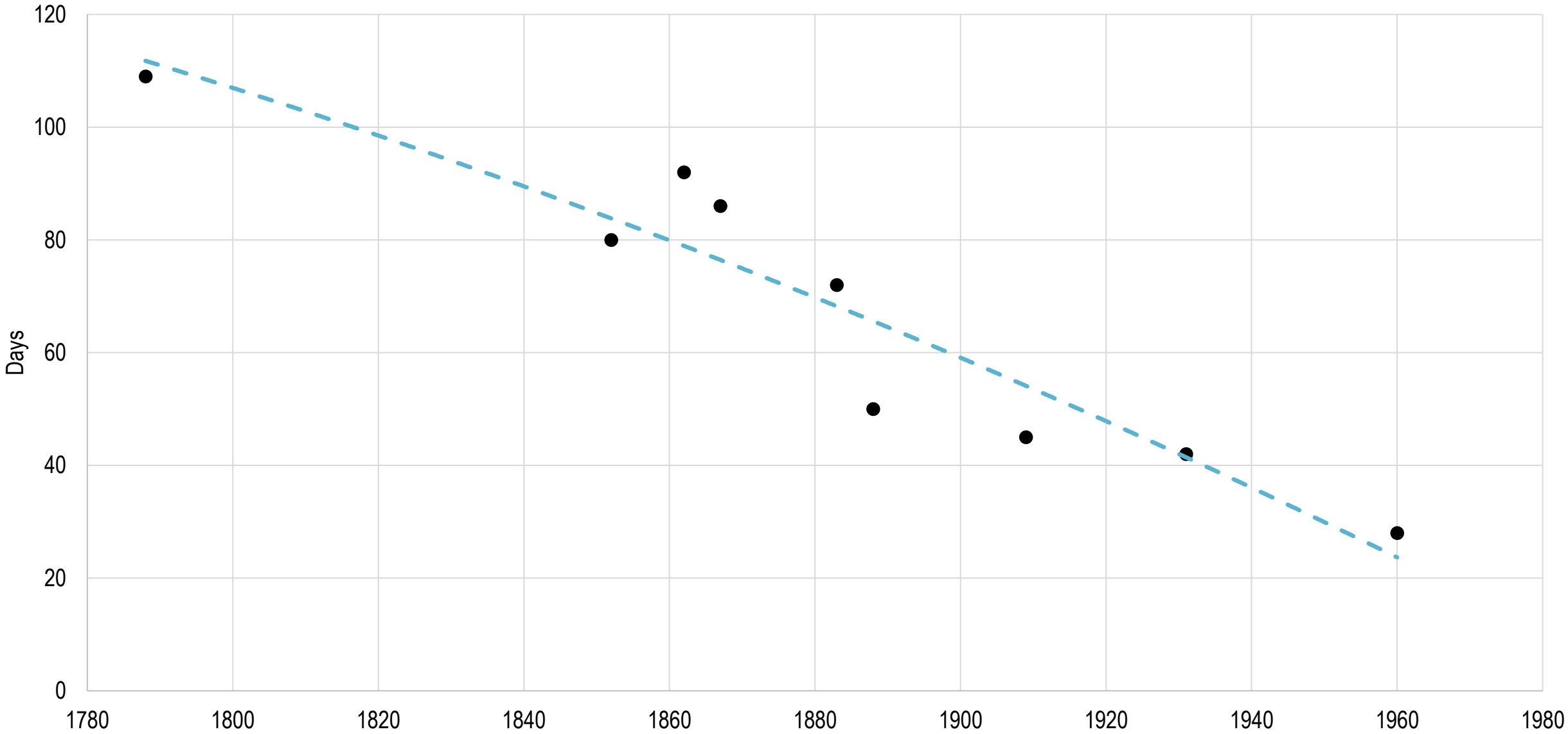
# World Merchant Fleet by Motive Power, 1914-1937



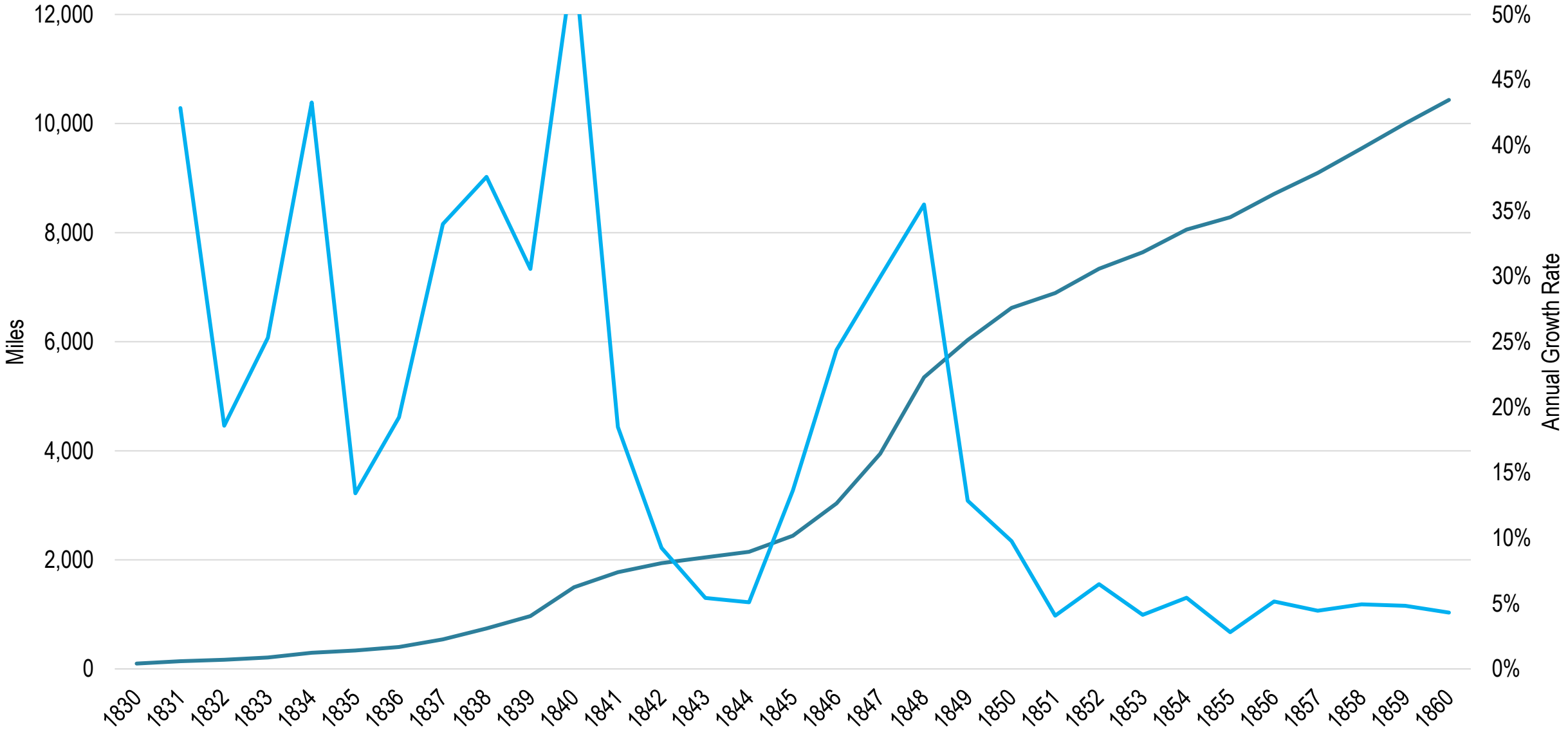
# Liner Transatlantic Crossing Times, 1833 – 1952 (in days)



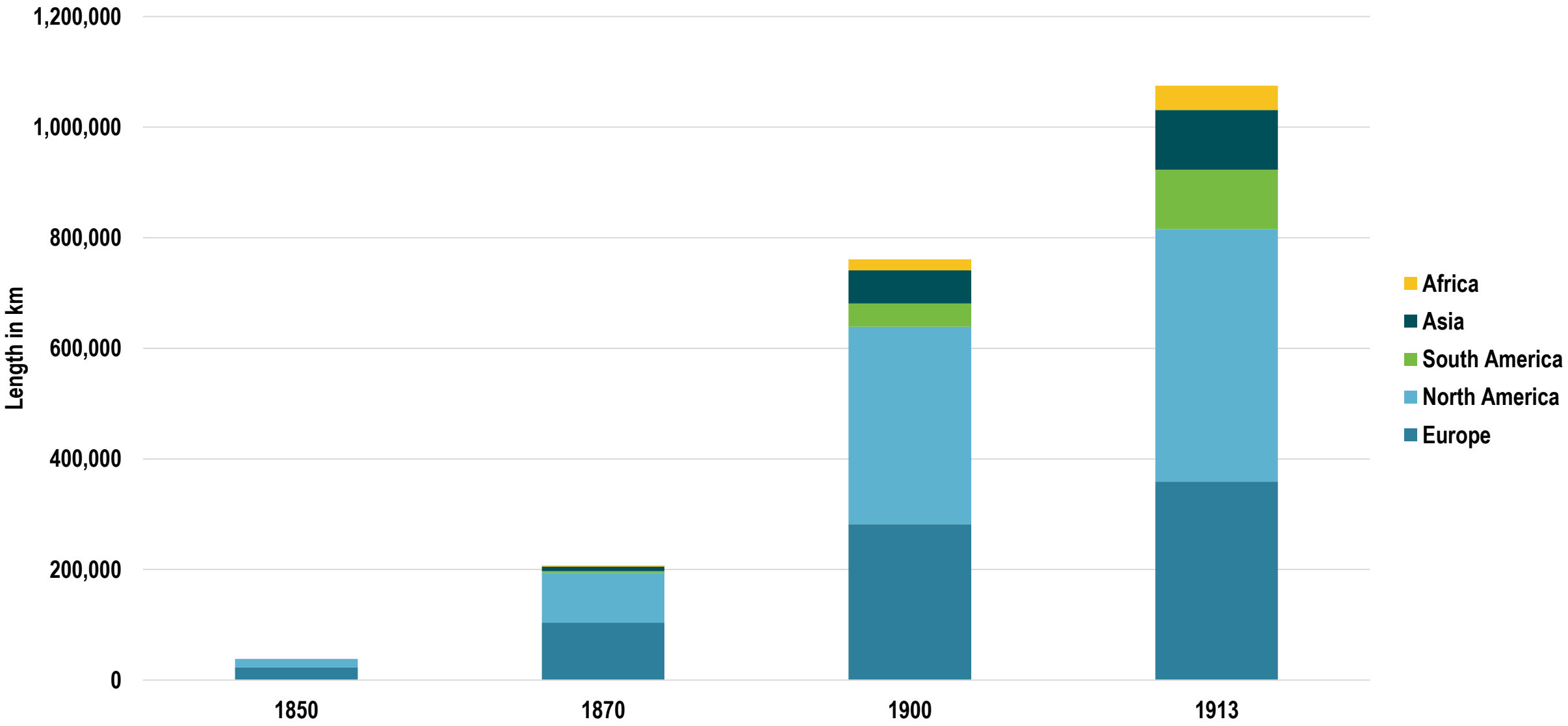
# Maritime Journey from Britain to Australia, 1788-1960



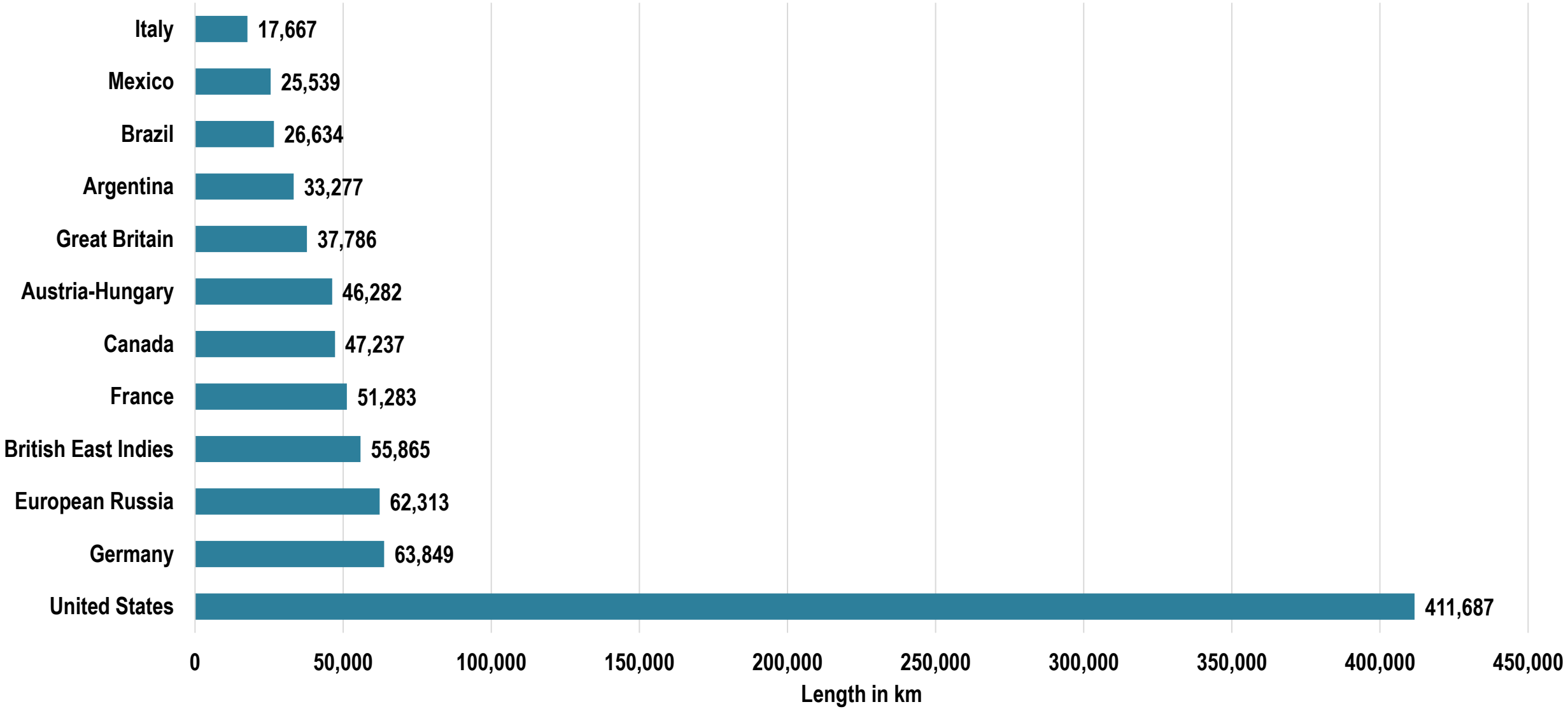
# Length of the British Railway System, 1830-1860



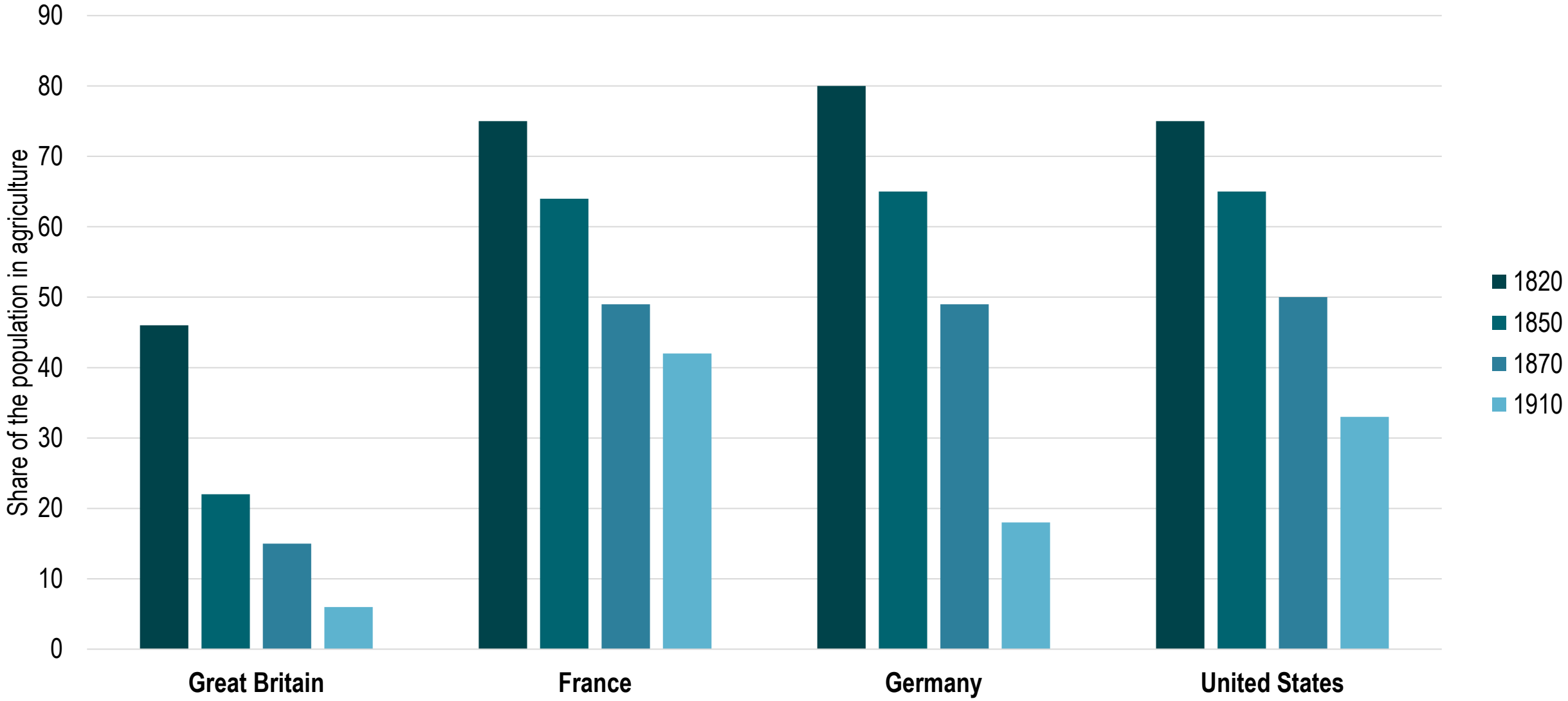
# Evolution of the World Railway Network, 1850-1913



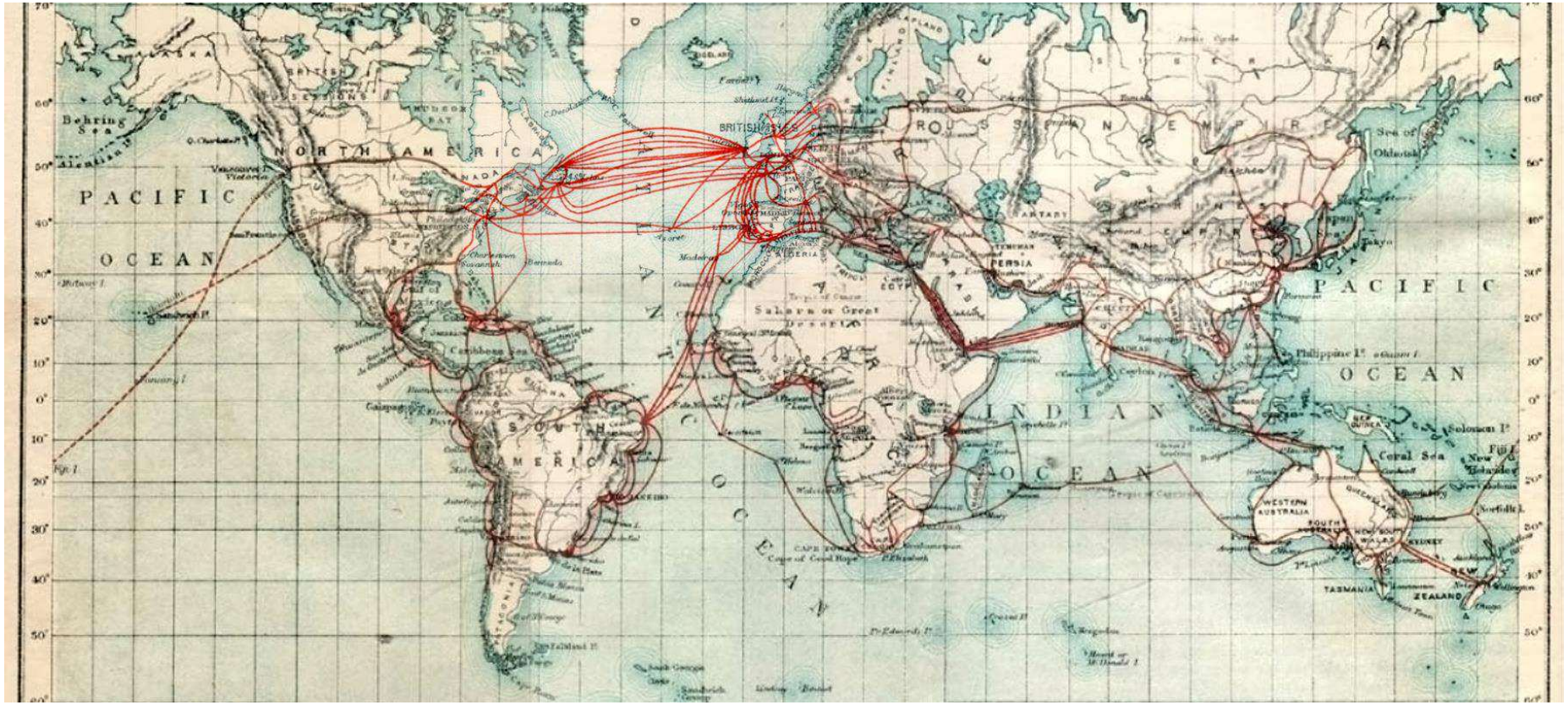
# Length of the World's Largest Railway Systems, 1913



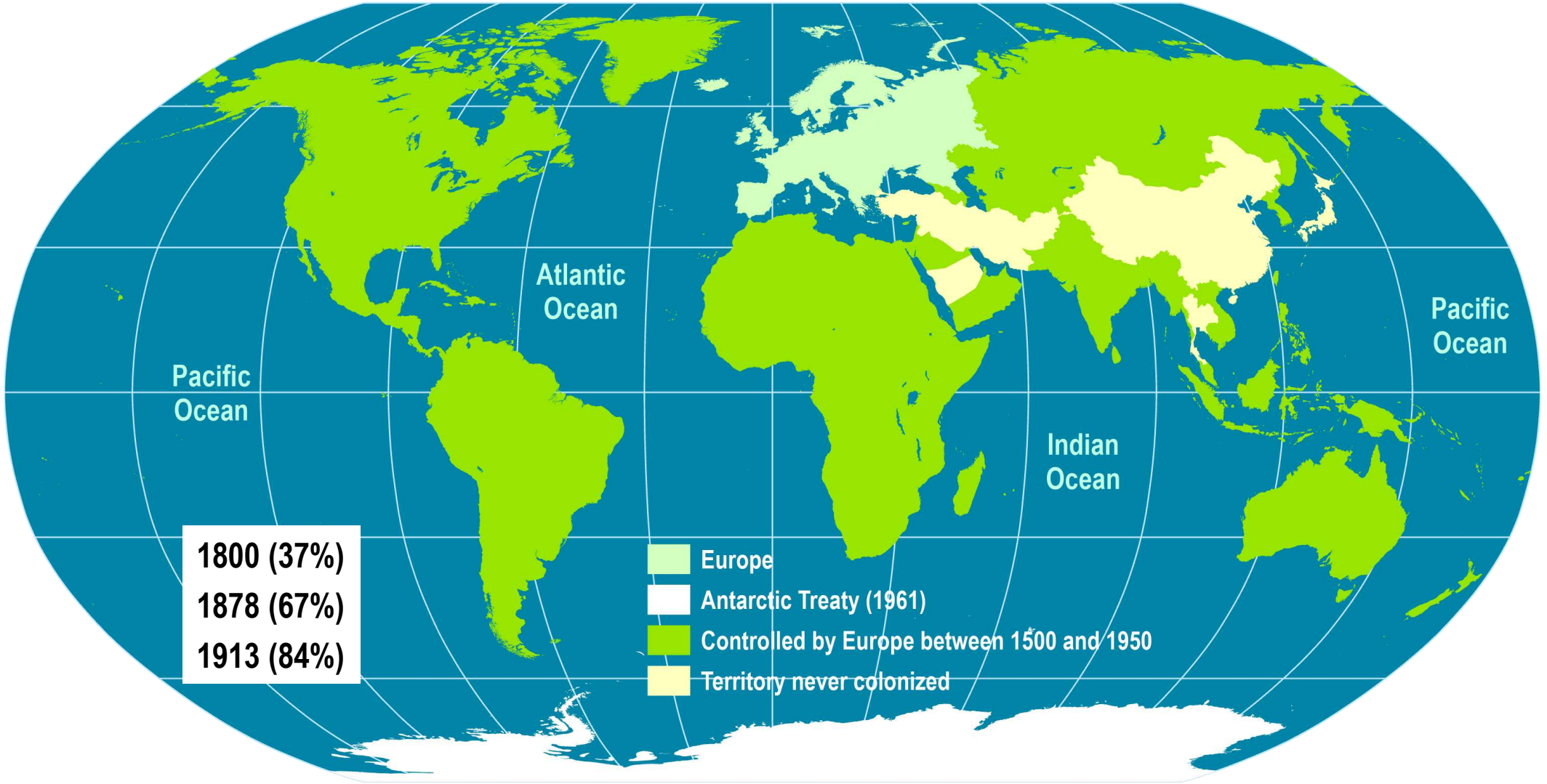
# Share of the Population in Agriculture, Early Industrial Countries, 1820-1910



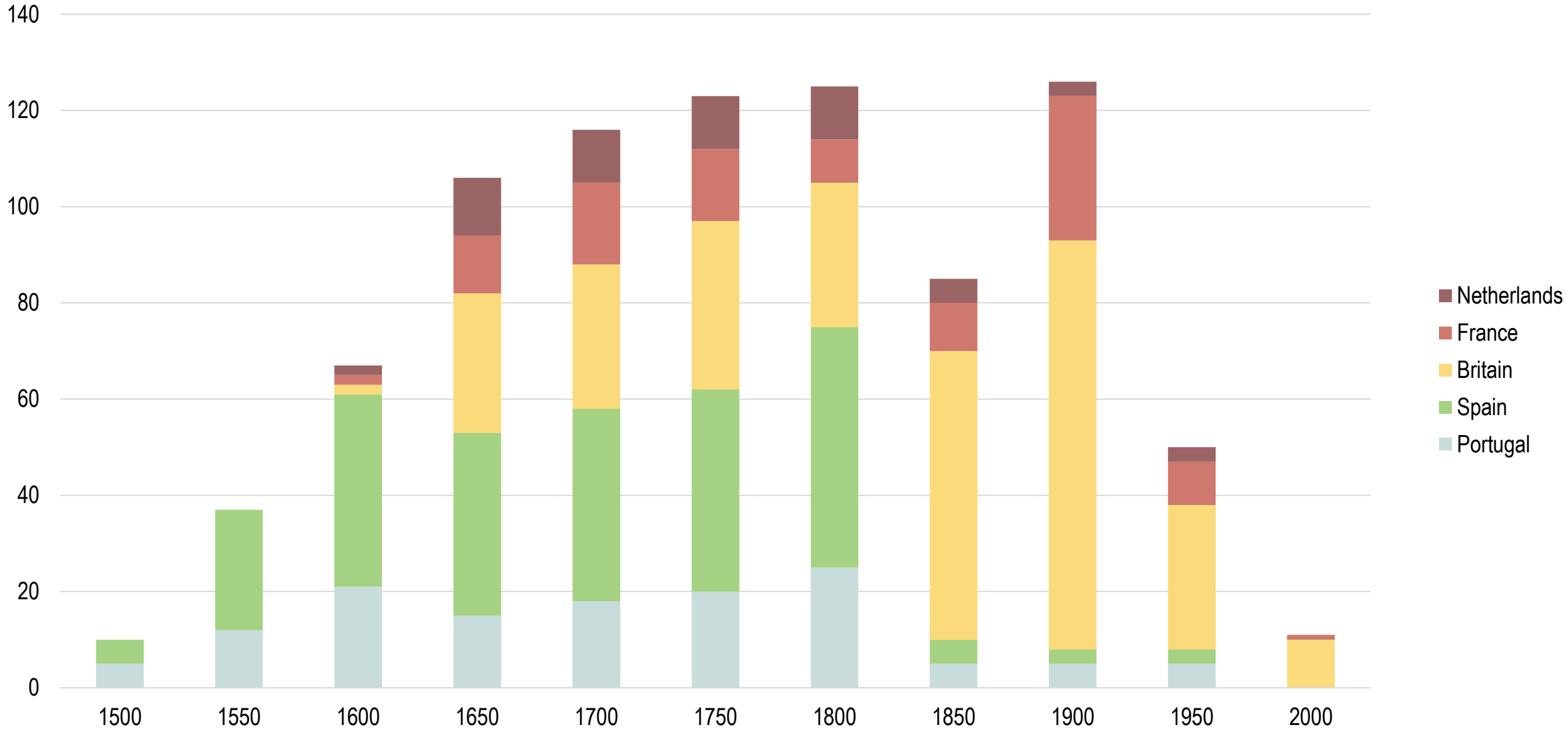
# Global Telegraph System, c1901 (the Victorian Internet)



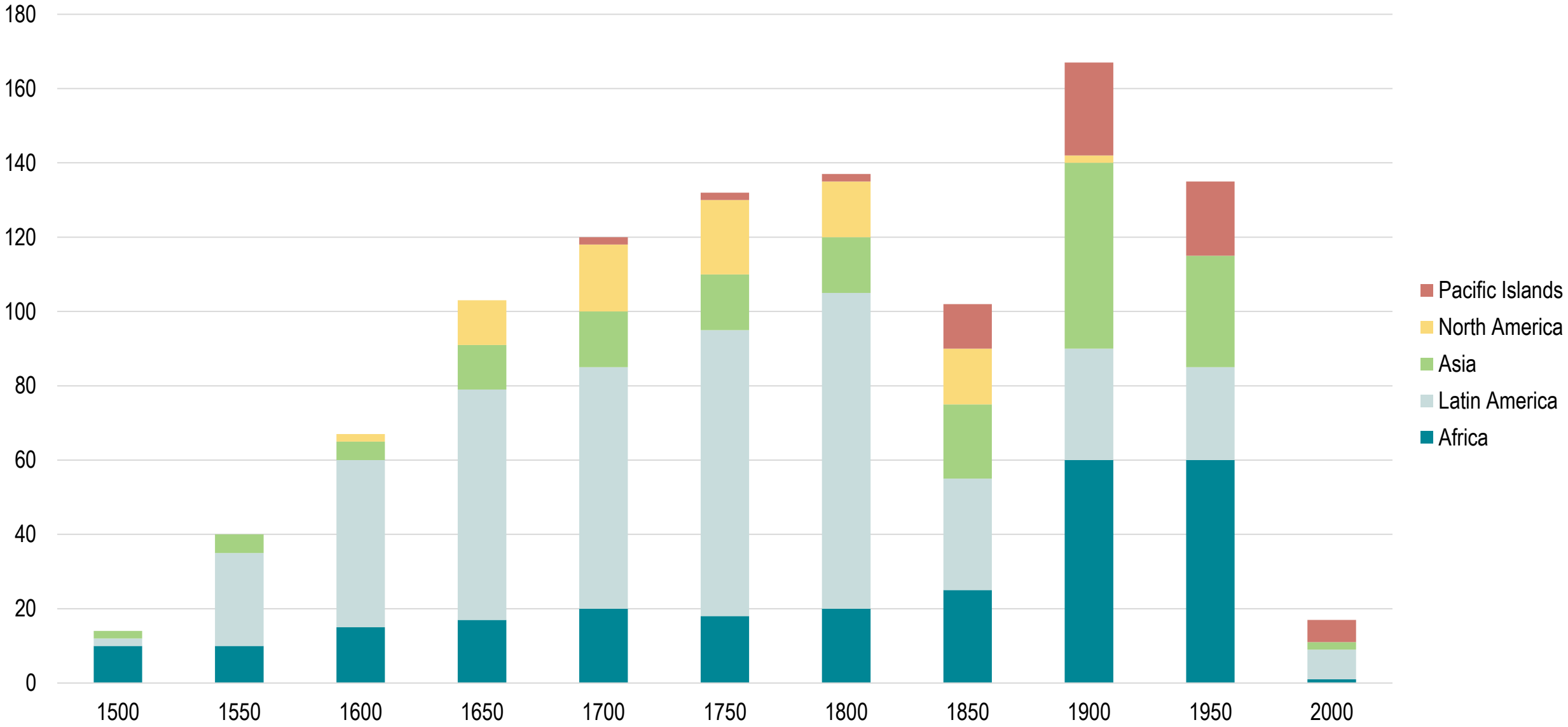
# European Control of the World, 1500-1950

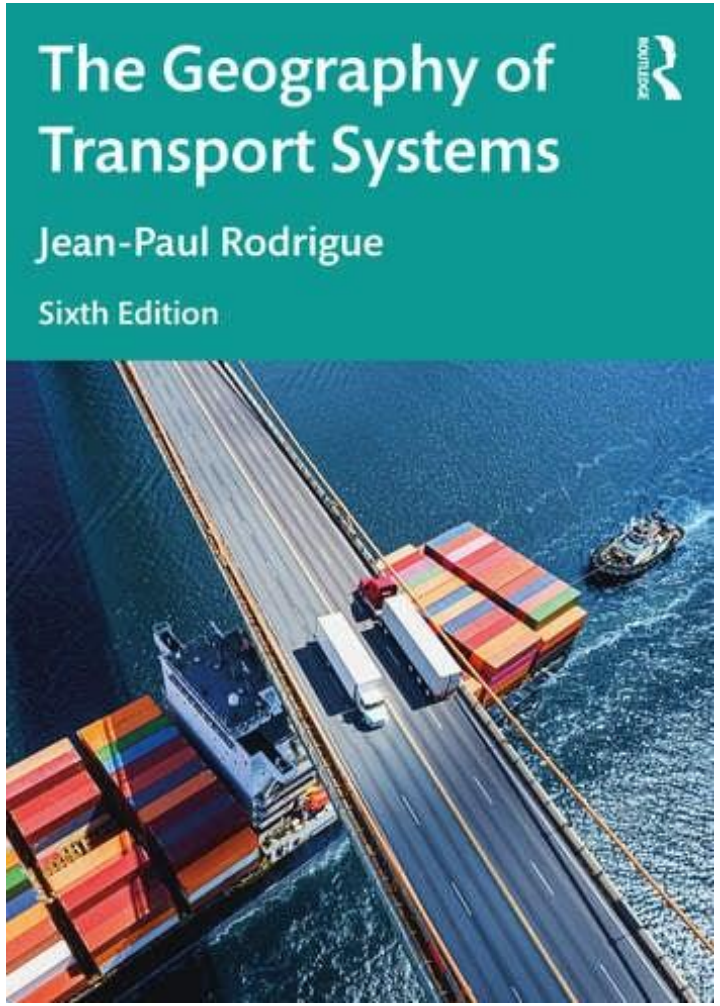


# Colonies Controlled by Main Colonial Powers, 1500-2000



# Colonies by Main World Region, 1500-2000

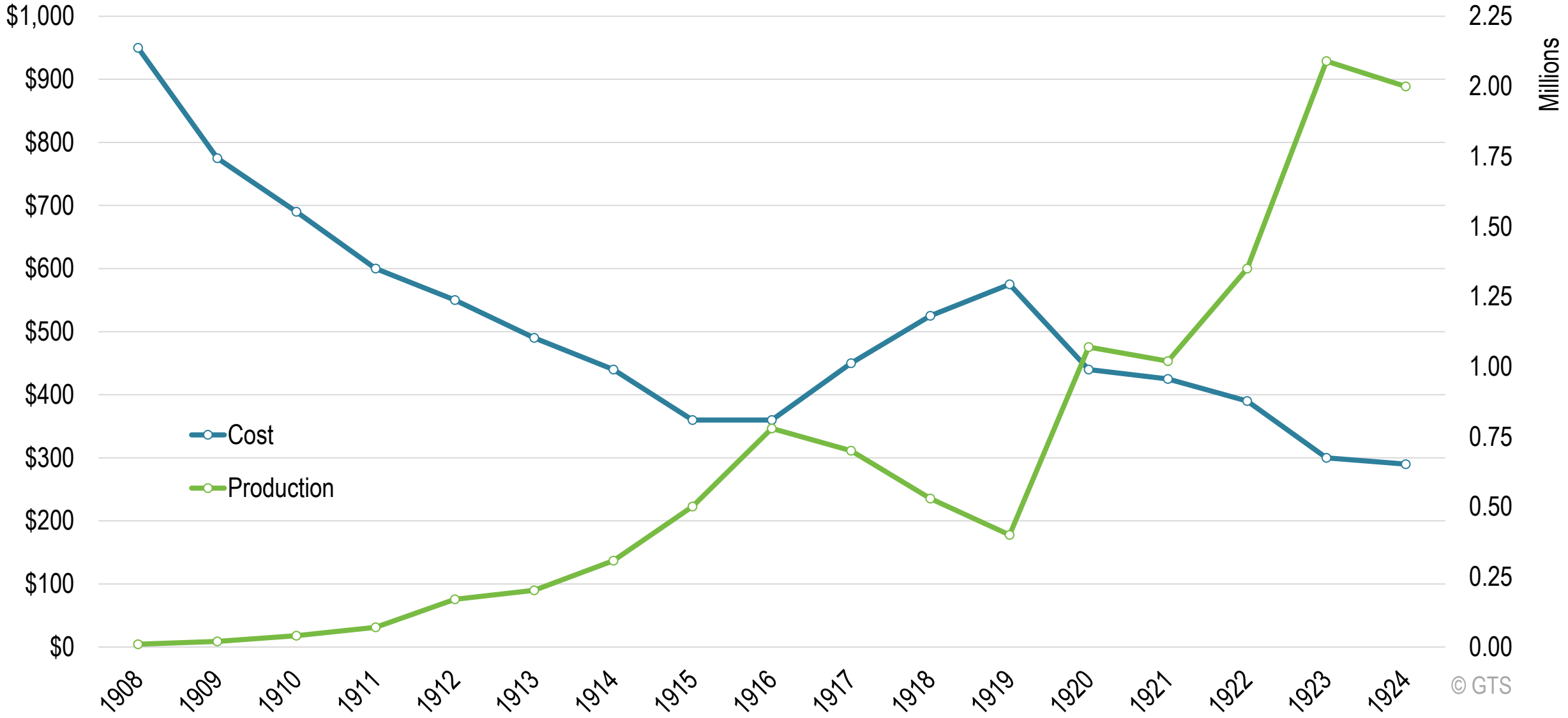





# The Setting of Global Transportation Systems

Chapter 1.3

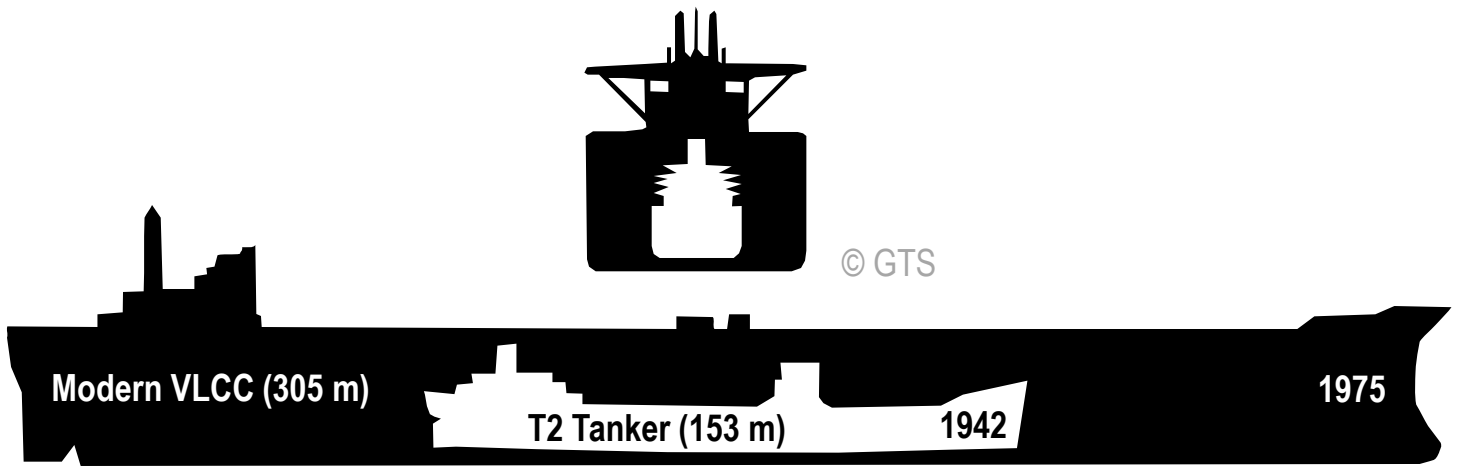
# Cost and Production of Ford Vehicles, 1908-1924



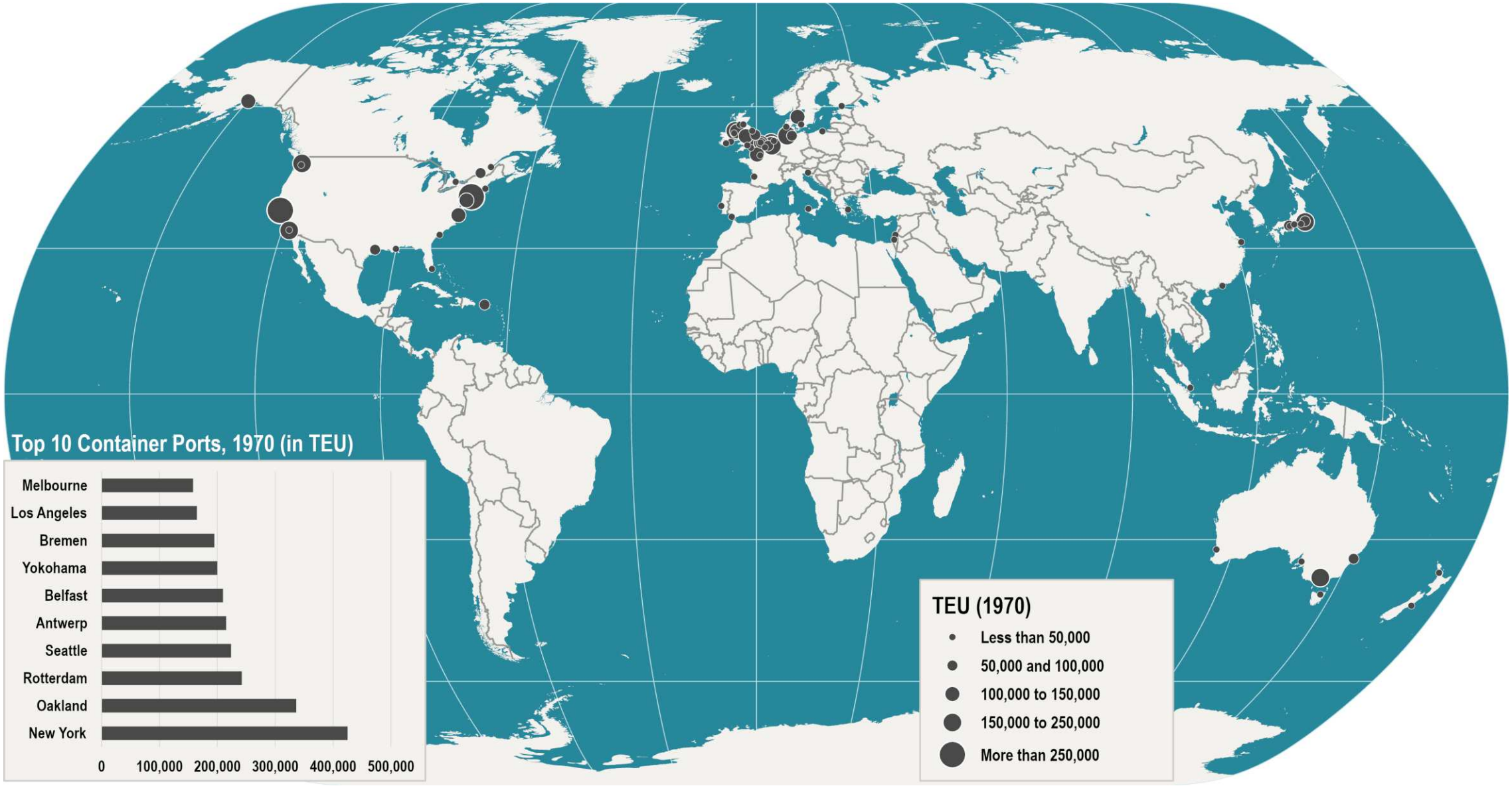
# United States Maritime Commission Cargo Ships, 1938-1947

| Type | Function | Period | # Constructed | Length (m) | Beam (m) | DWT |
|---|---|---|---|---|---|---|
| C-1 | Small cargo | 1940-45 | 173 | 127 | 18 | 8,075 |
| C-2 | General cargo | 1938-45 | 173 | 140 | 19 | 8,794 |
| C-3 | General cargo | 1940-47 | 465 | 150 | 21 | 12,500 |
| C-4 | General cargo; Troop ship | 1941-46 | 75 | 159 | 22 | 6,100 |
| EC-2 | Emergency cargo; Liberty ship | 1941-45 | 2,720 | 134 | 17 | 10,419 |
| VC-2 | General cargo; Victory ship | 1944-46 | 534 | 138 | 19 | 10,734 |
| T2 | Tanker | 1940-45 | 536 | 160 | 21 | 16,400 |
| T3 | Tanker | 1939-46 | 63 | 159 | 23 | 18,400 |

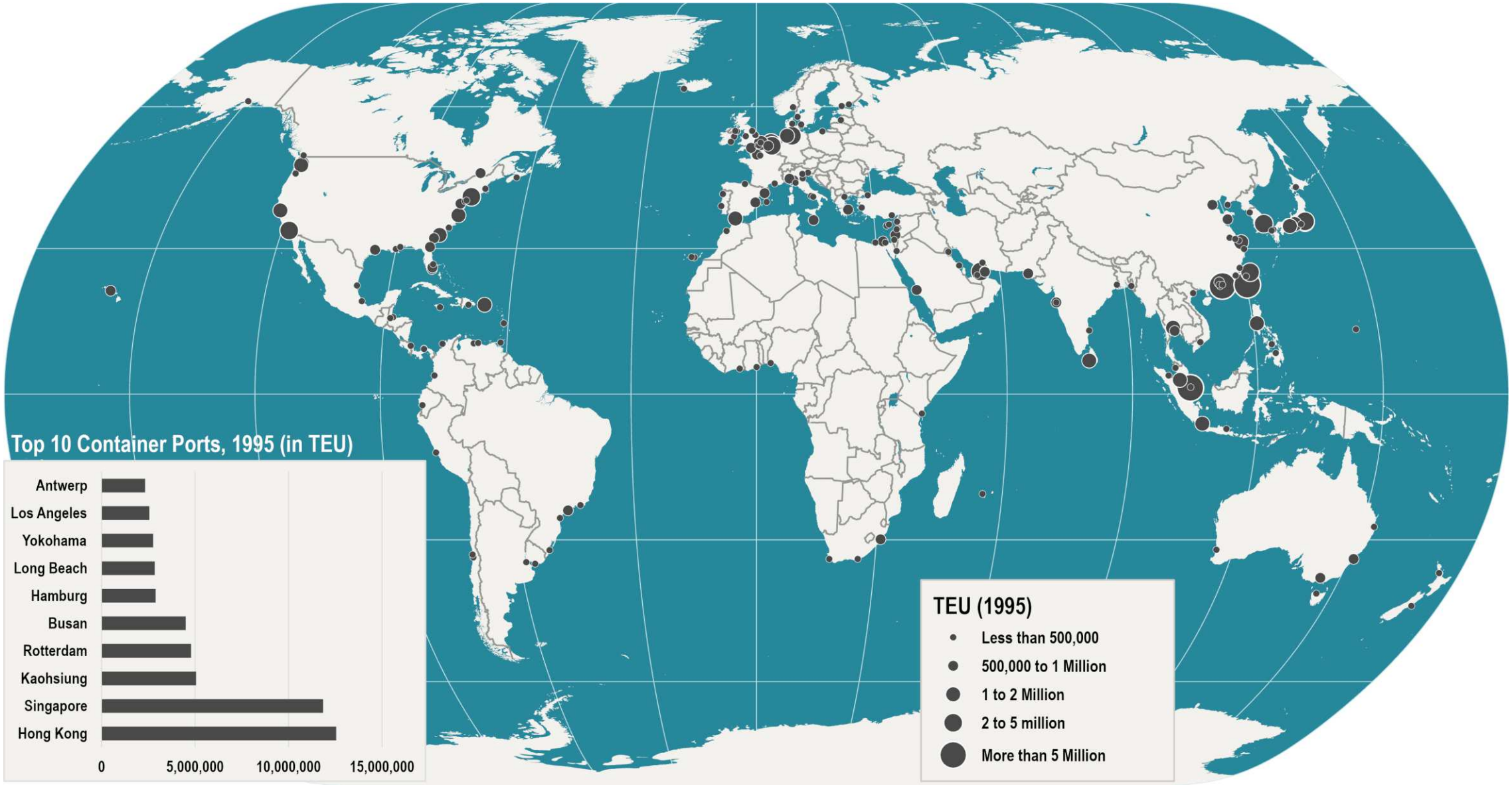
# Comparison between a Contemporary and Second World War Tanker



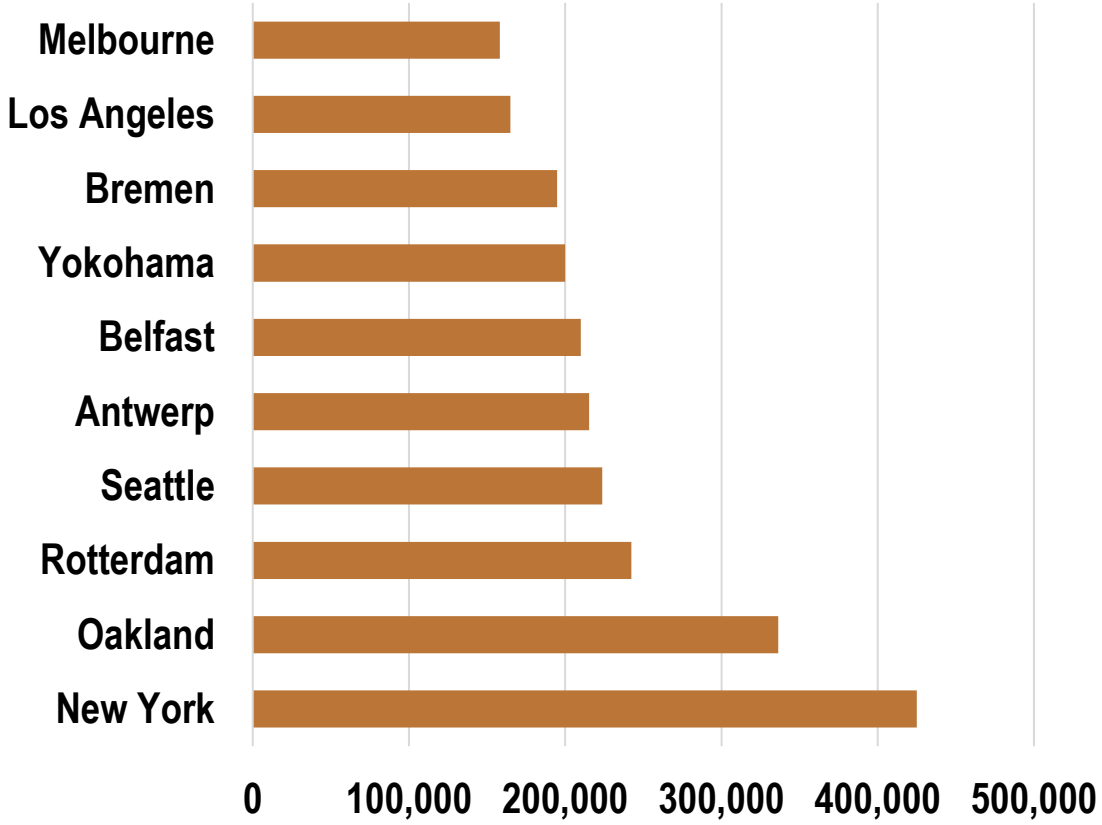
# The Dawn of Containerization: 1970

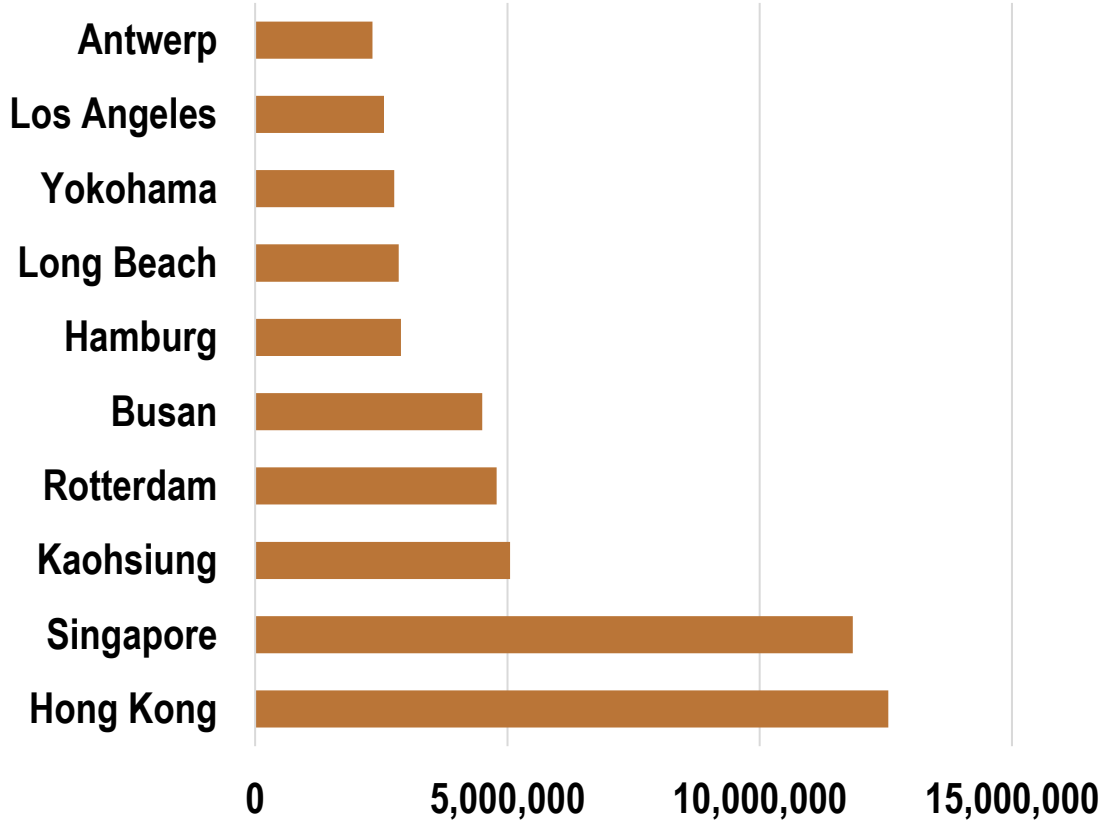


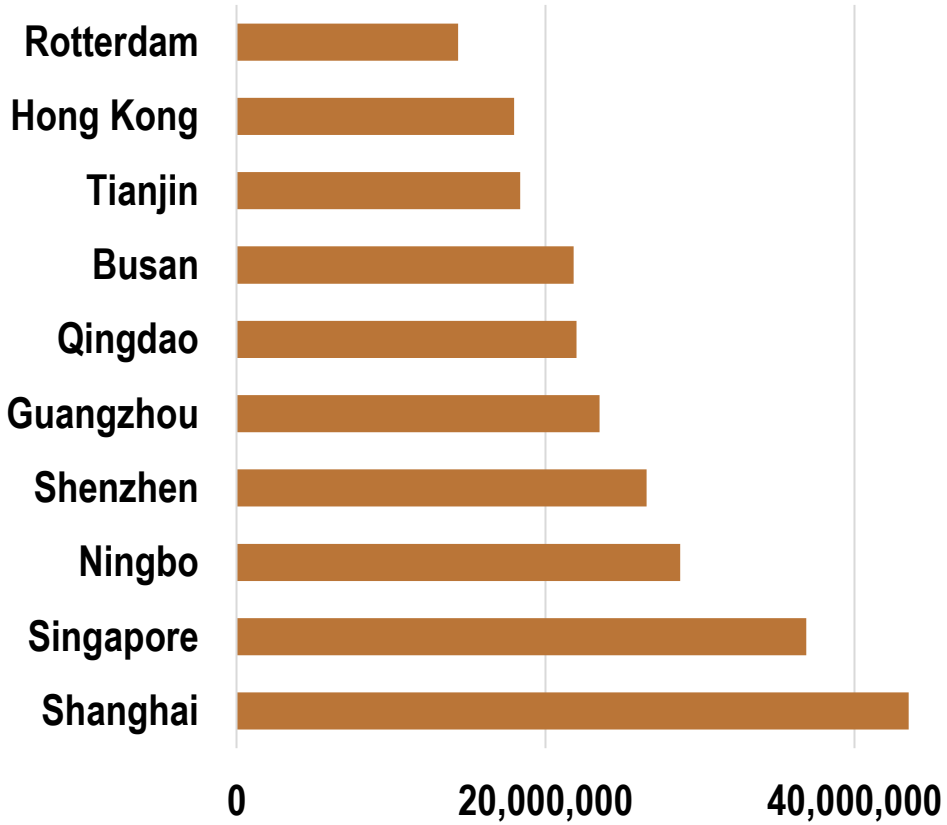
# Containerization Coming to Age: 1995



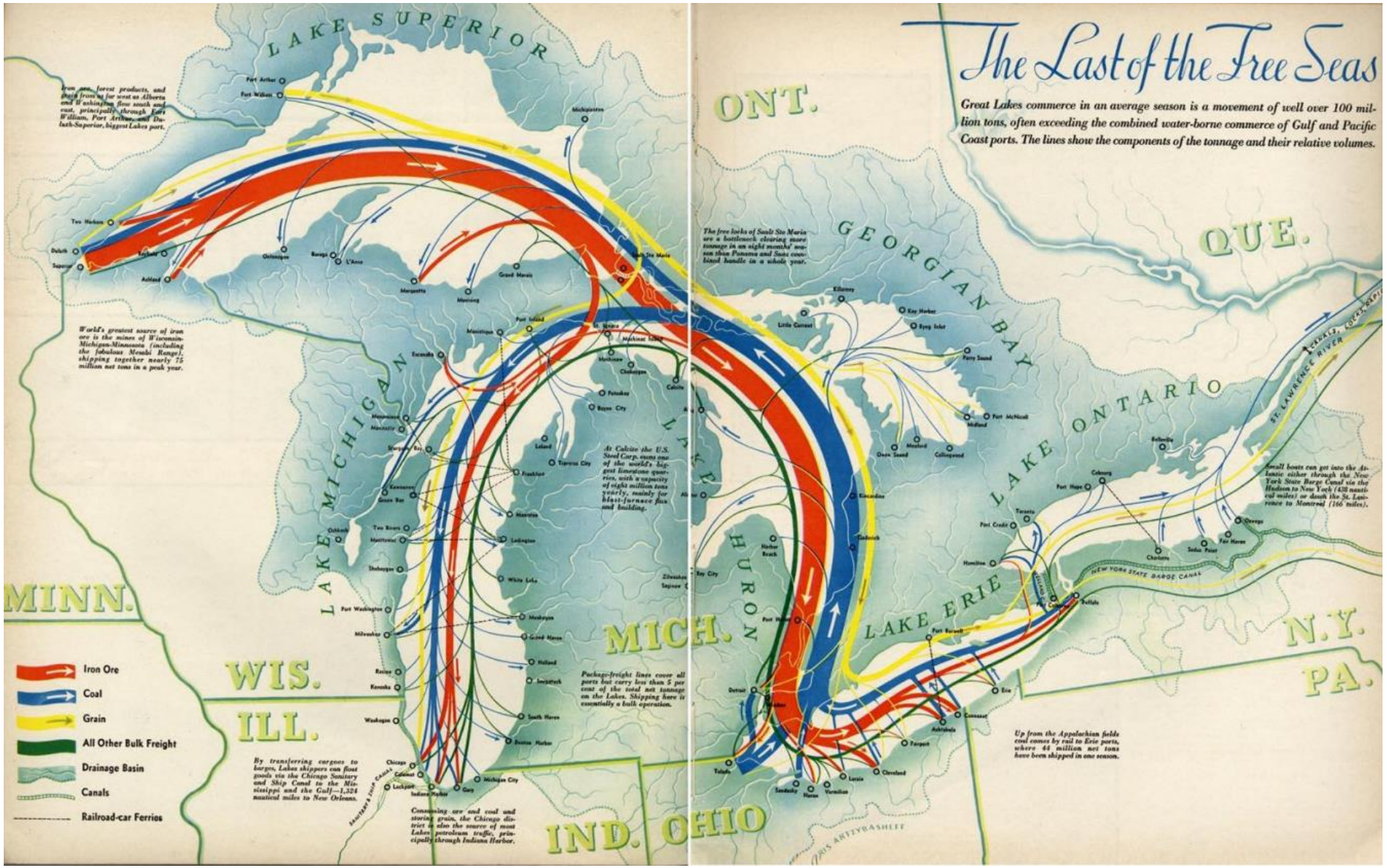
# Peak Containerization: 2020



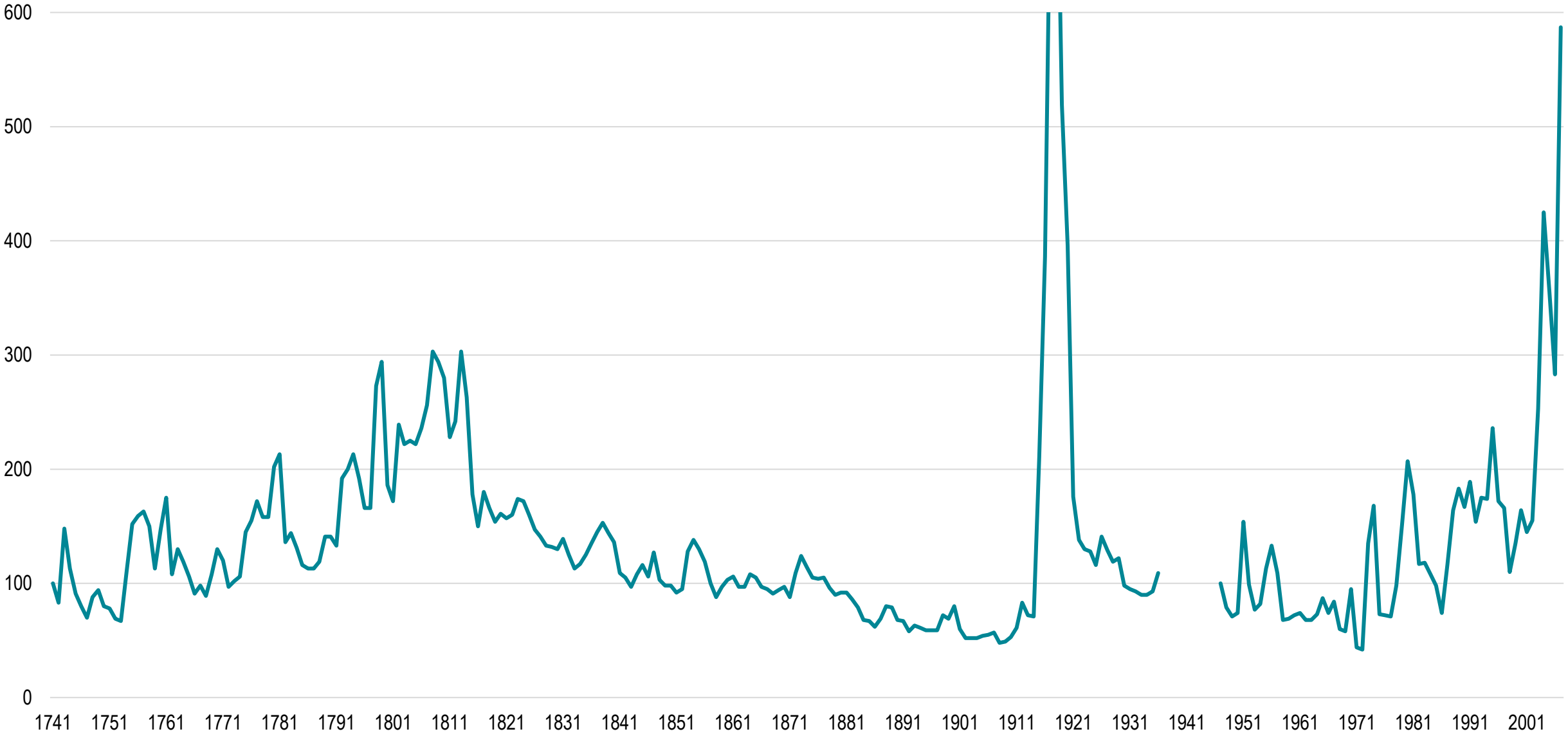





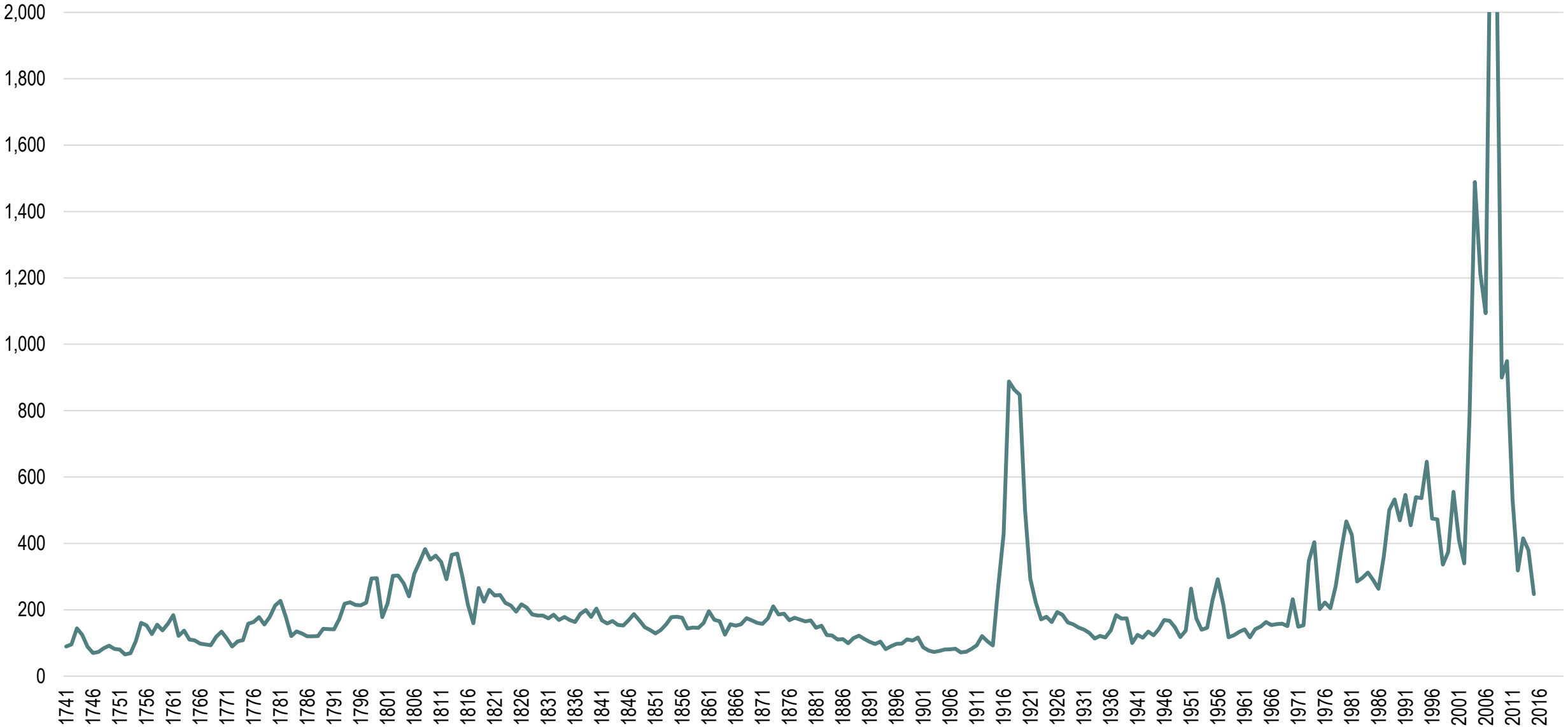
# Major Commodity Flows over the Great Lakes, 1940



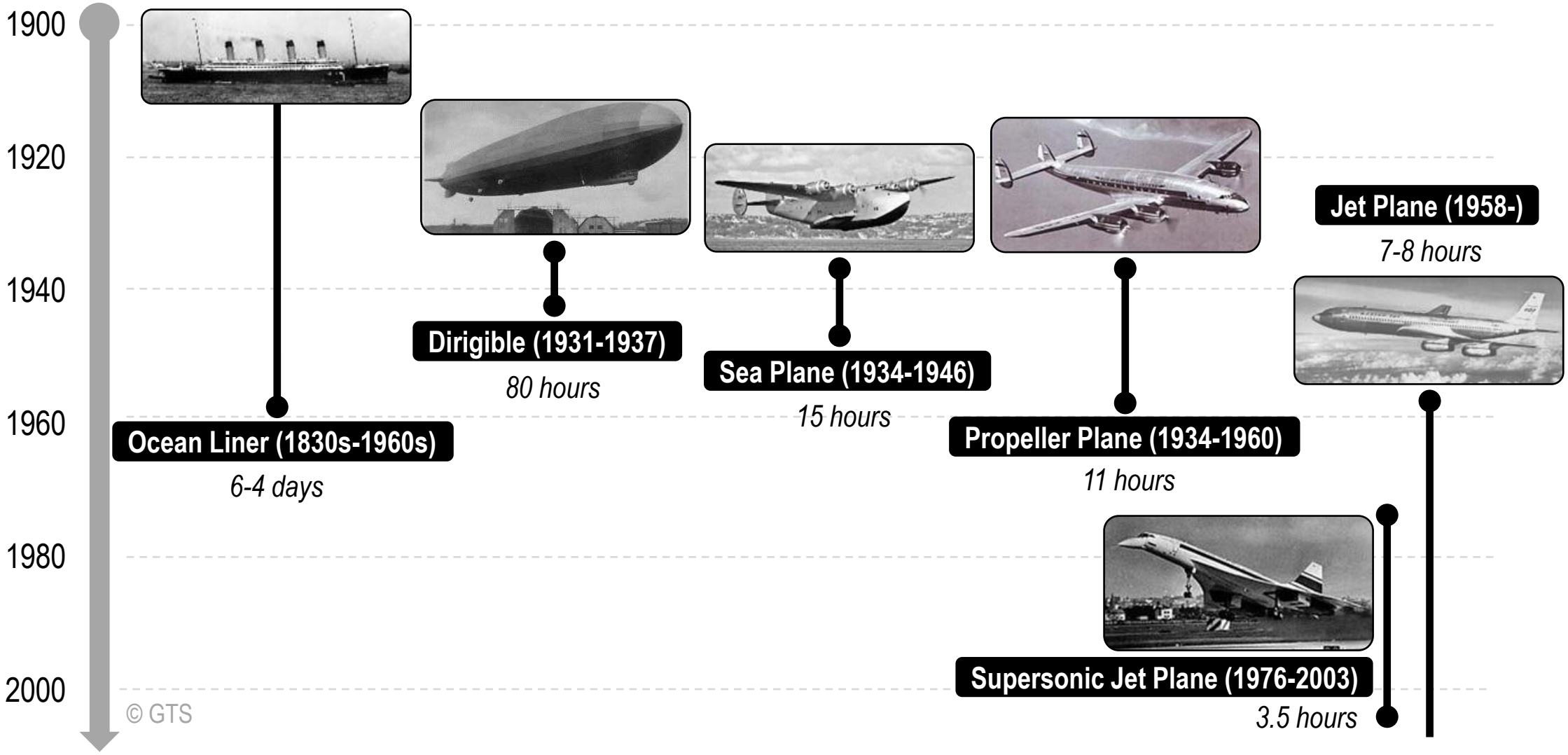
# Maritime Economics Freight Index, 1741-2007



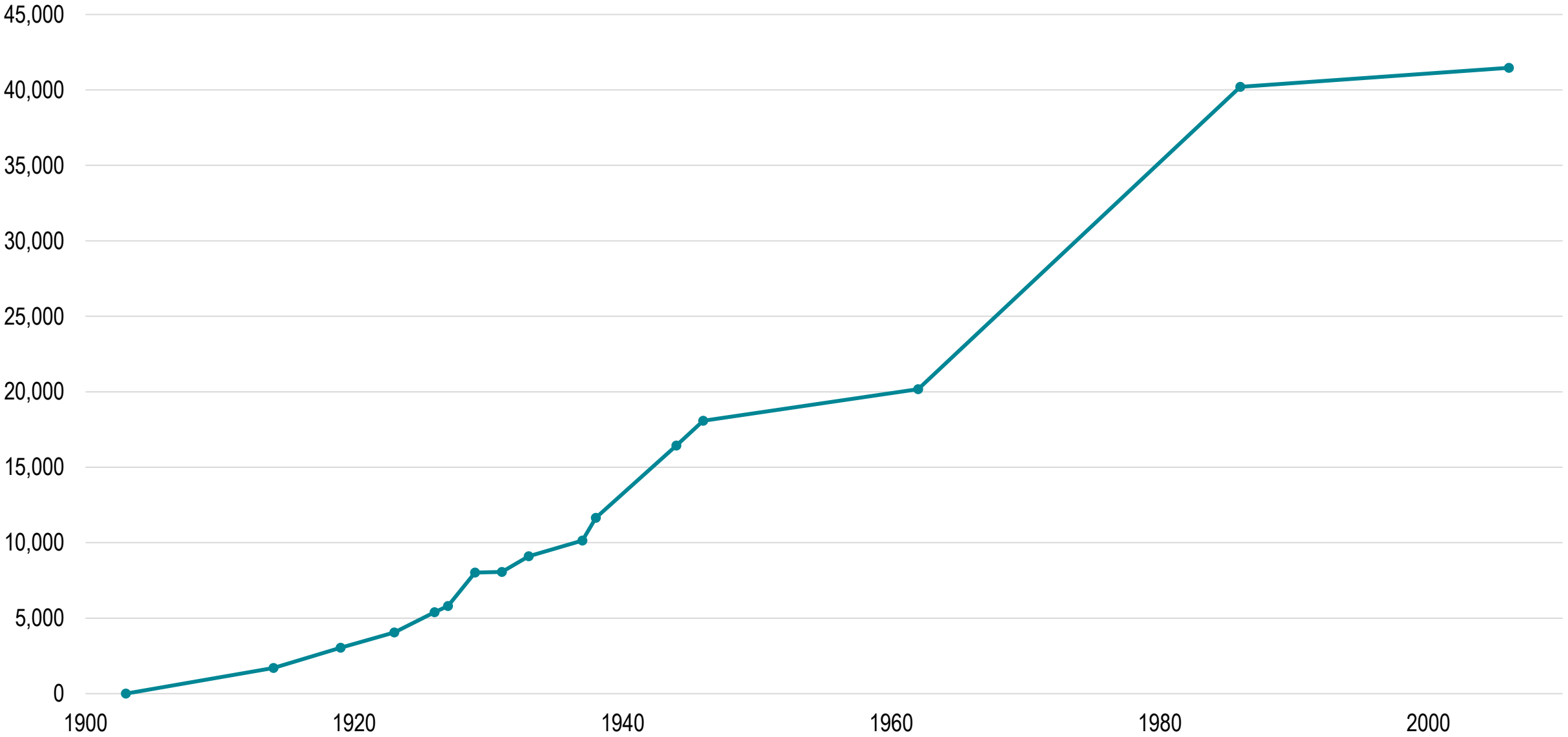
# Long Term Freight Market Index (LFI), 1741-2015



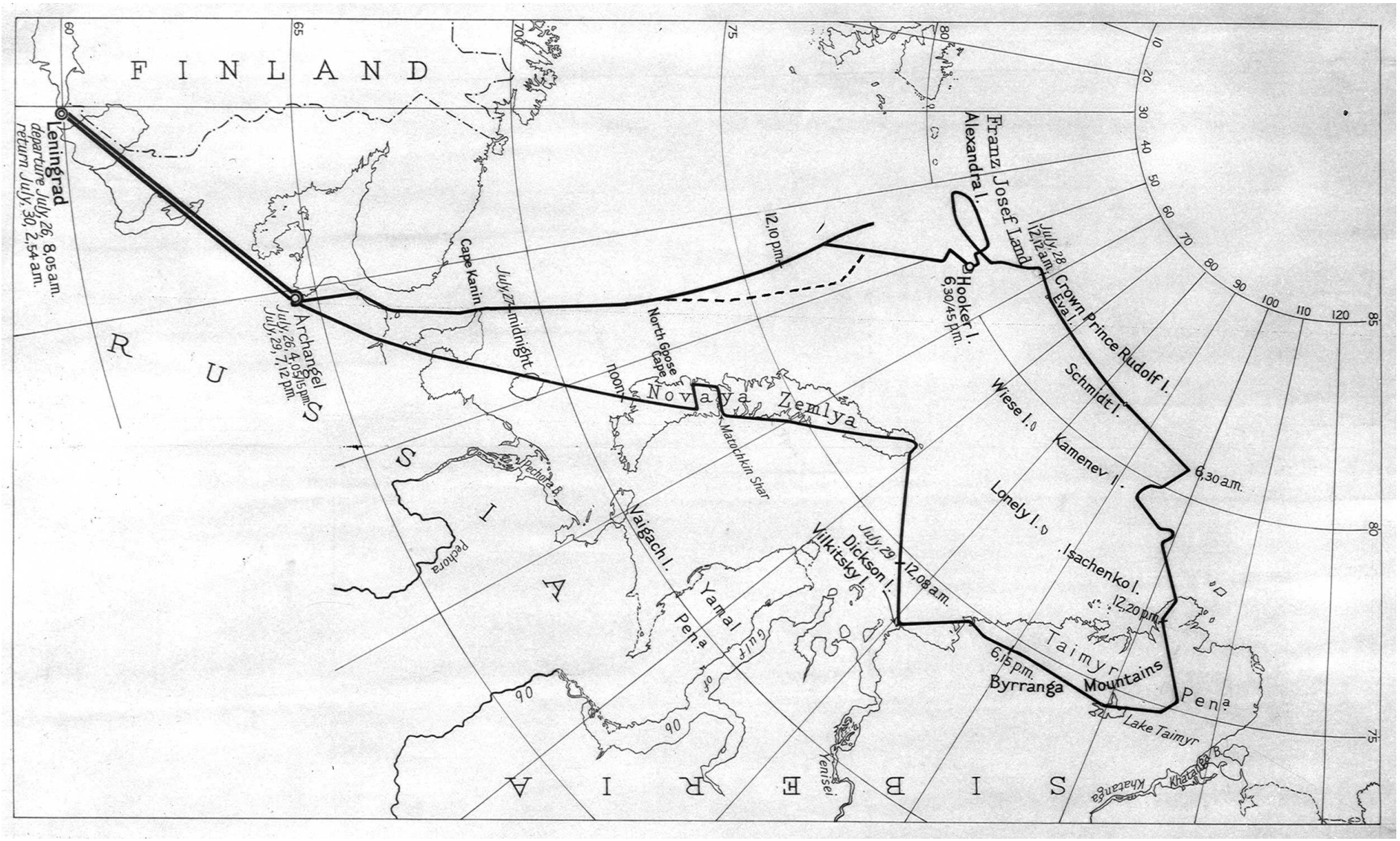
# Evolution of Powered Transatlantic Passenger Modes



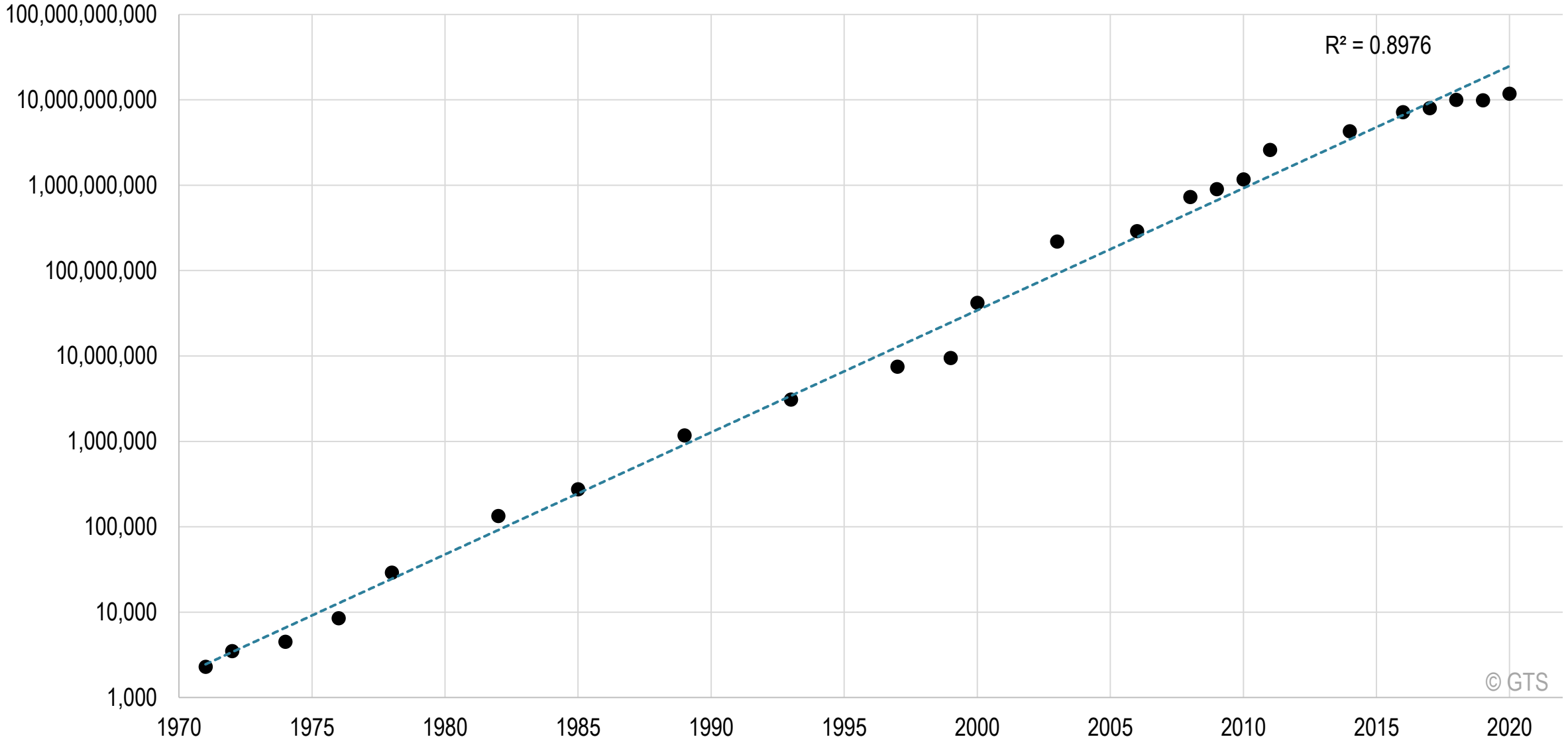
# Longest Non-Commercial Flight Distance (in km)



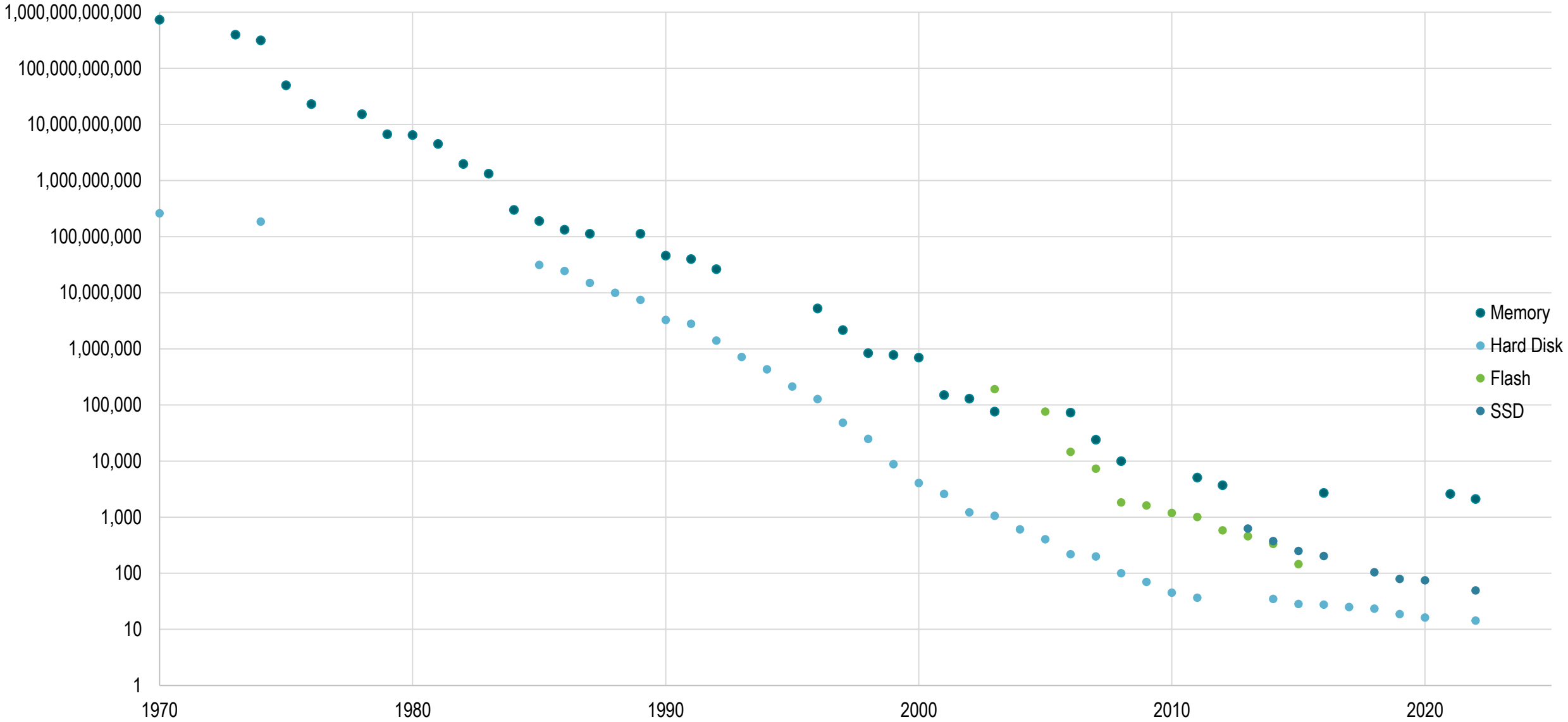
# Route of the Graf Zeppelin into the Arctic (1931)



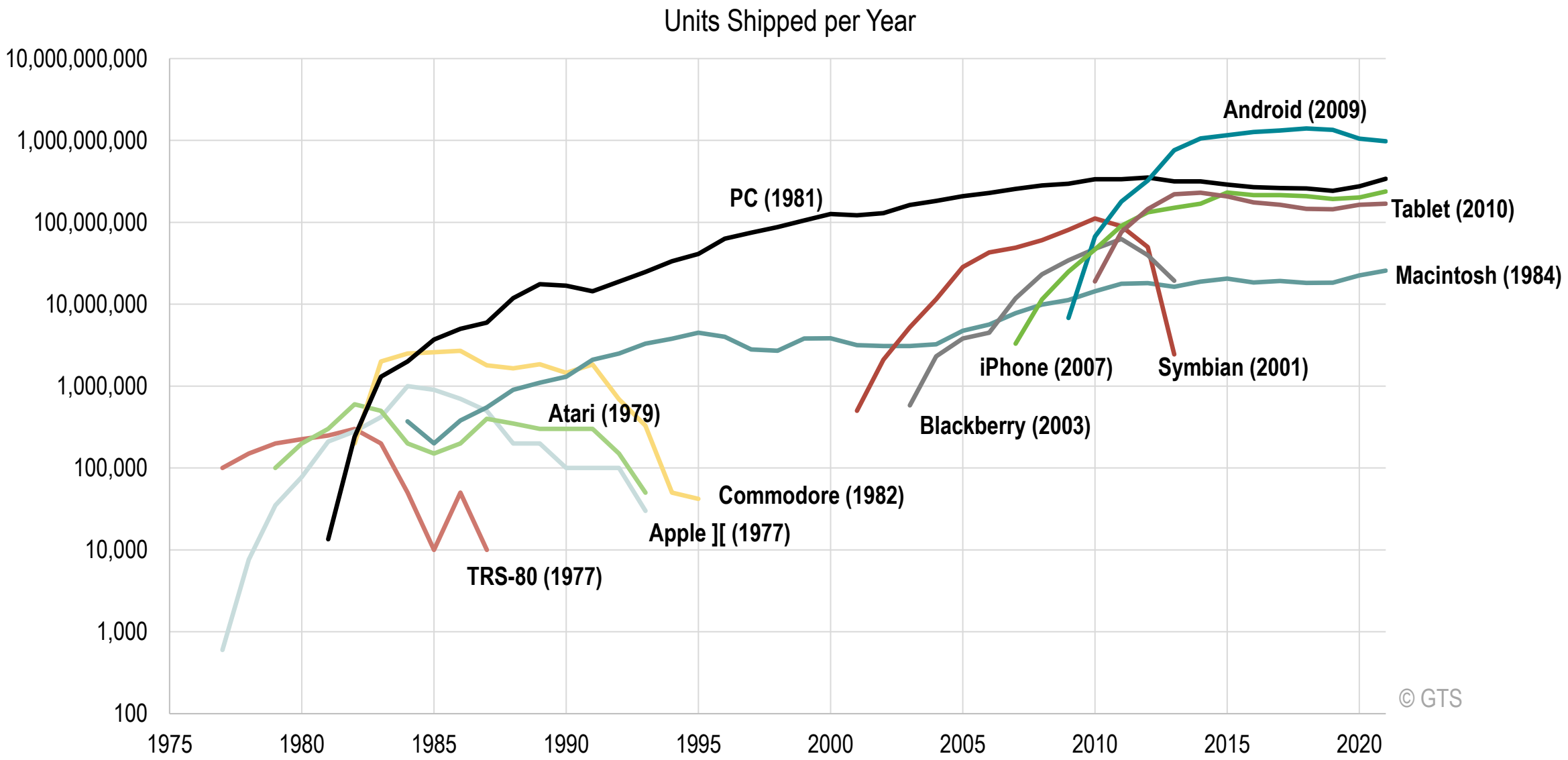
# Moore’s Law: Transistors per Microprocessor, 1971-2022



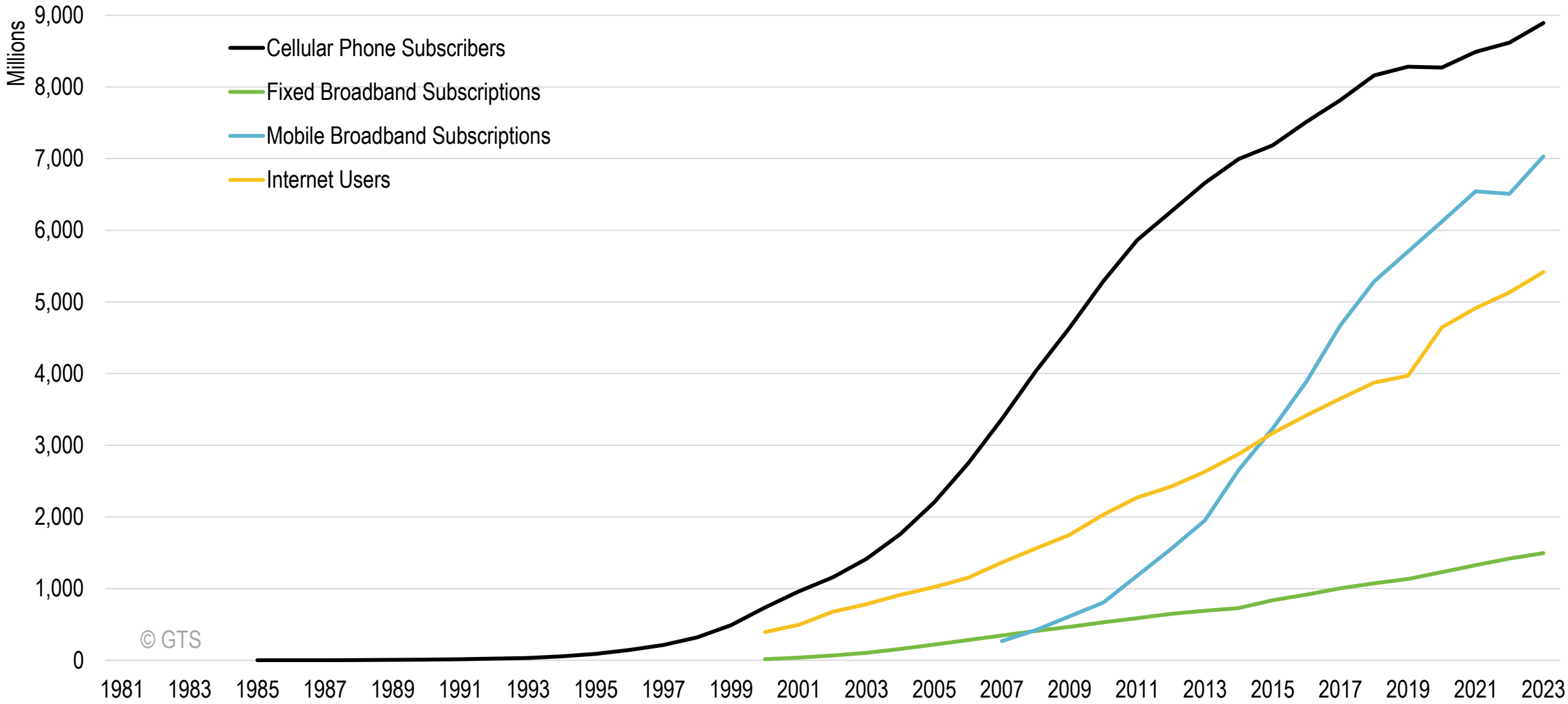
# Computer Storage Space, 1970-2022 (Dollars per Gigabyte)



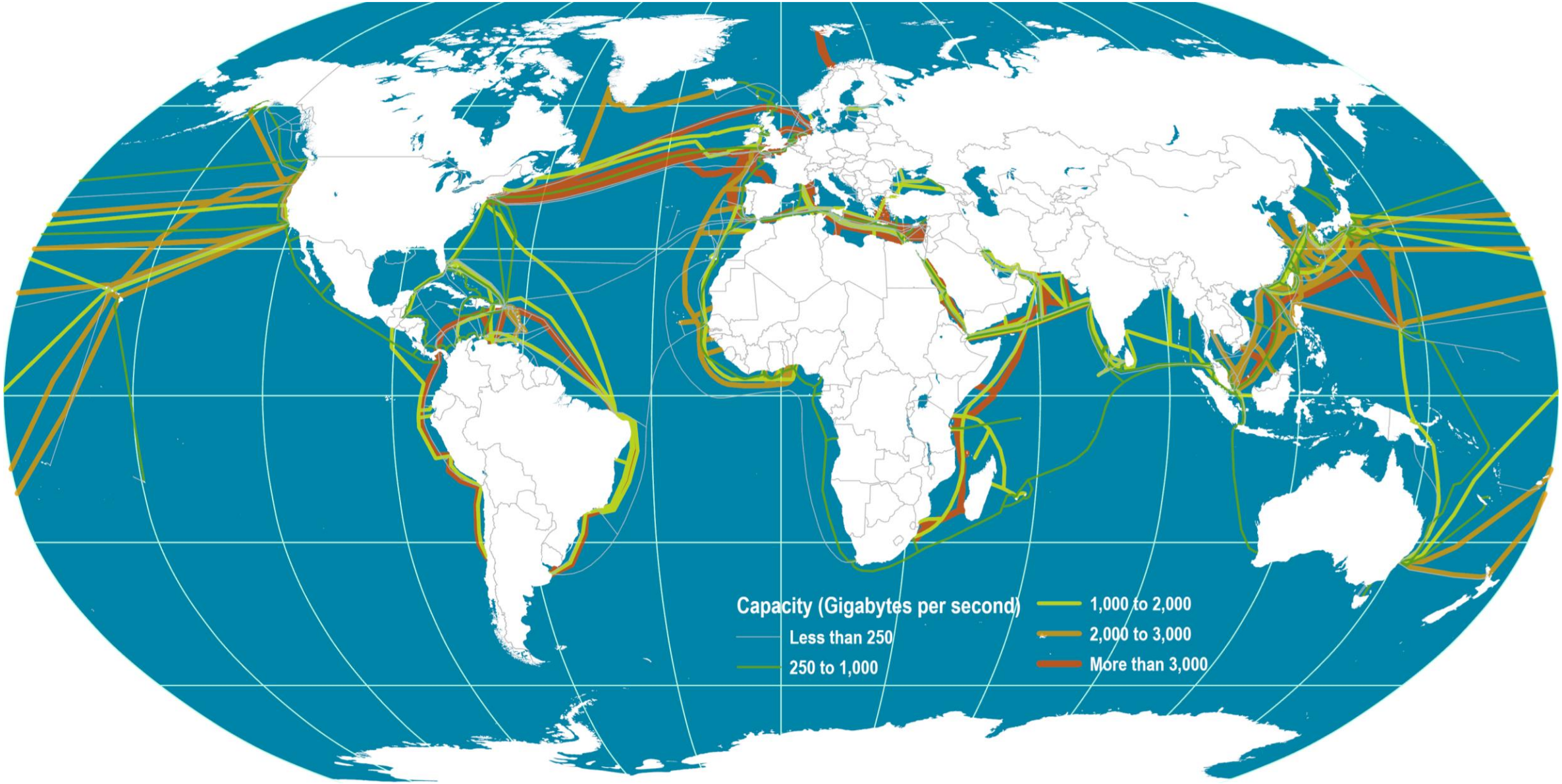
# Diffusion of Personal Computing Devices, 1977-2021



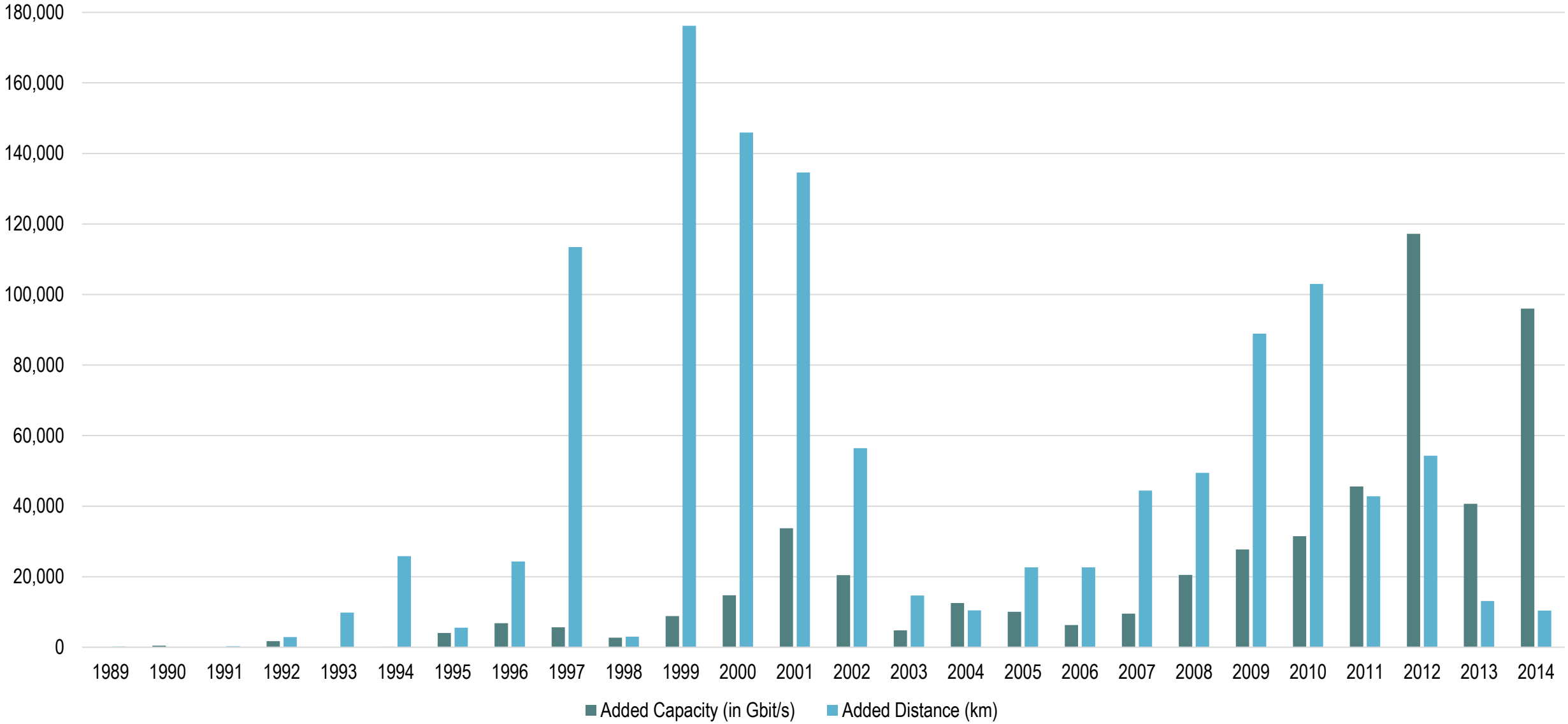
# Diffusion of Telecommunication Services, 1985-2023



# Global Submarine Cable Network



# Annual Oceanic Cable Capacity Increase, 1989-2014



# Some Long Distance Travel Costs

| Link | Cost in Dollars (Current 2005 Dollars) |
|---|---|
| Transatlantic steamship (1880s) | $35 to $100 ($1,000 to $3,000) |
| Transcontinental rail (1880s) | $100 to $200 ($3,000 to $6,000) |
| Transcontinental rail (1940s) | $70 to $100 ($250 to $350) |
| Transcontinental air (1940s) | $300 ($3,600) |
| Transcontinental air (1960s) | $150 ($1,200) |
| Transcontinental air (2000s) | $600 |

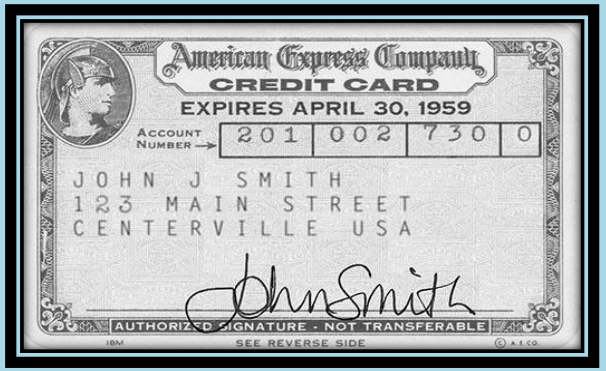
# Evolution of Mobility, United States, 1800-2000

| | Average ground travel speed | Average mobility | Per capita GDP |
|---|---|---|---|
| 1800 | 3 mph | 1,500 miles per year | $1,200 |
| 1850 | 4 mph | 1,600 miles per year | $1,900 |
| 1900 | 8 mph | 2,000 miles per year | $5,000 |
| 1950 | 23 mph | 6,900 miles per year | $12,000 |
| 2000 | 34 mph | 18,000 miles per year | $35,000 |

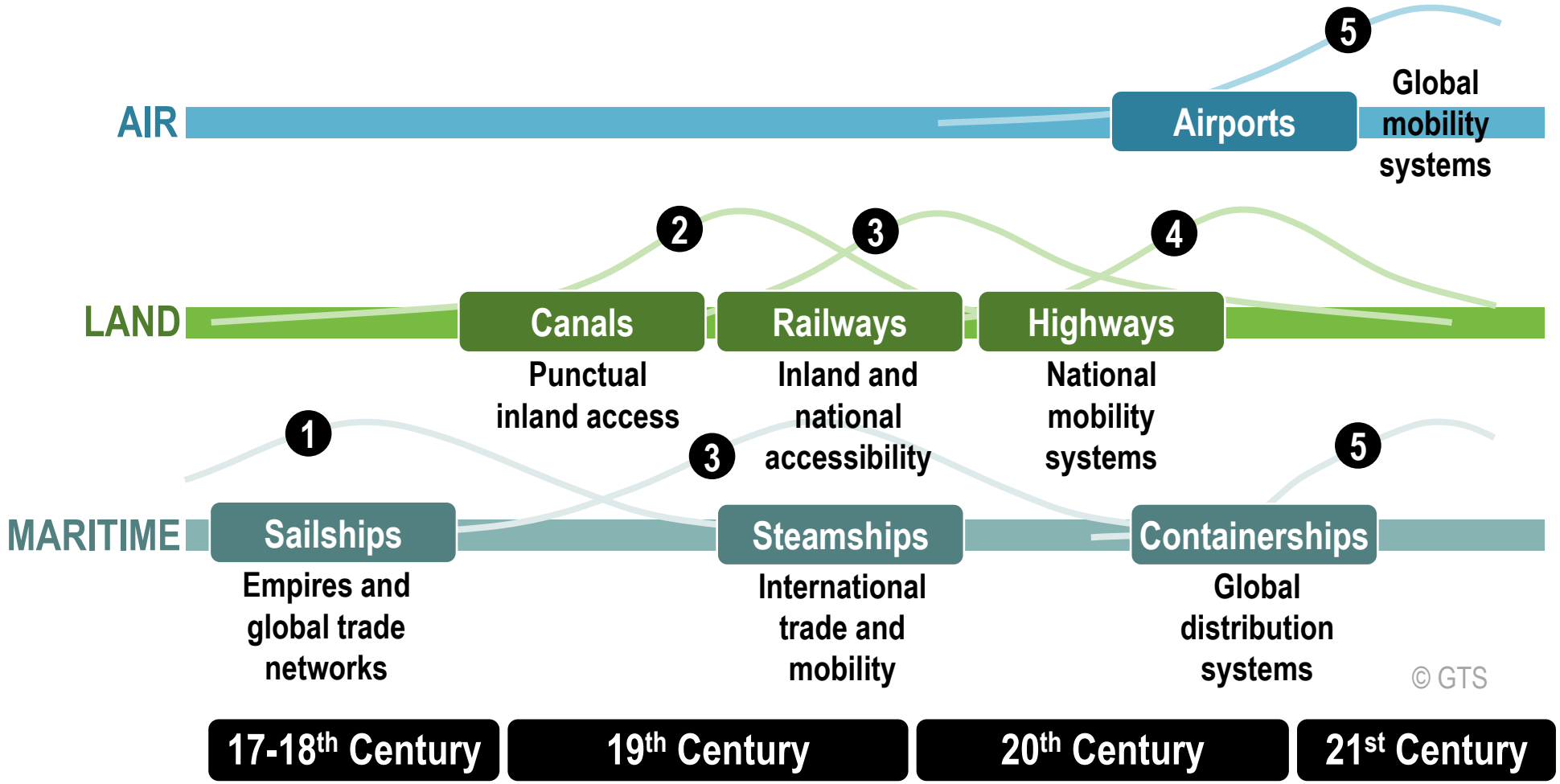
# Some Impacts of Early Containerization

| | Pre-Containerization (1965) | Post-Containerization (1970-71) |
|---|---|---|
| Dock labor productivity | 1.7 tons per hour | 30 tons per hour |
| Port concentration (loading ports servicing Europe/Australia trade) | 11 ports | 3 ports |
| Insurance costs (Australia / Europe imports) | £0.24 per ton | £0.04 per ton |
| Inventory holding costs (Hamburg/Sydney) | £2 per ton | £1 per ton |

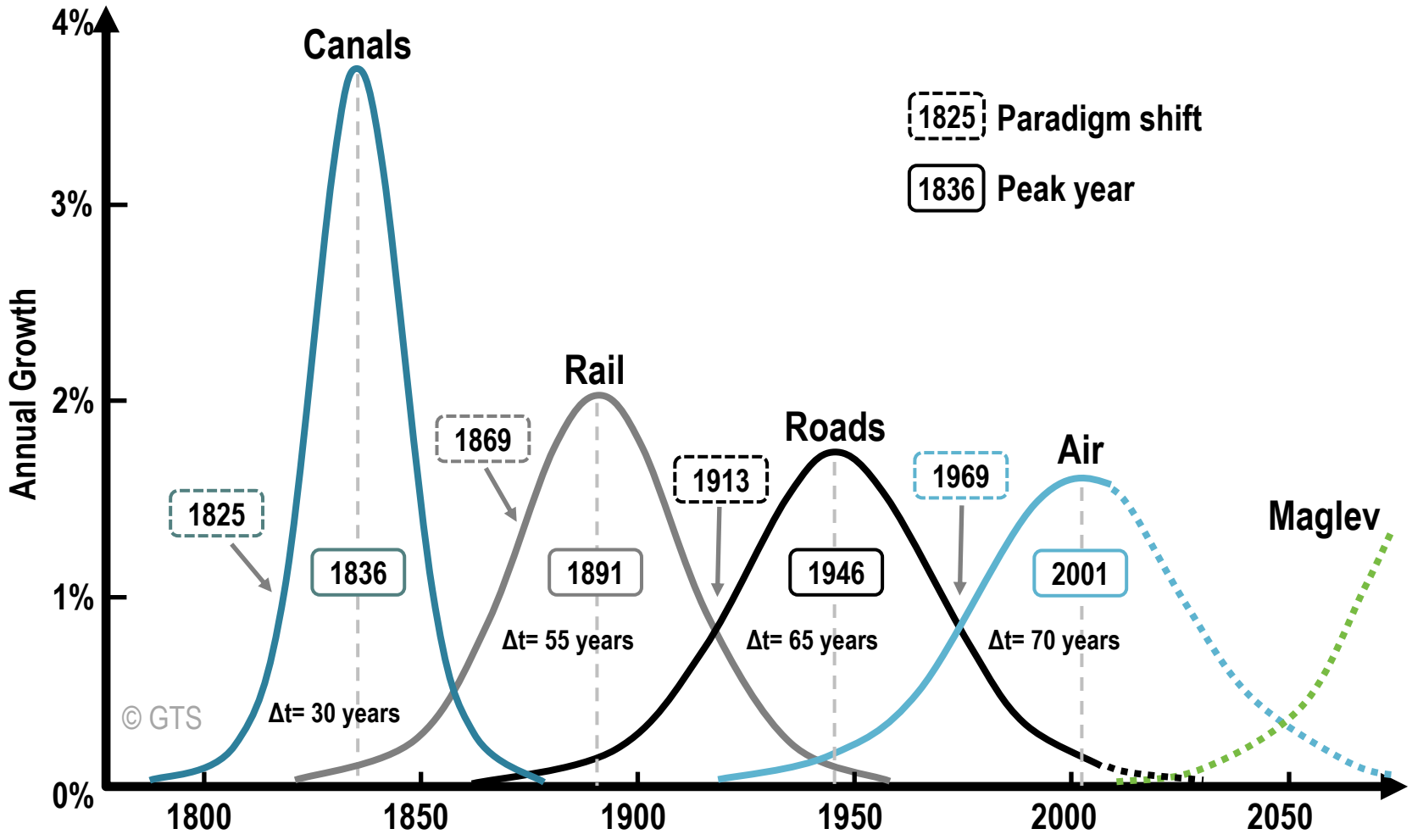
# Corporate Adaptation to Transport Innovations: American Express and Wells Fargo

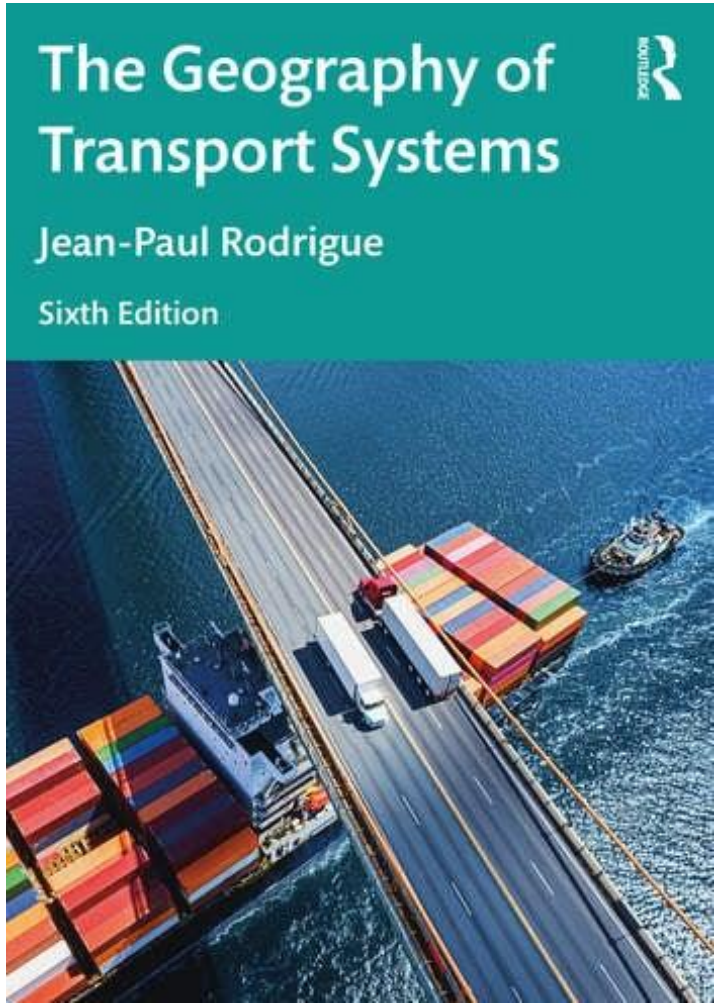
| | Interstate Wagon Services | Rail Services | Financial Services |
|---|---|---|---|
| American Express |  |  |  |
| | 1850: Established in Buffalo, NY | 1883: Express trains<br>1918: Exiting the express business | 1857: Money orders<br>1891: Traveler's cheques<br>1958: Credit cards |
| Wells Fargo |  |  |  |
| | 1852: Established in San Francisco, CA<br>1866: Stagecoach services | 1888: Express trains | 1905: Wells Fargo Bank<br>1967: Credit cards<br>1995: Web banking accounts |

# Cumulative Waves of Transport Development



# Growth of the US Transport System, 19th - 21st Century



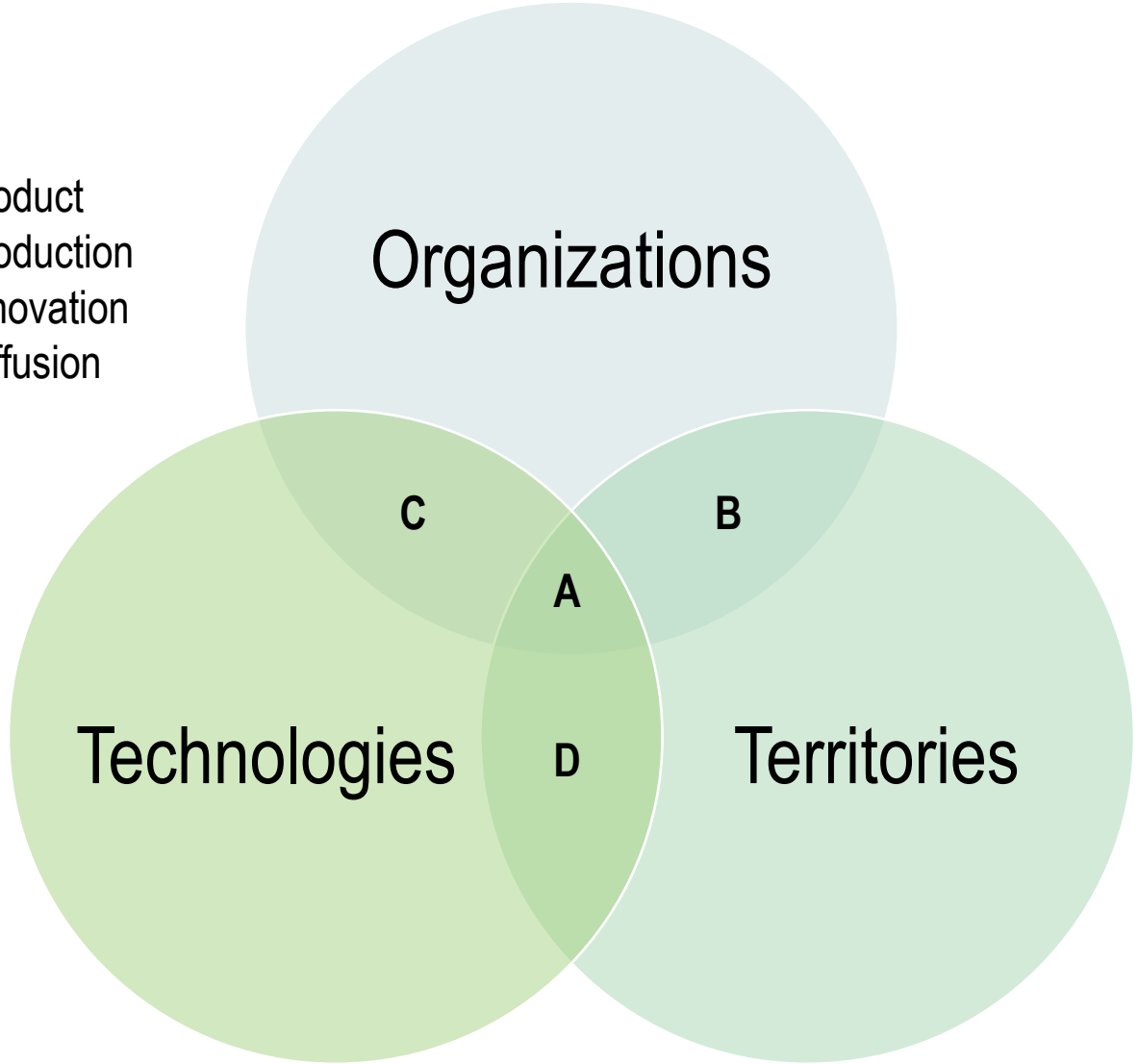



# Transportation and Commercial Geography

Chapter 1.4

# Dimensions of Economic Geography

A: Product
B: Production
C: Innovation
D: Diffusion

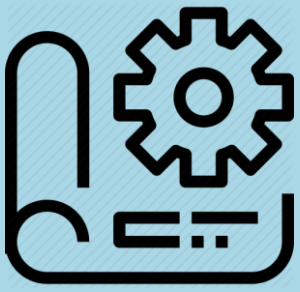


# The Drivers of Trade and Globalization

## INTEGRATION

- Regulatory chains.
- Harmonization of regulatory regimes.
- Trade agreements.

## PRODUCTION



- Supply / value chains.
- Offshoring.
- Global production networks.

## TRANSPORTATION

- Transport chains.
- Containerization.
- Transborder transportation.

## TRANSACTIONS

- Information chains (ICT).
- Investment capital.
- Credit for transactions.

## STANDARDS

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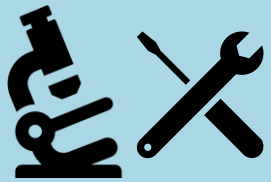
Measures, voltage, telecommunications, containers, currencies

# Globalization as a Driver of Added Value



**RESEARCH AND DEVELOPMENT**

Finding better products and processes through innovation.

**INPUT COSTS**

Using the advantages of locations (land, labor, capital, resources).

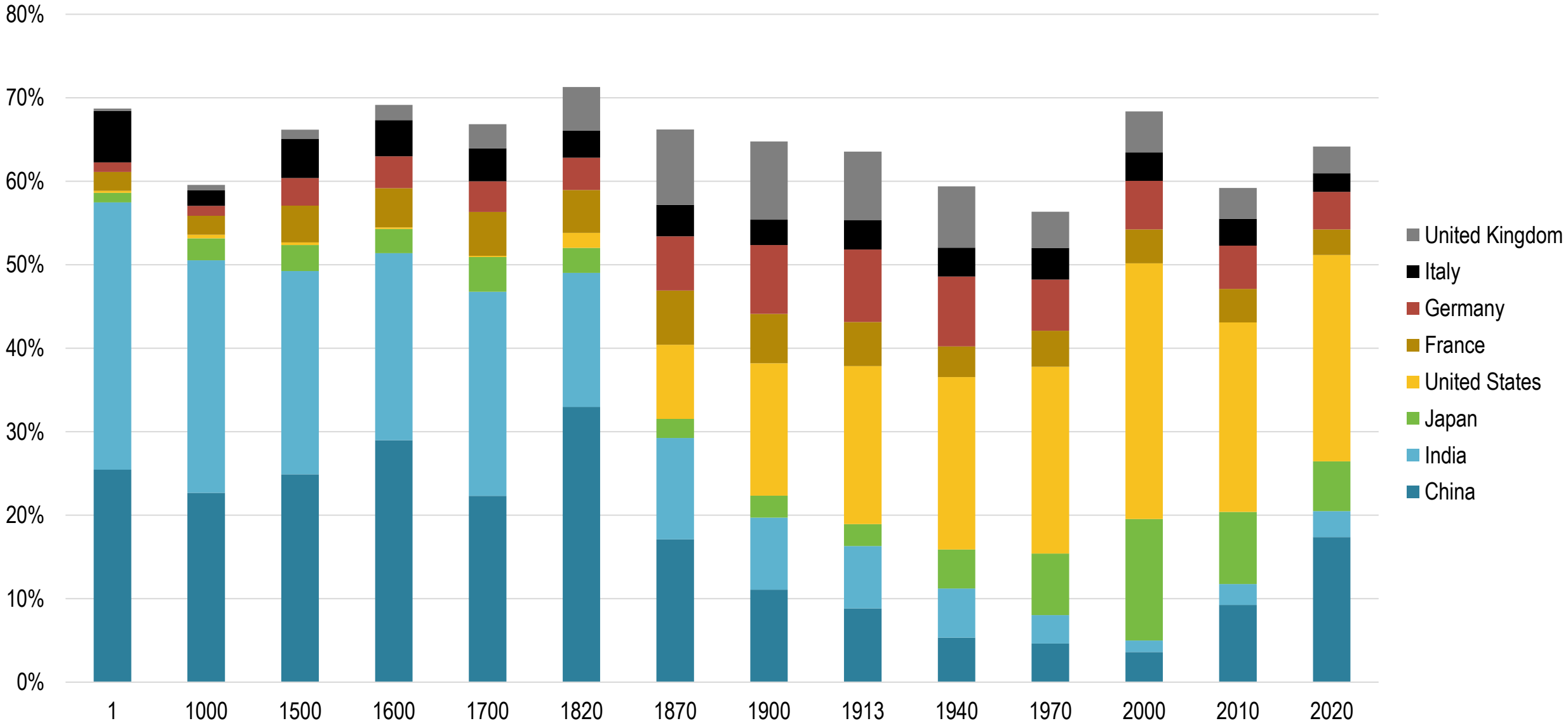
**TRANSPORTATION**

Effectively transporting and distributing resources, parts and finished goods.

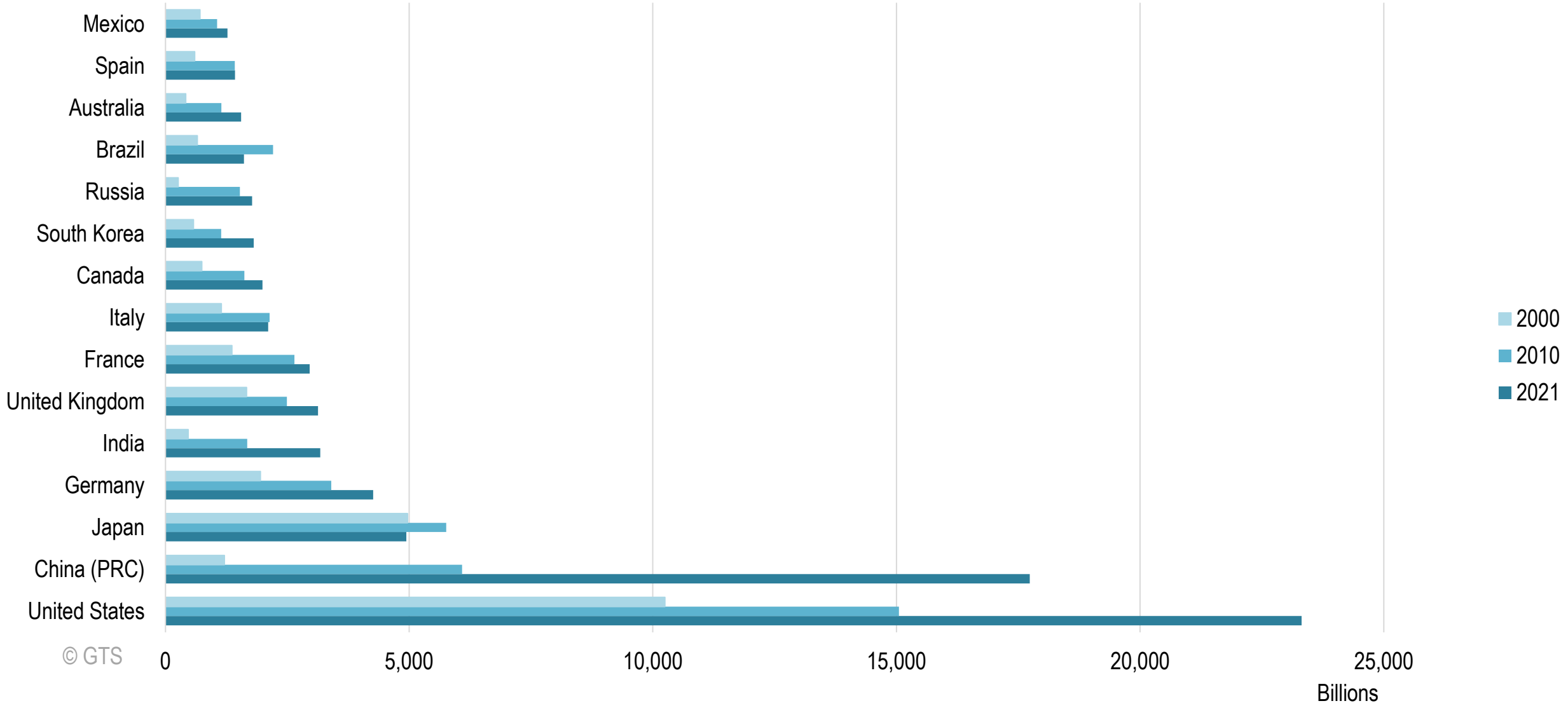
**SUSTAINABILITY**

Improving resource, environmental and energy efficiency.

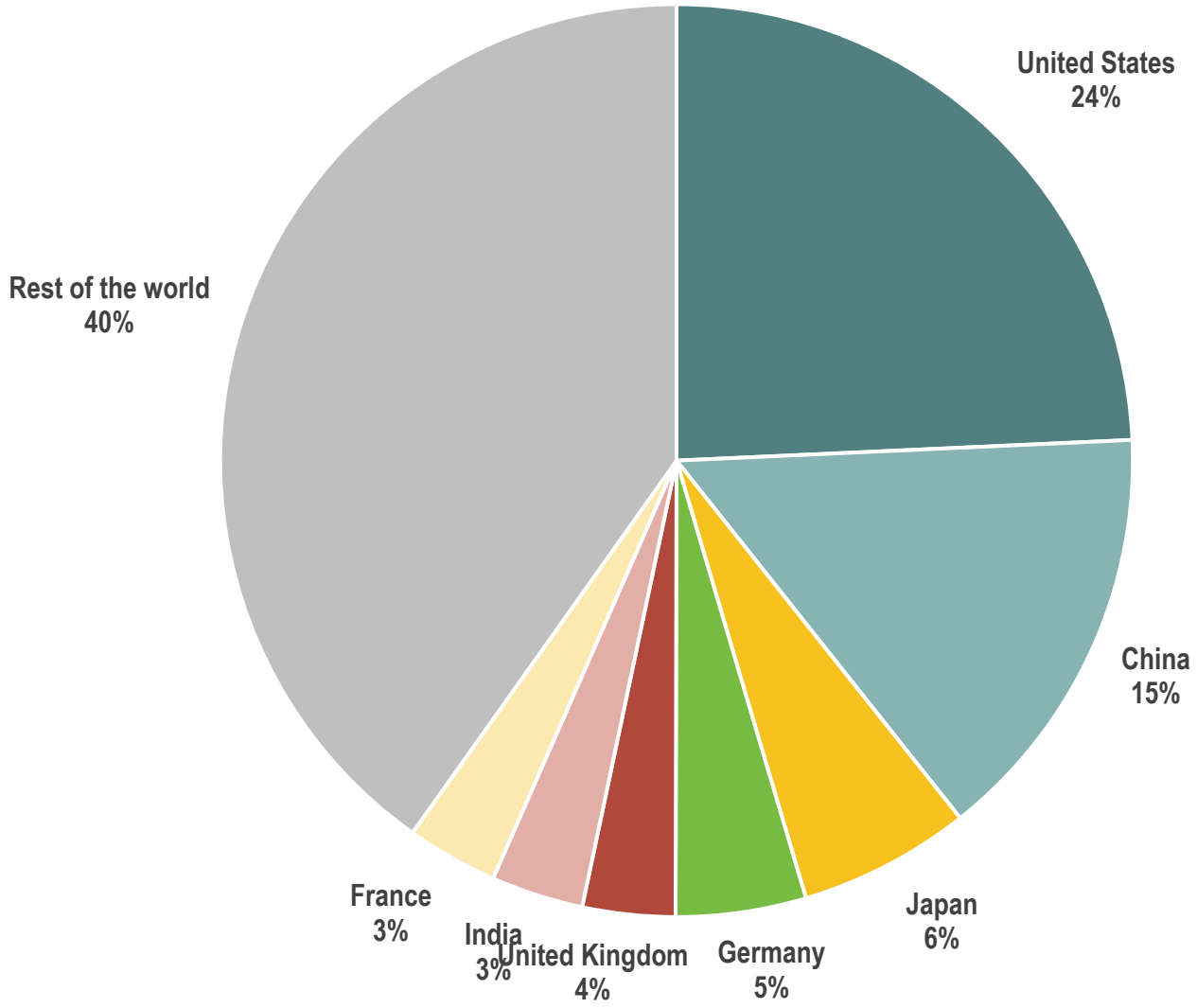
# World GDP, 1CE - 2020



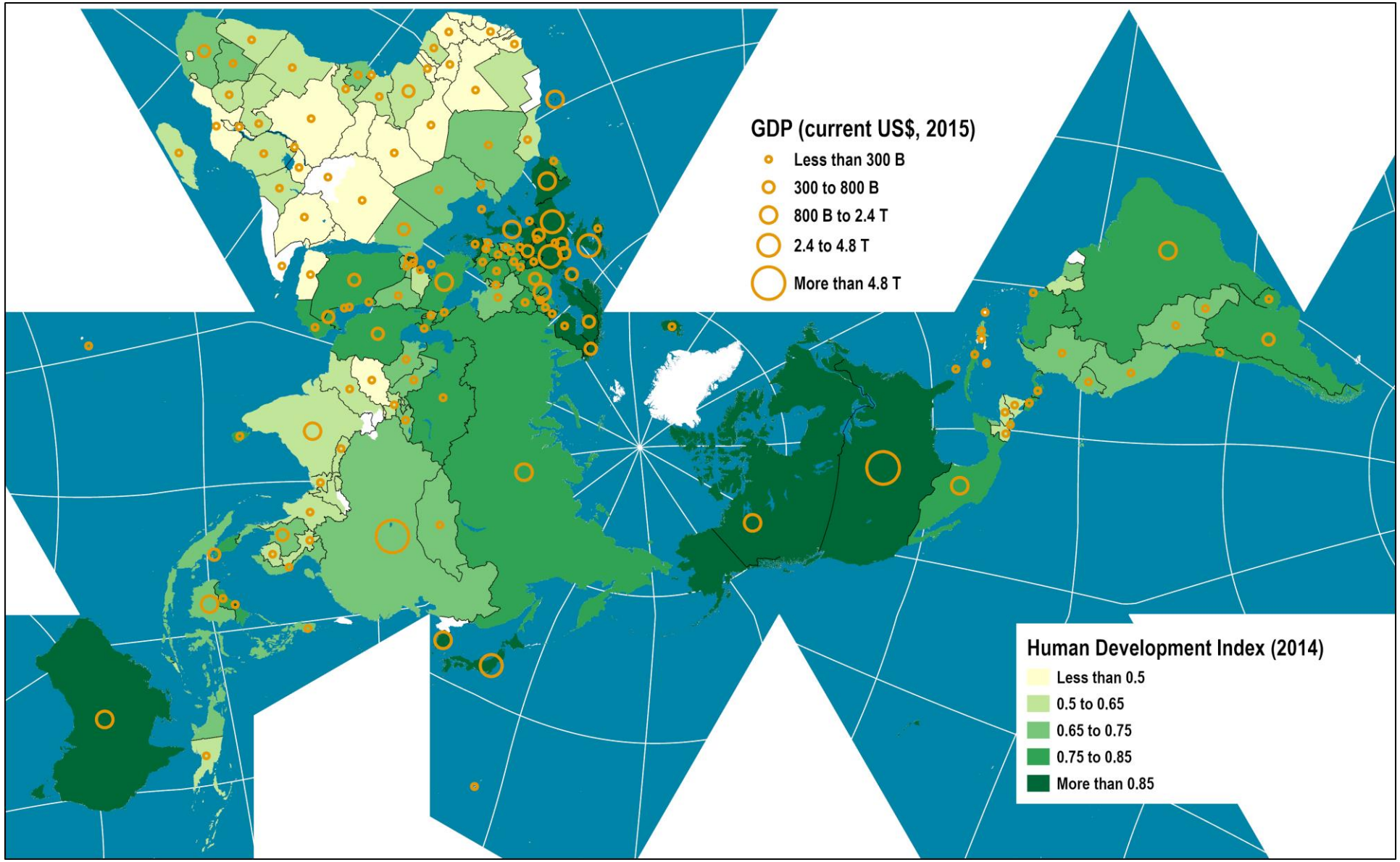
# World Nominal GDP, 2000-2021 (in billion USD)



# Share of the World GDP, 2016 (Current USD)

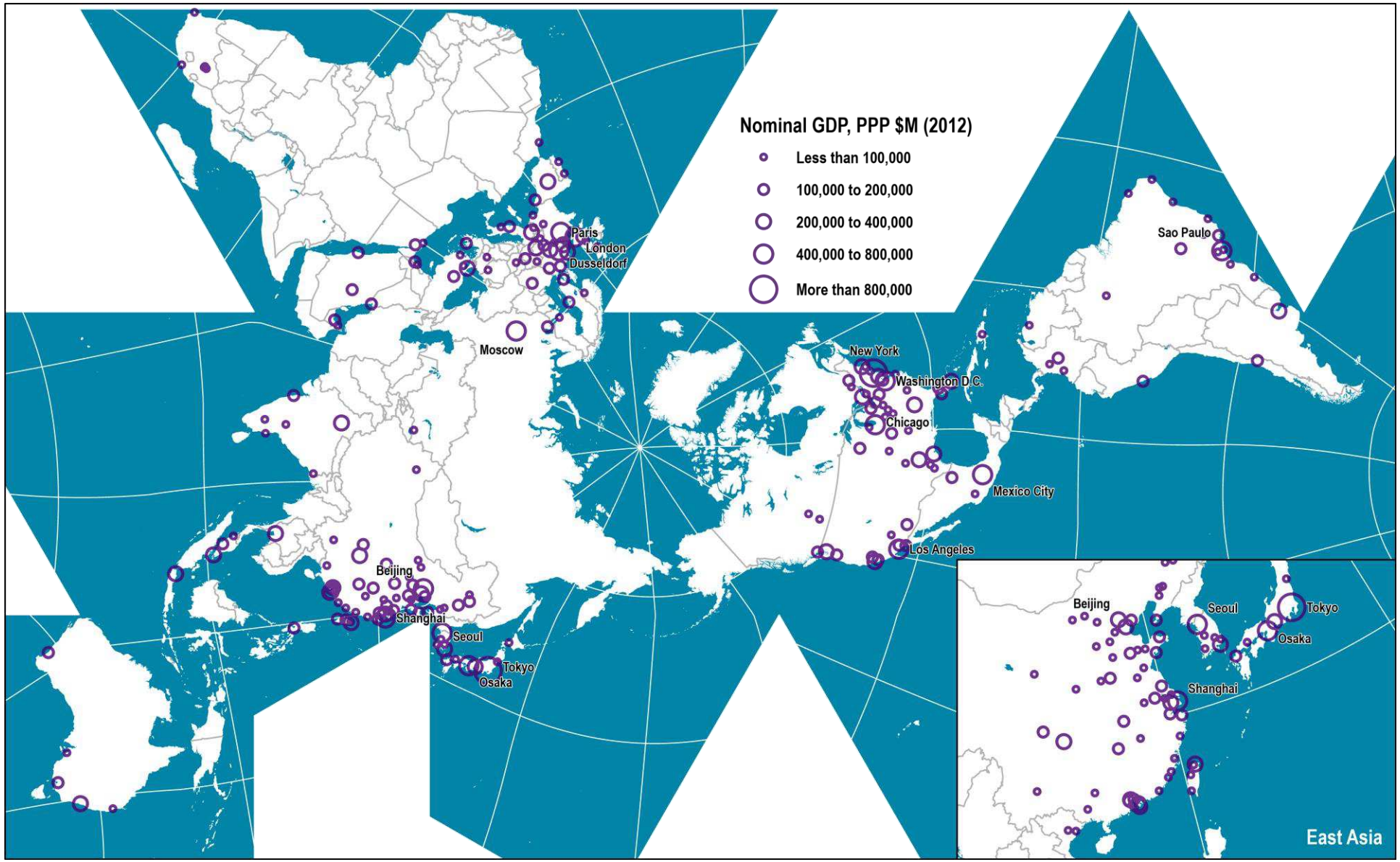


# Global Gross Domestic Product and Human Development Index, 2015

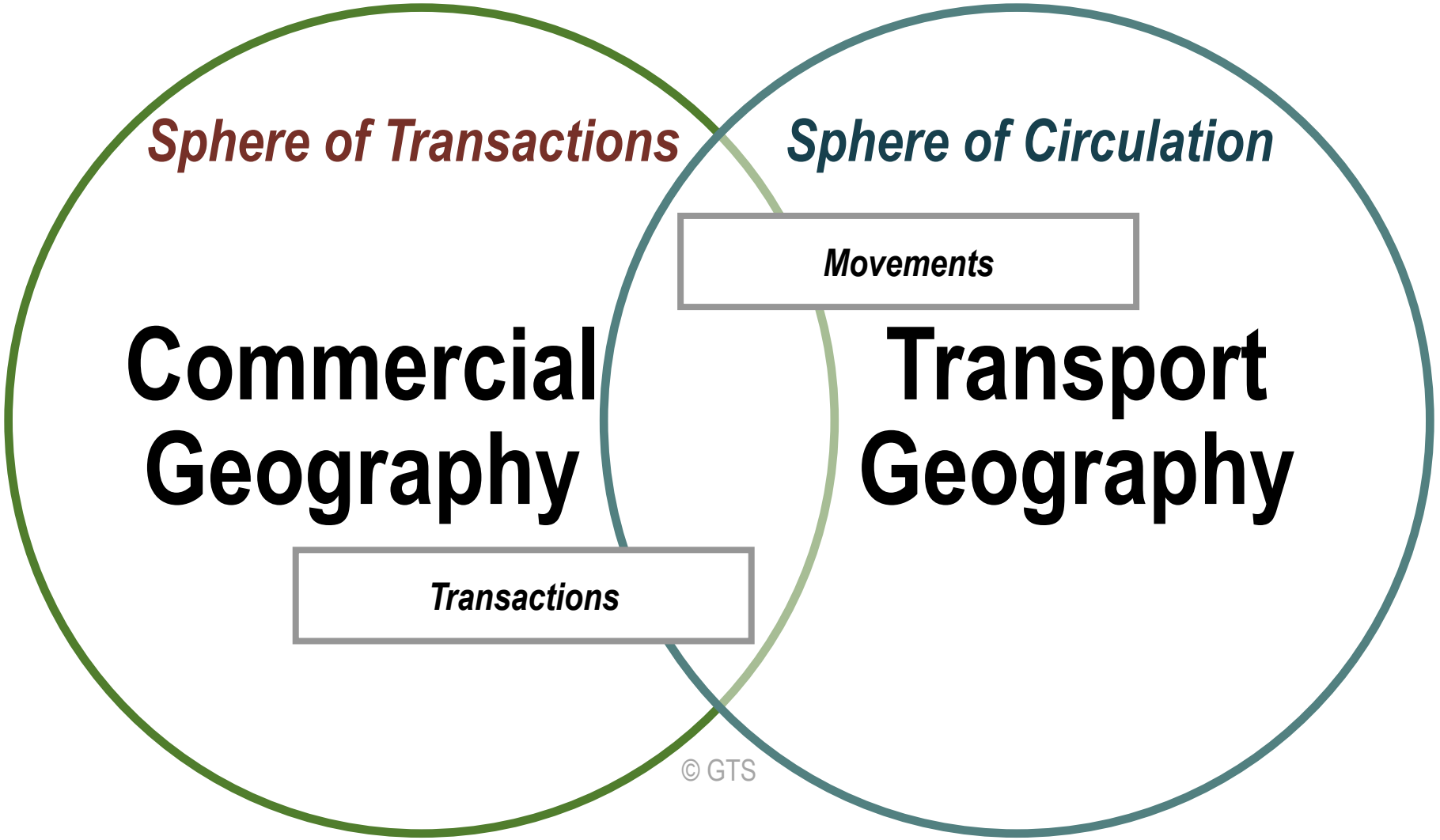


# Global Competitiveness Index, 2018

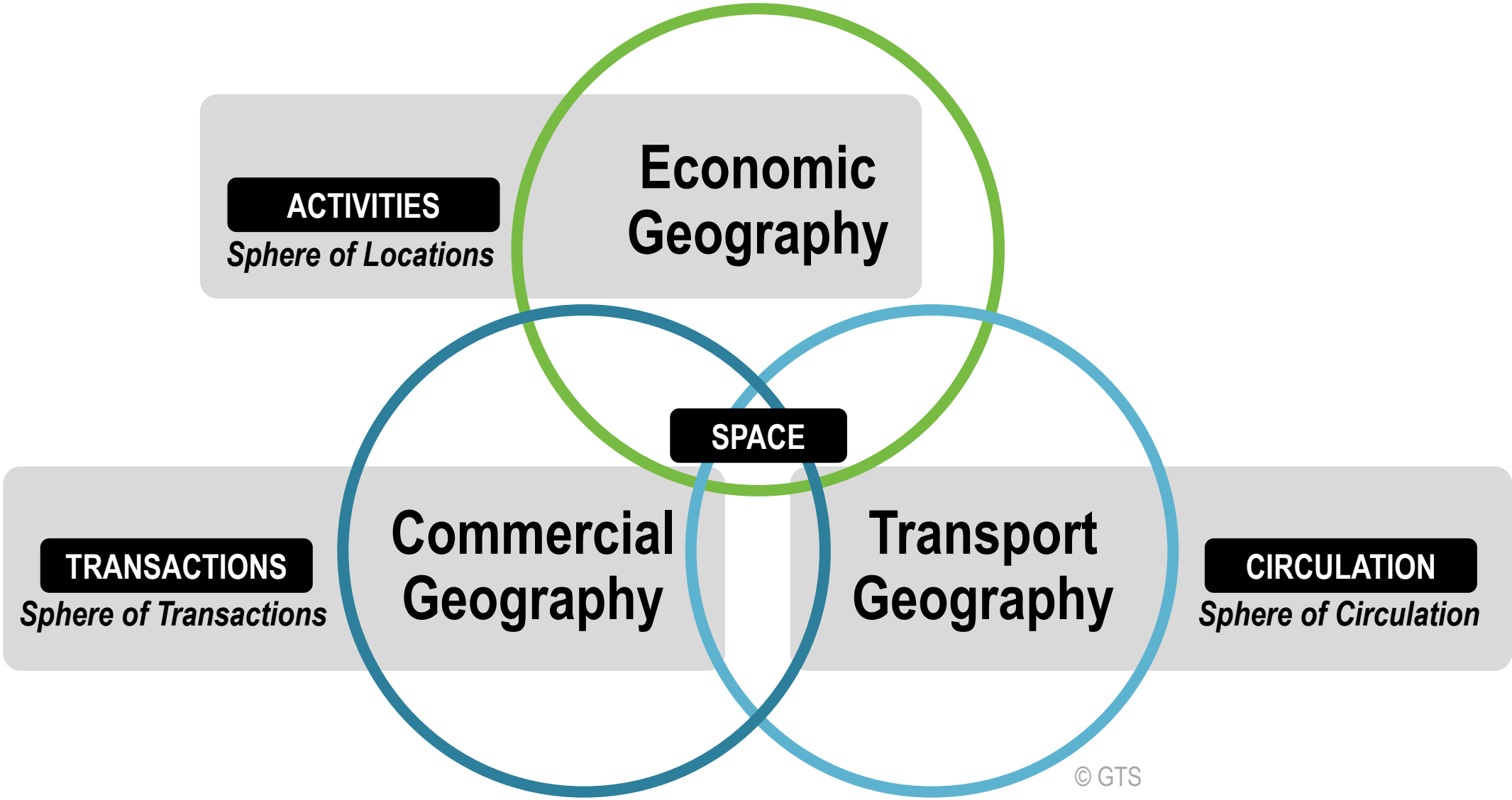
# The Economic Output of the World's Major Metropolitan Areas, 2012



# Economic, Transport and Commercial Geography



# Economic, Transport and Commercial Geography



# Main Forms of Competitiveness in Transportation

**COSTS**

- Comparative low cost.
- Input costs.
- Dynamic pricing.

**DIFFERENTIATION**

- Services.
- Performance.
- Reliability.

**FOCUS**

- Mode.
- Market area.
- Customer base.

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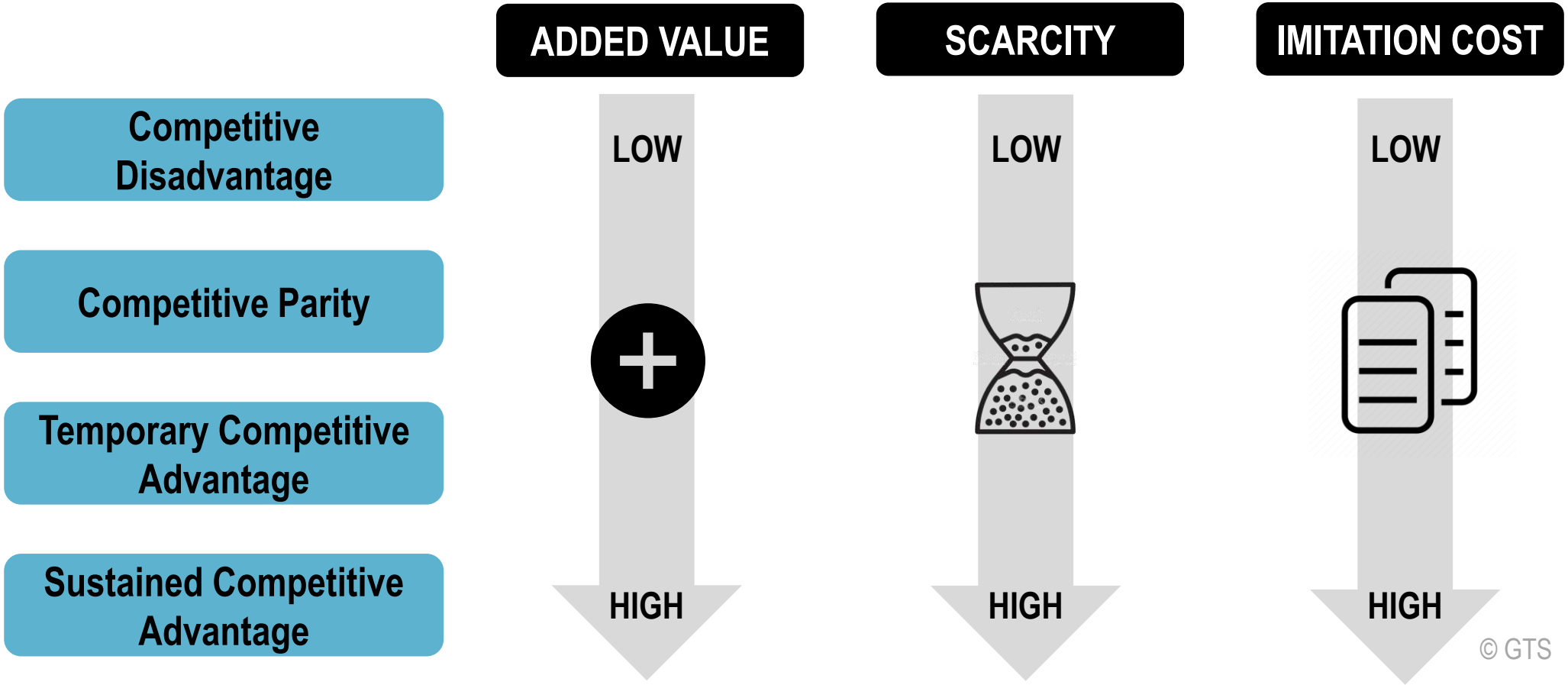
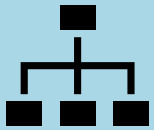
# Types of Competitive Advantages



# Types of Innovation

## ORGANIZATION



- Market information.
- Managing organizational resources.
- Mergers and acquisitions.
- Business practices.

## PROCESS

- Assembly and manufacturing.
- Use of resources.

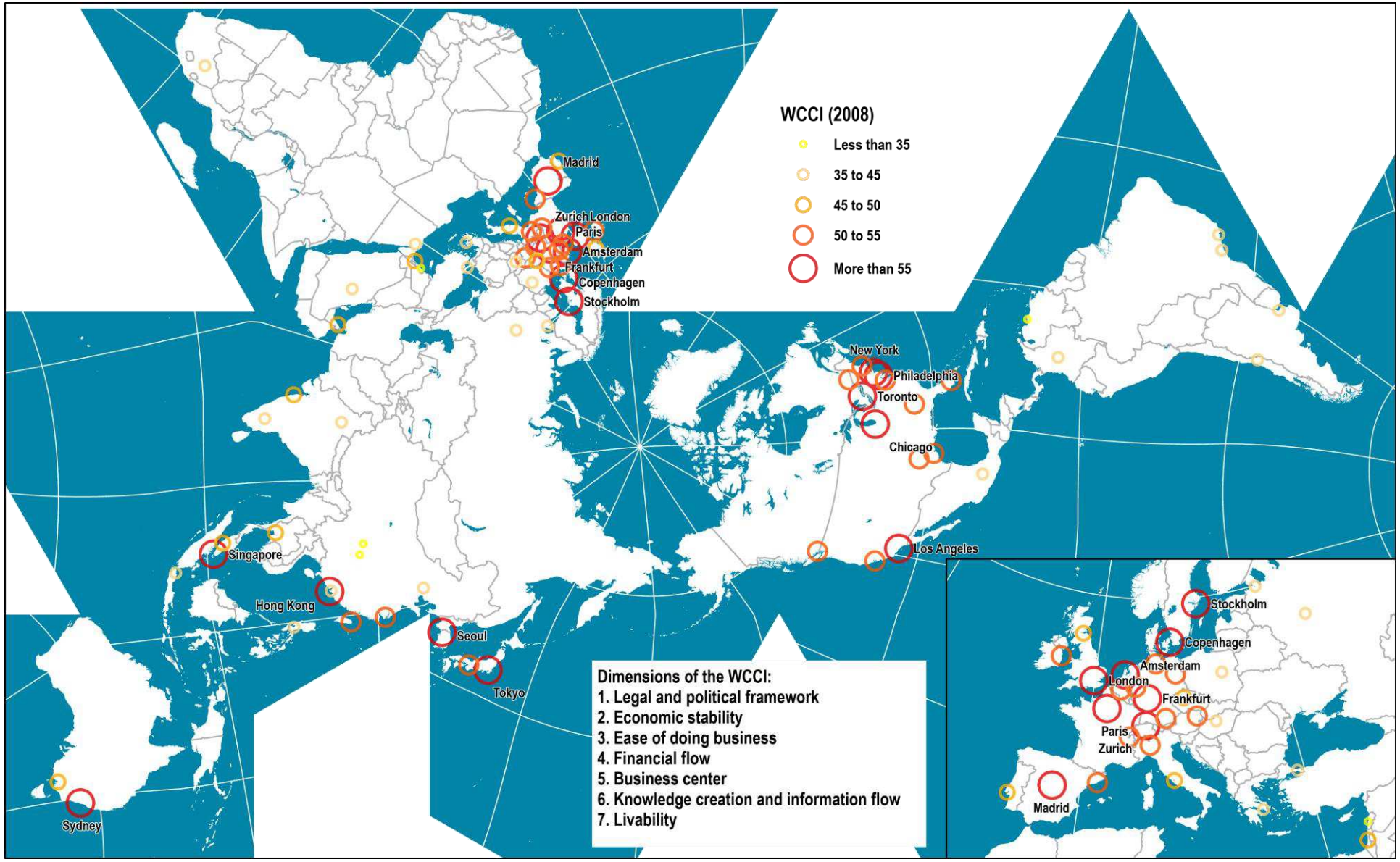
## PRODUCT

- Product design.
- Product quality.

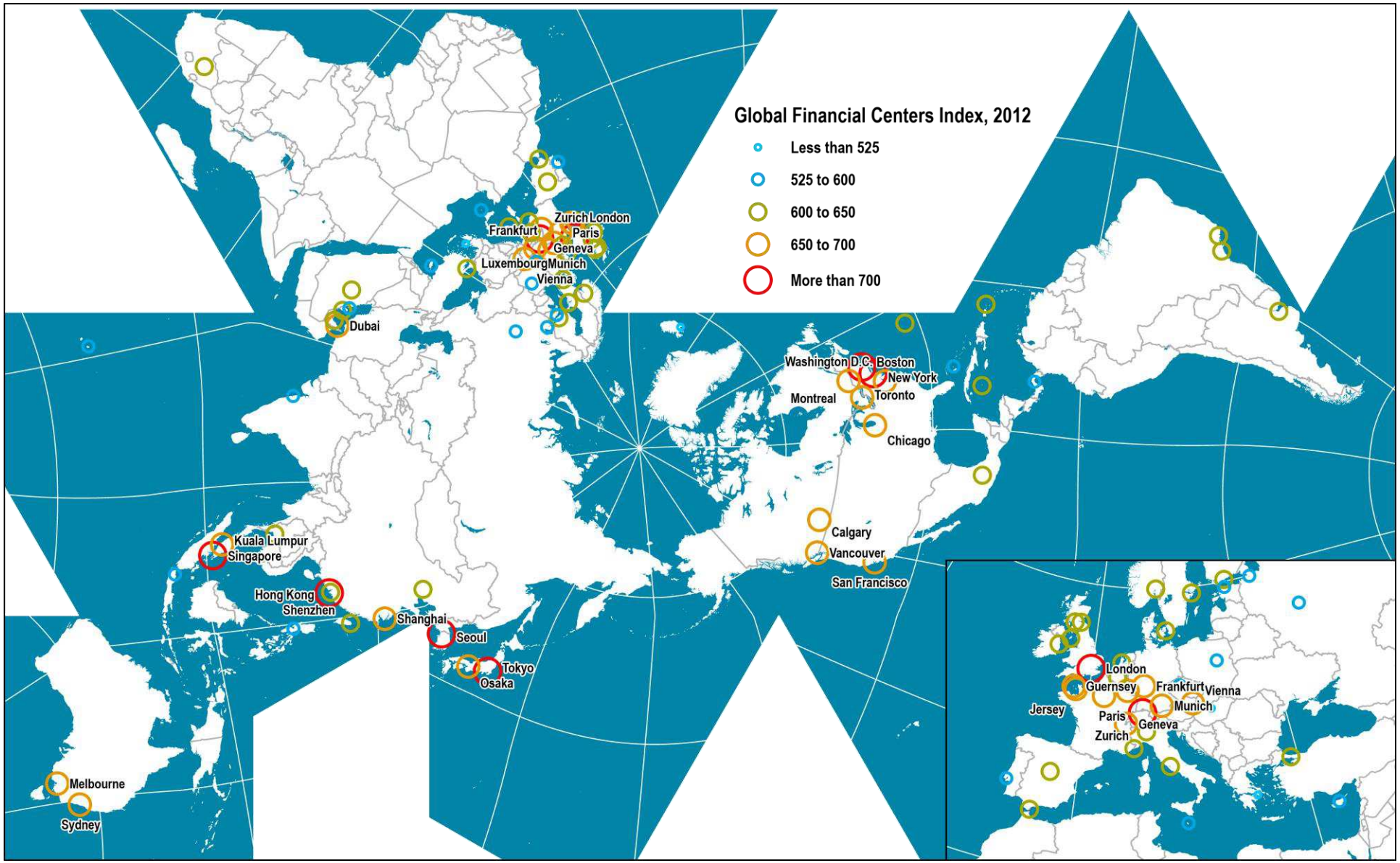
## DISTRIBUTION

- Access to markets.
- Transport costs.
- Packaging and packing.

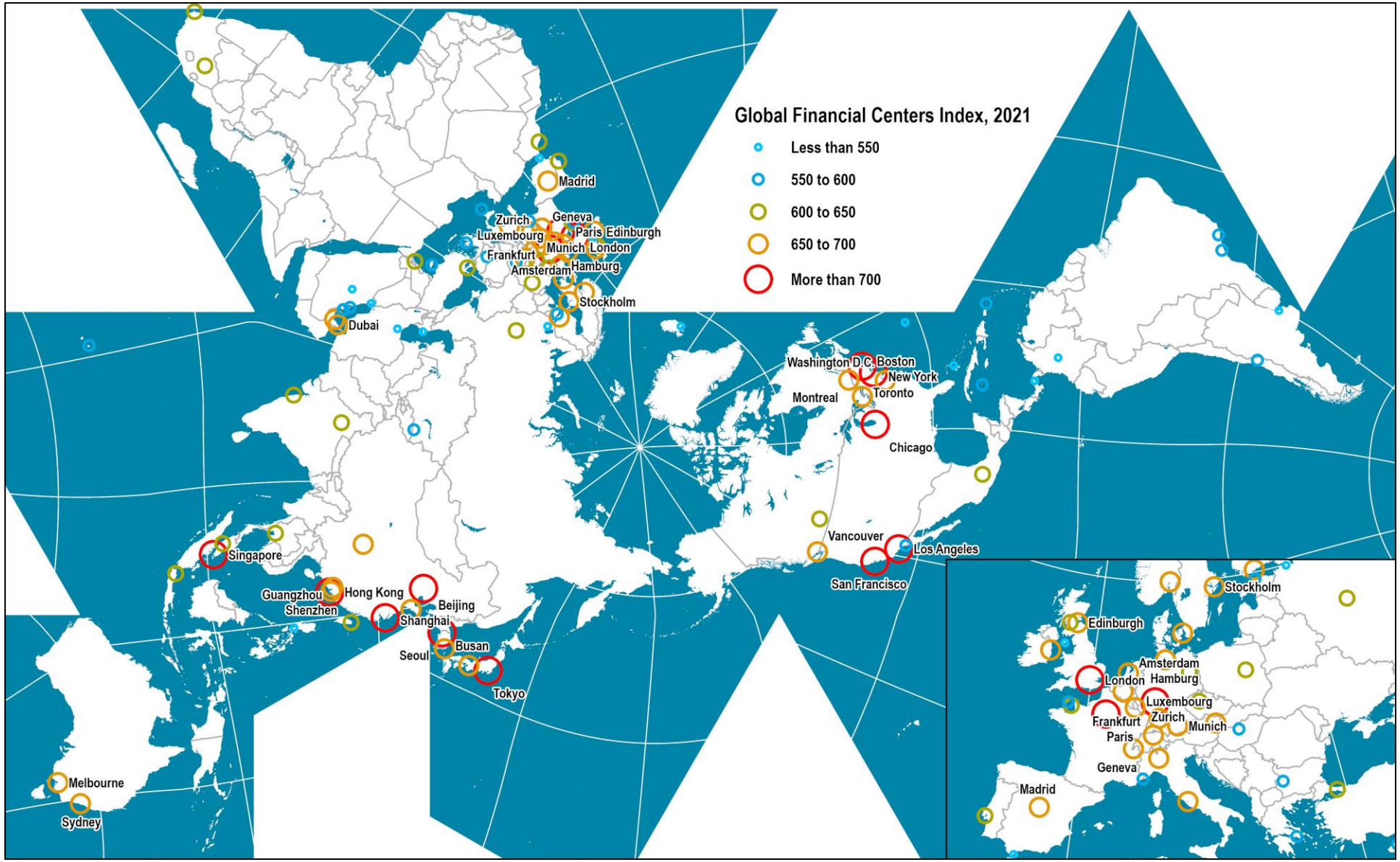
# Worldwide Centers of Commerce Index, 2008 (Removed – no longer updated)



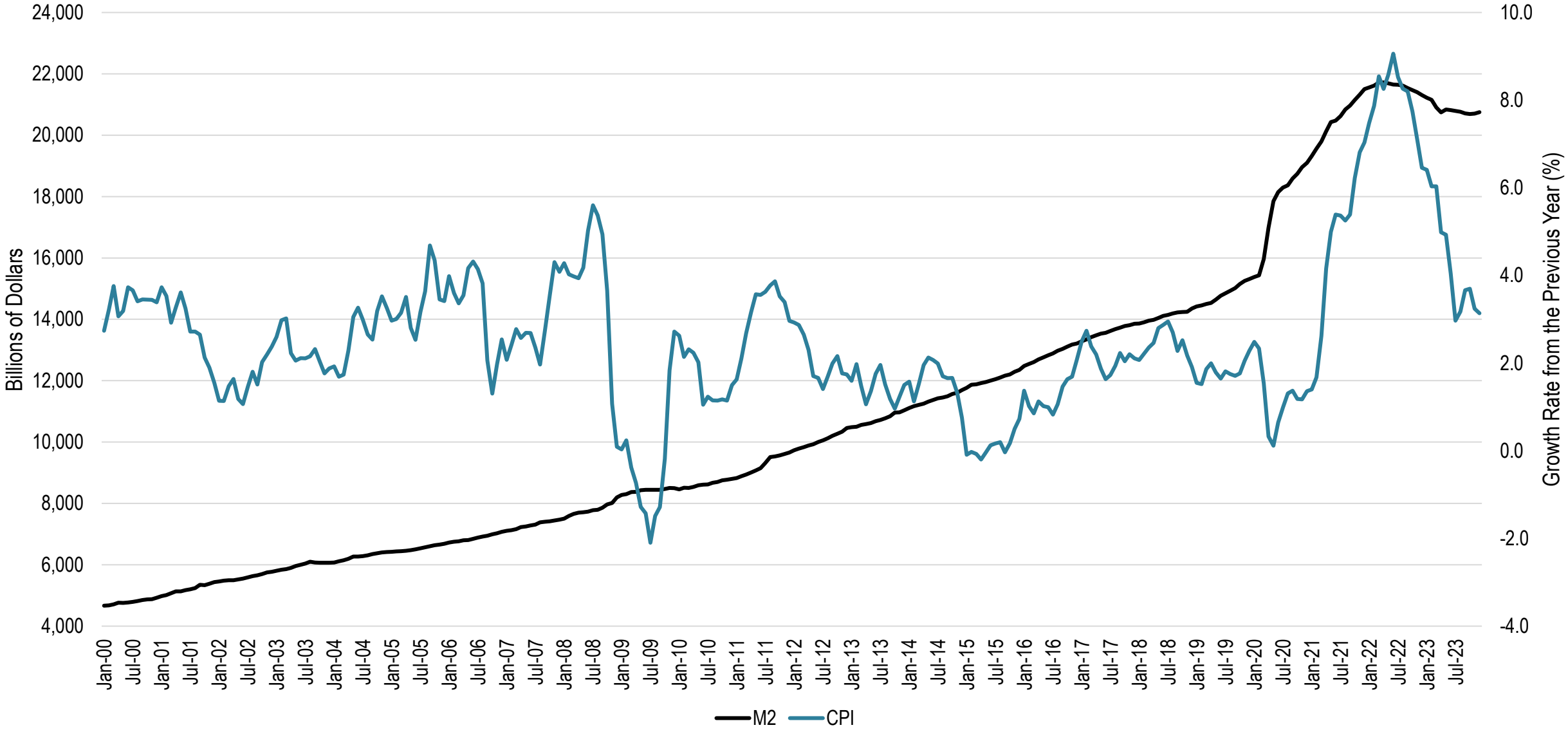
# Global Financial Centers, 2012



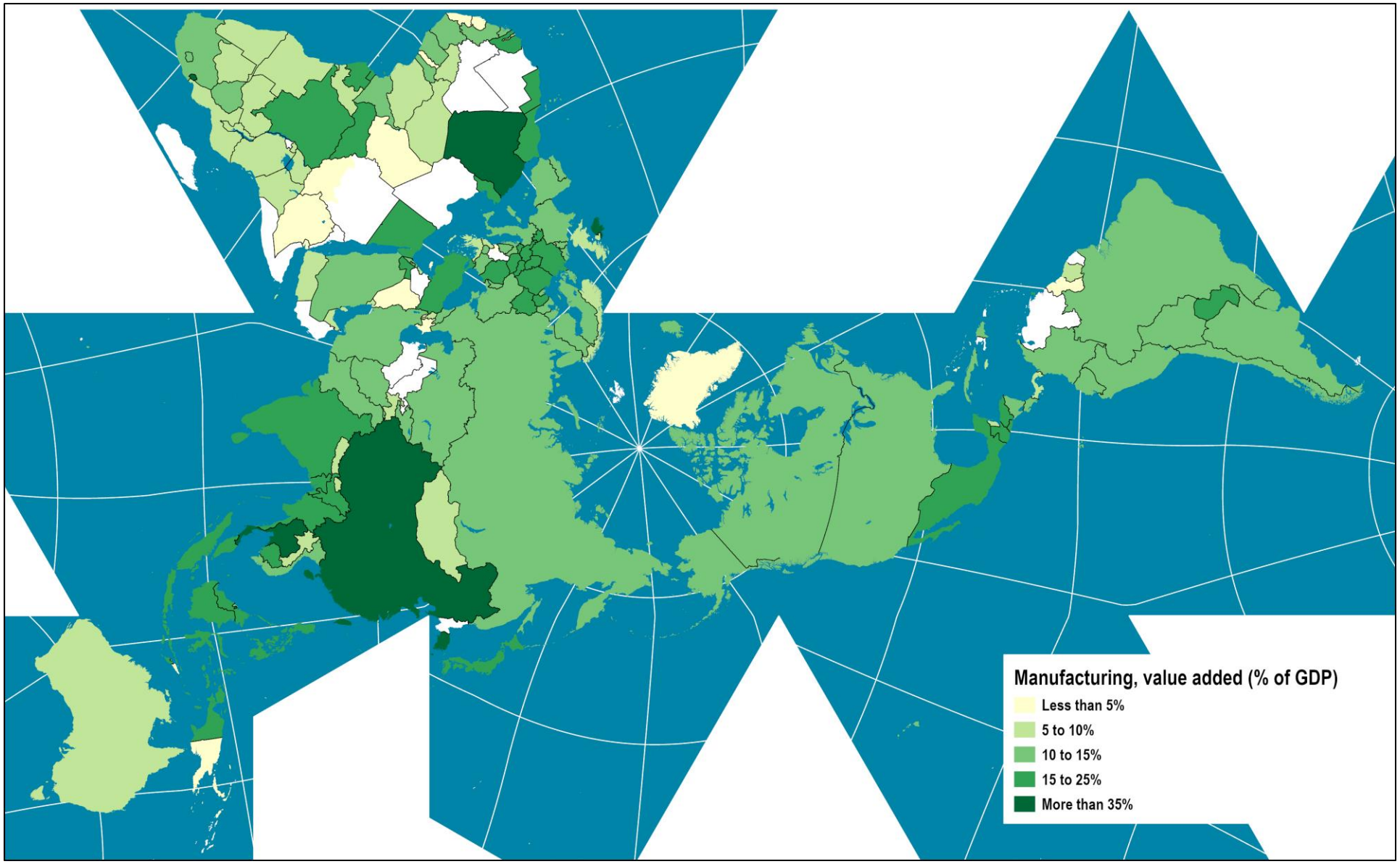
# Global Financial Centers, 2021



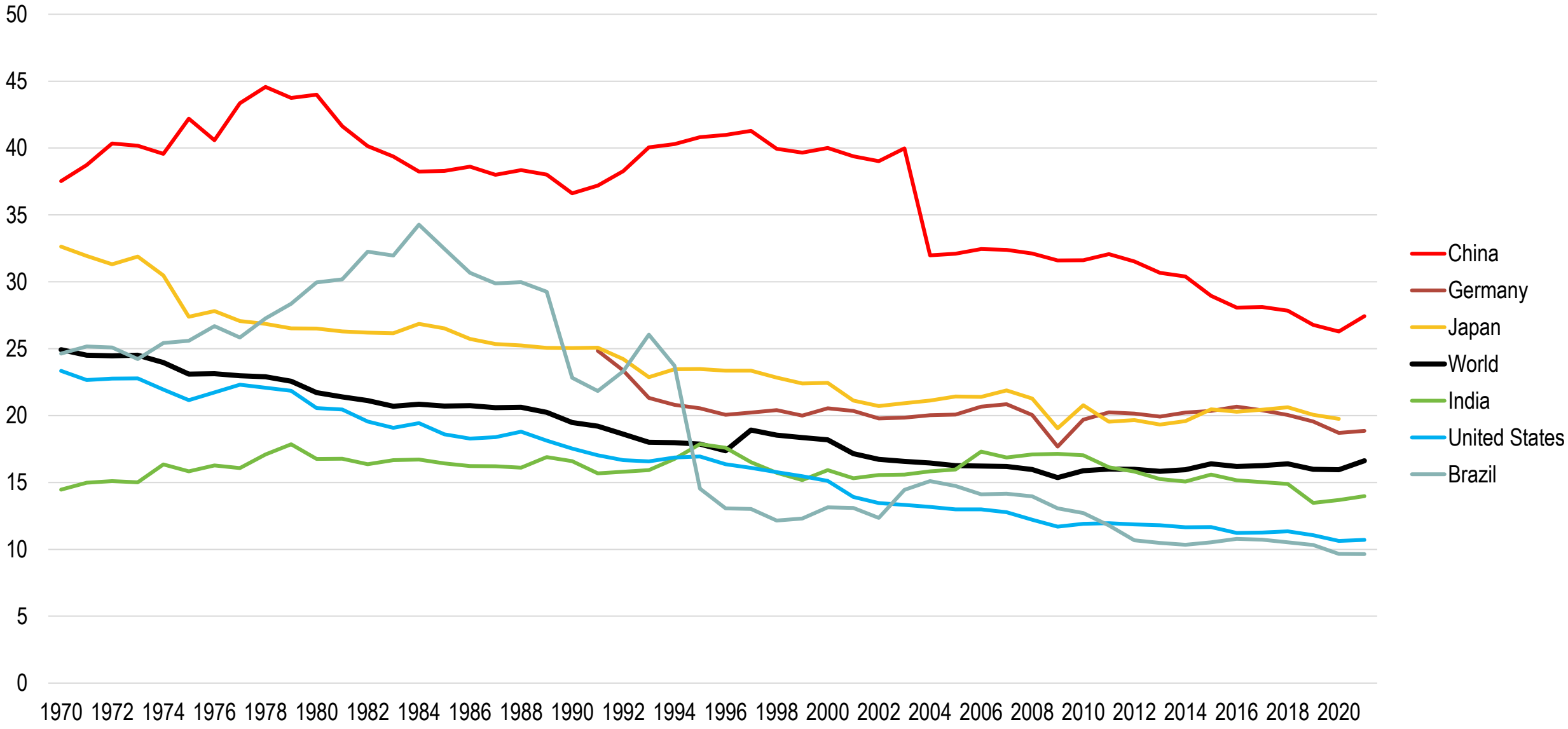
# M2 Money Supply and Consumer Price Index, United States, 2000-2023



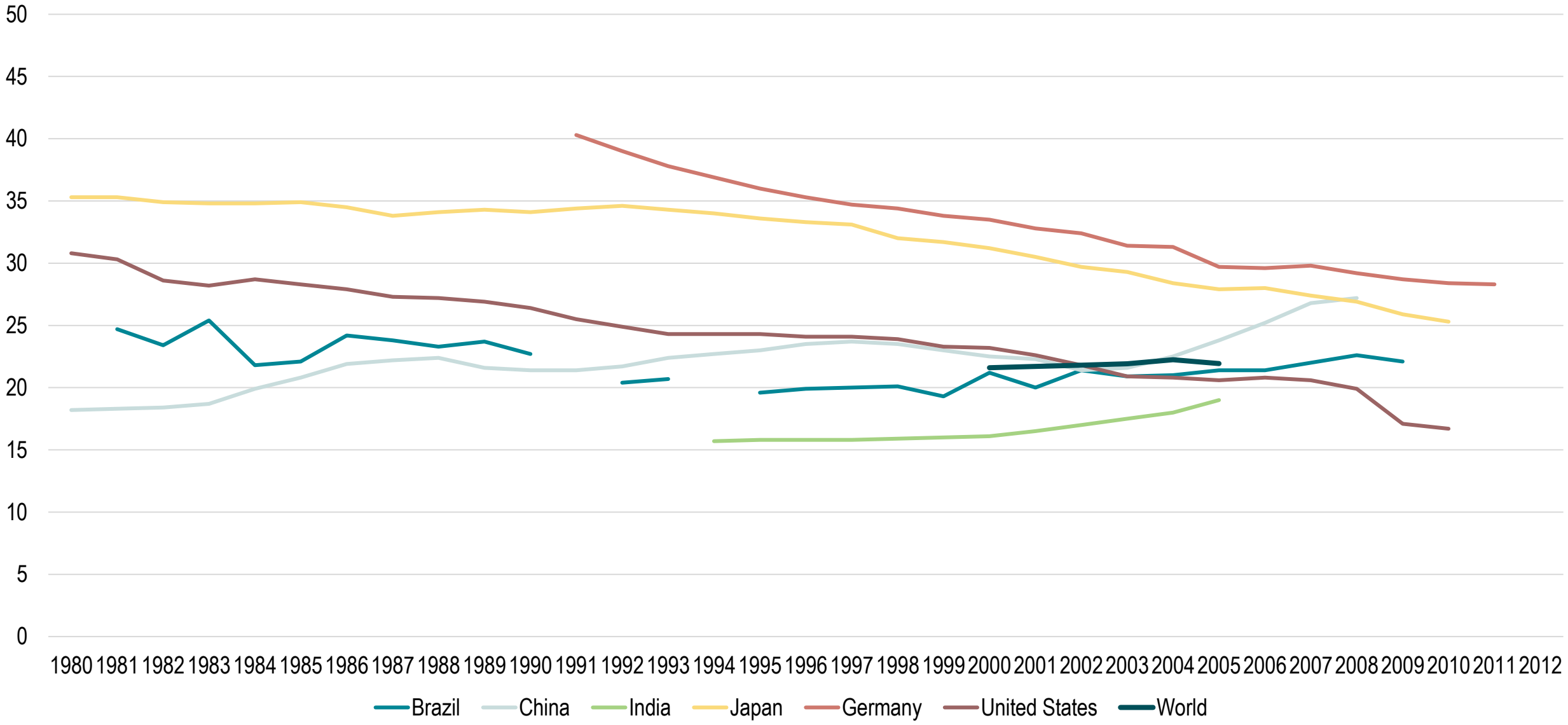
# Global Manufacturing, 2015



# GDP Share of Manufacturing, Selected Countries, 1970-2021



# Employment in Industry (in % of total Employment), 1980-2011



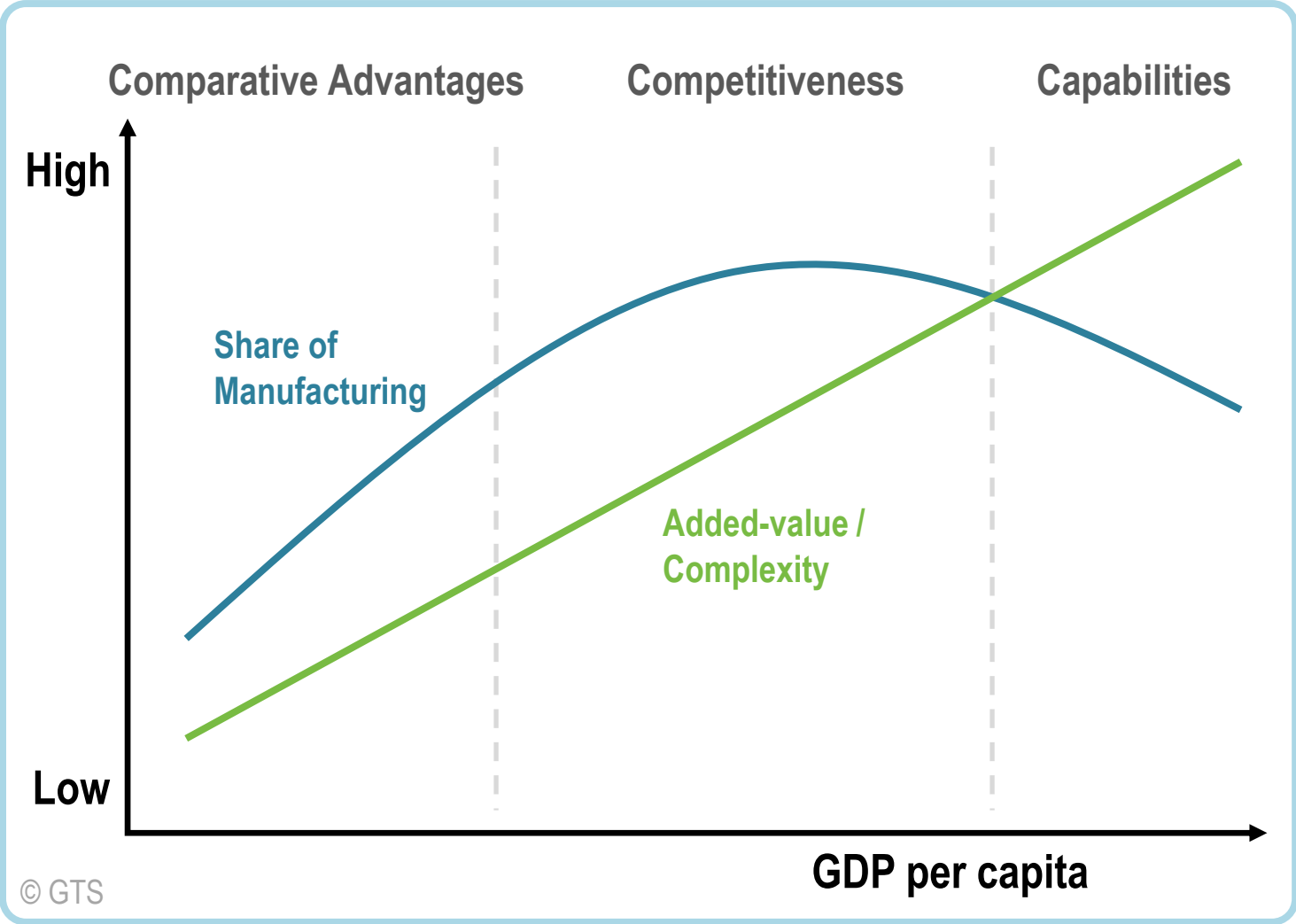
# Drivers of Change in Manufacturing and the Transition Towards Added-Value

**MARKET FORCES**
- Growth in emerging markets
- Demographic shifts

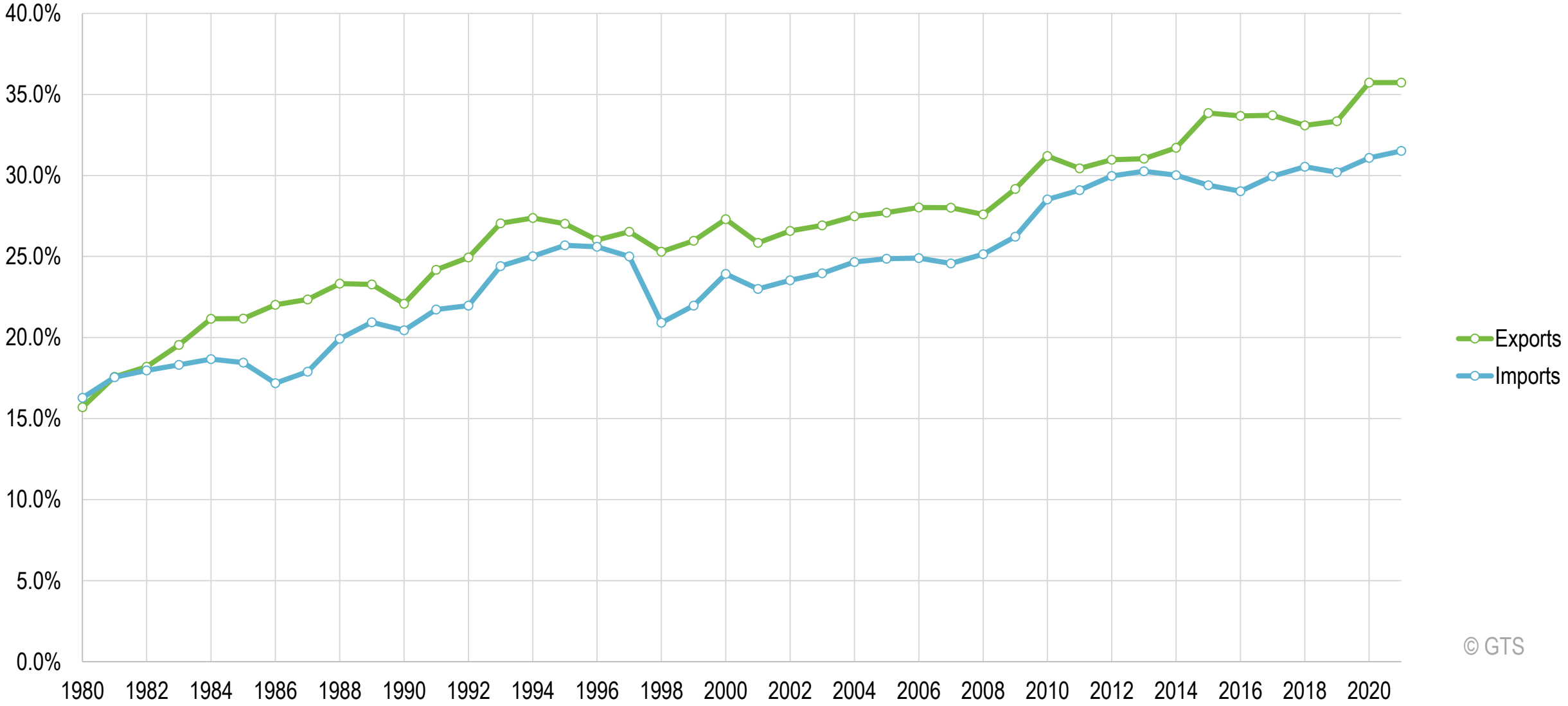
**TECHNOLOGIES**
- Digitalization and automation
- Production costs
- Improved logistics

**RESOURCES**
- Energy costs
- Natural resources

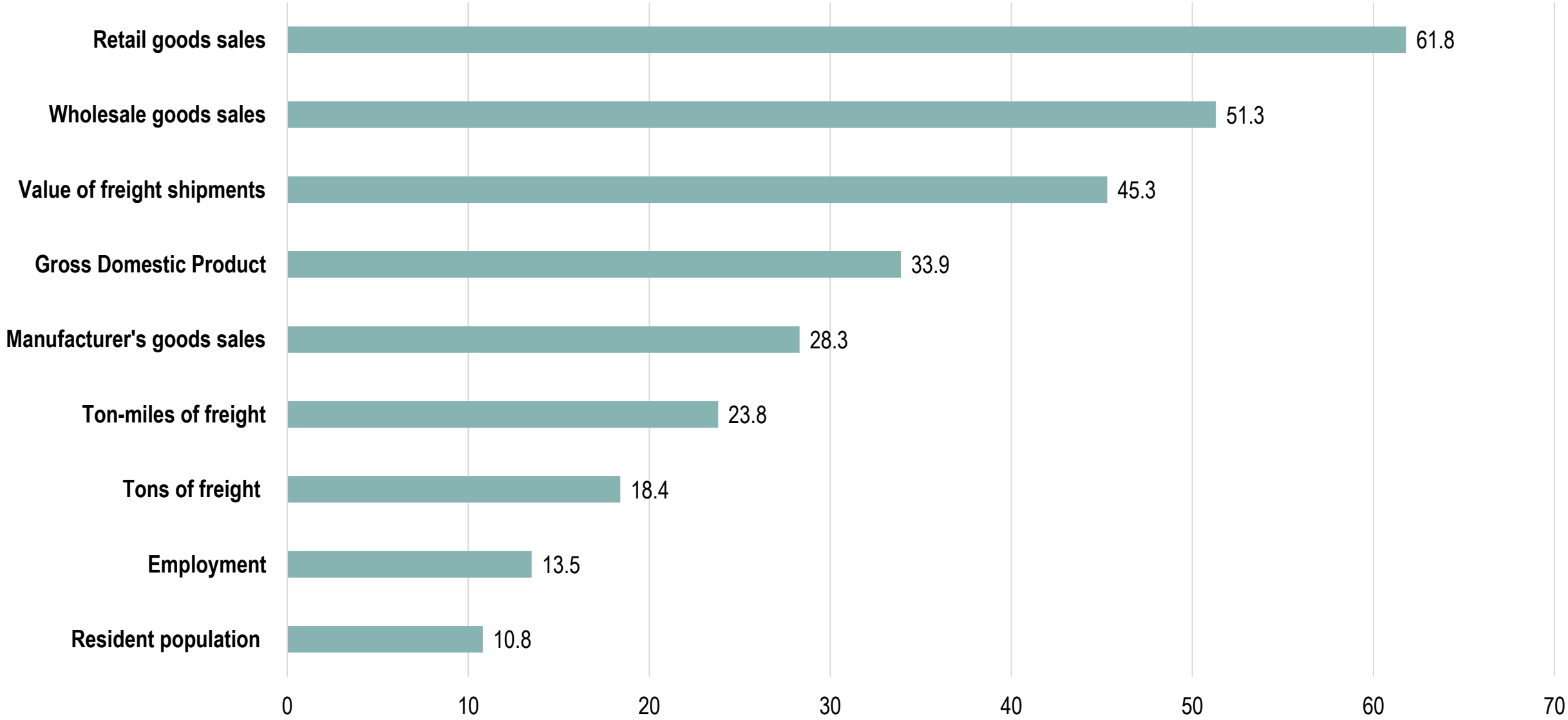
**POLICY**
- Environmental regulation
- Trade agreements
- Industrial policy



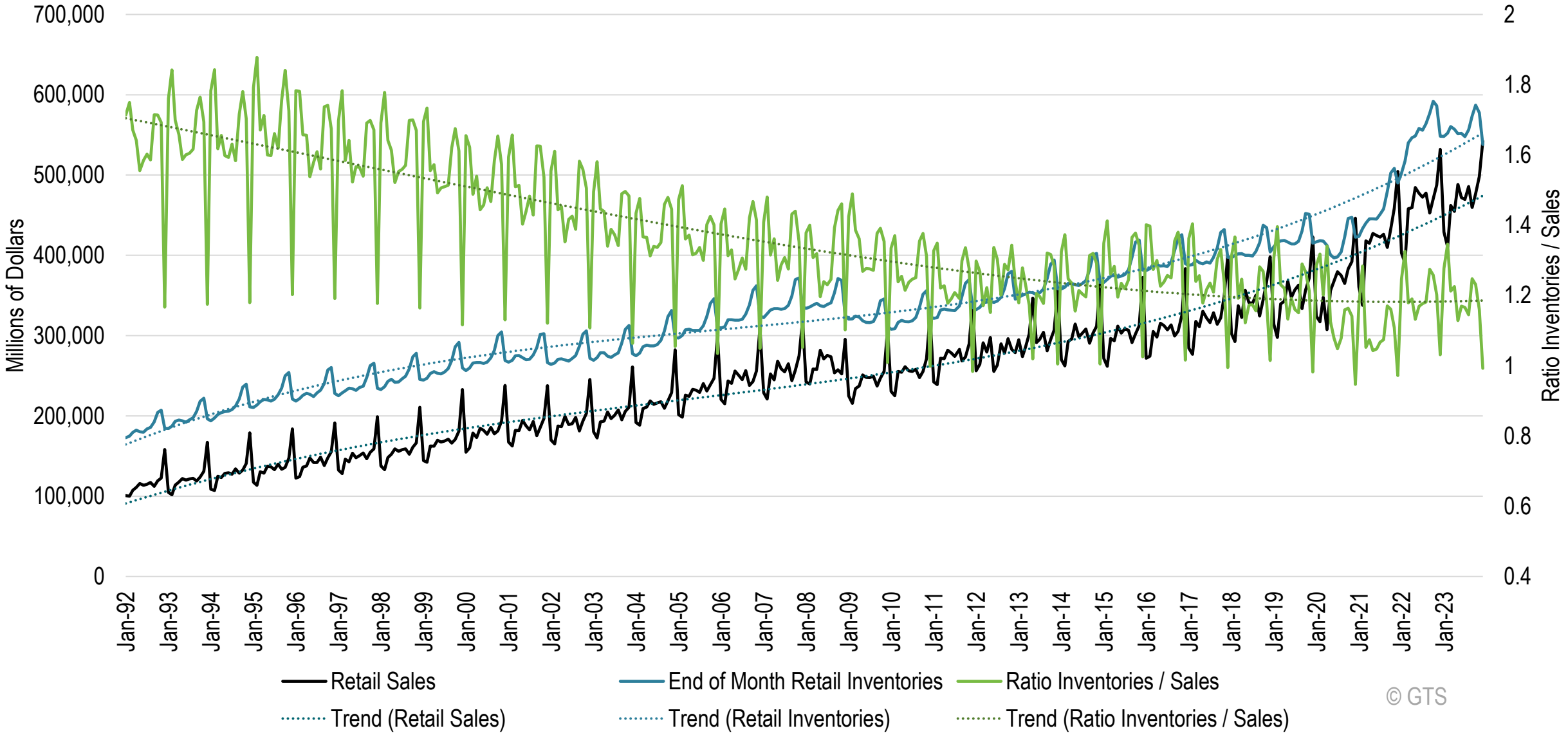
# Share of East Asia in the Value of World Merchandise Trade, 1980-2021



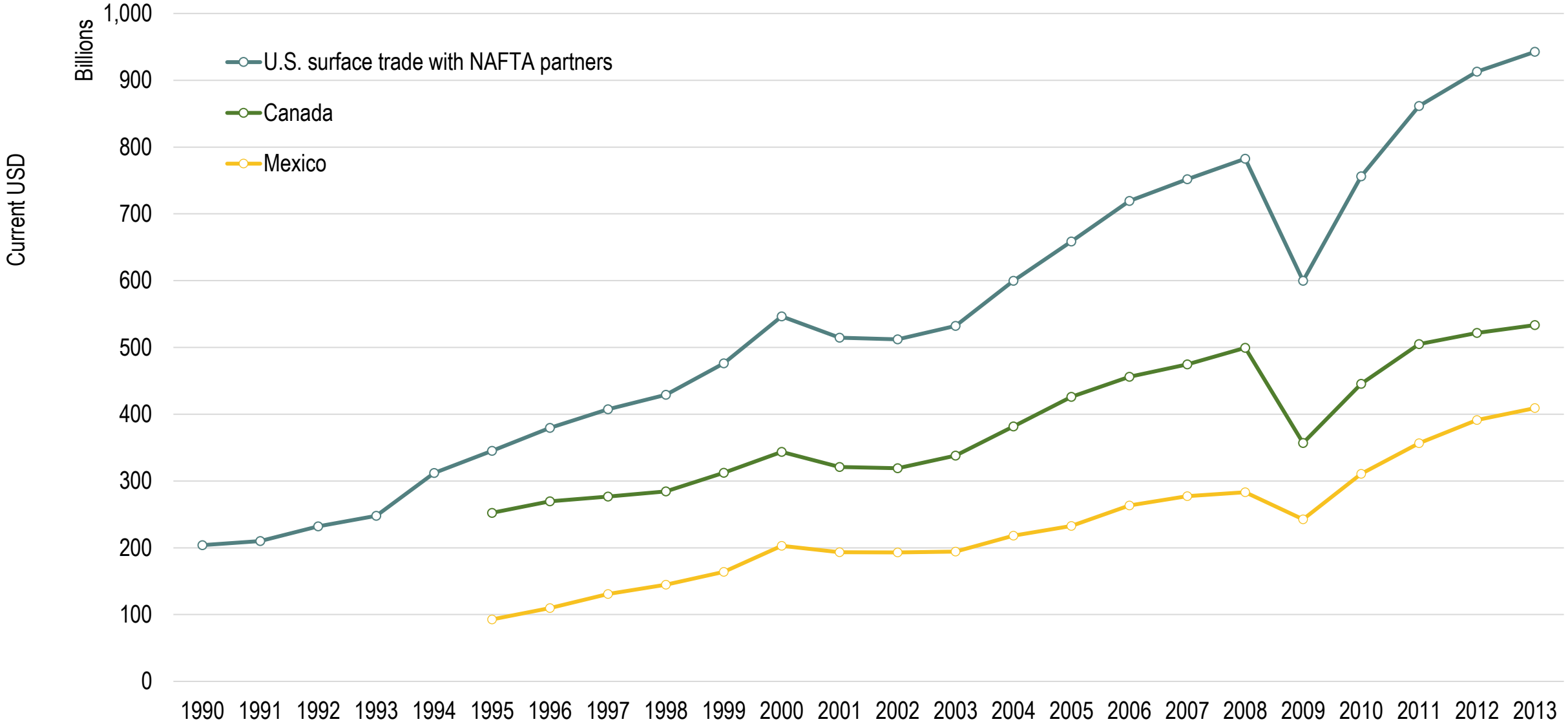
# Increases in U.S. Commercial Freight Shipments and Related Growth Factors, 1993–2002



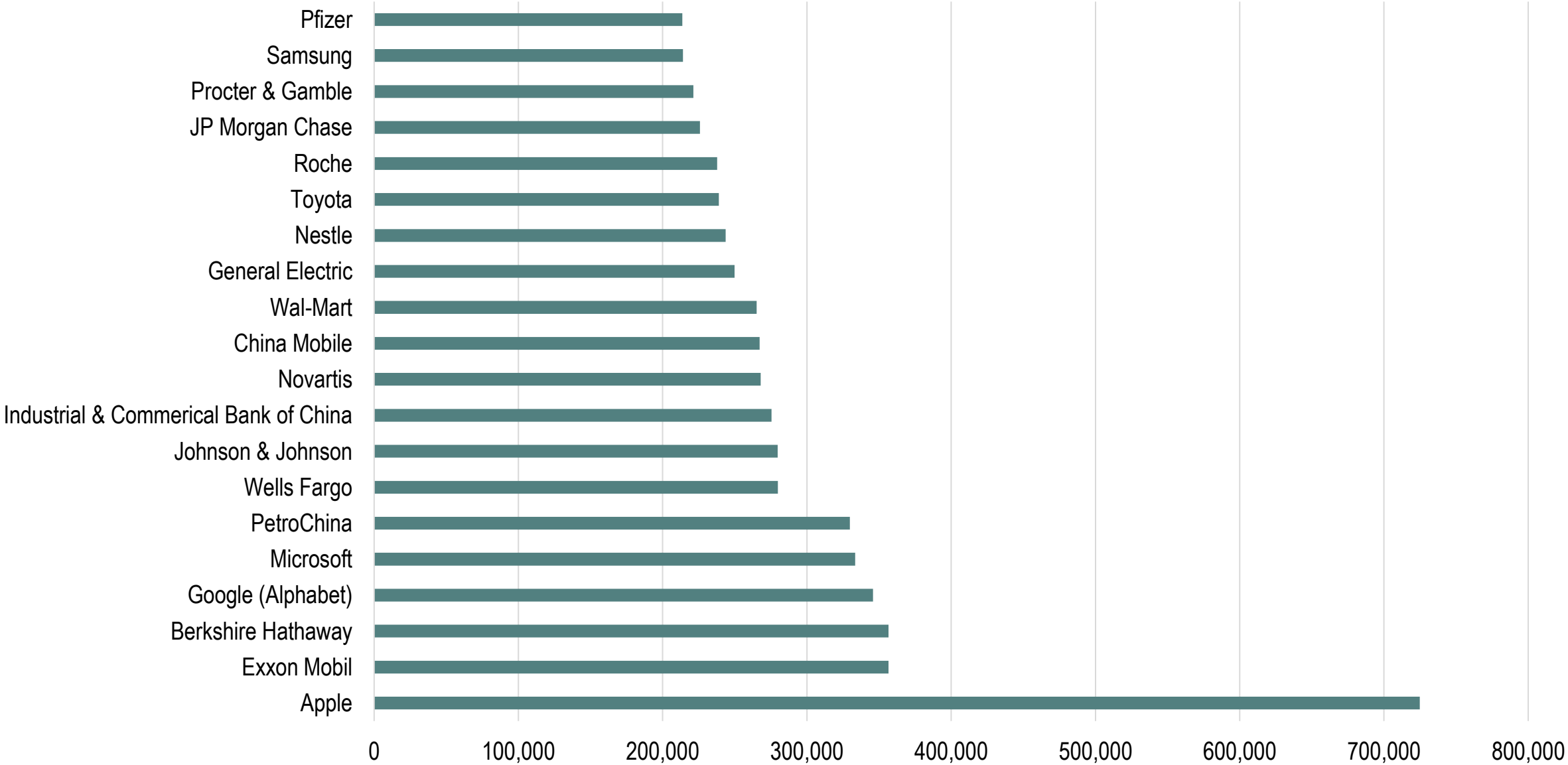
# Monthly Retail Sales and Inventories, United States, 1992-2023



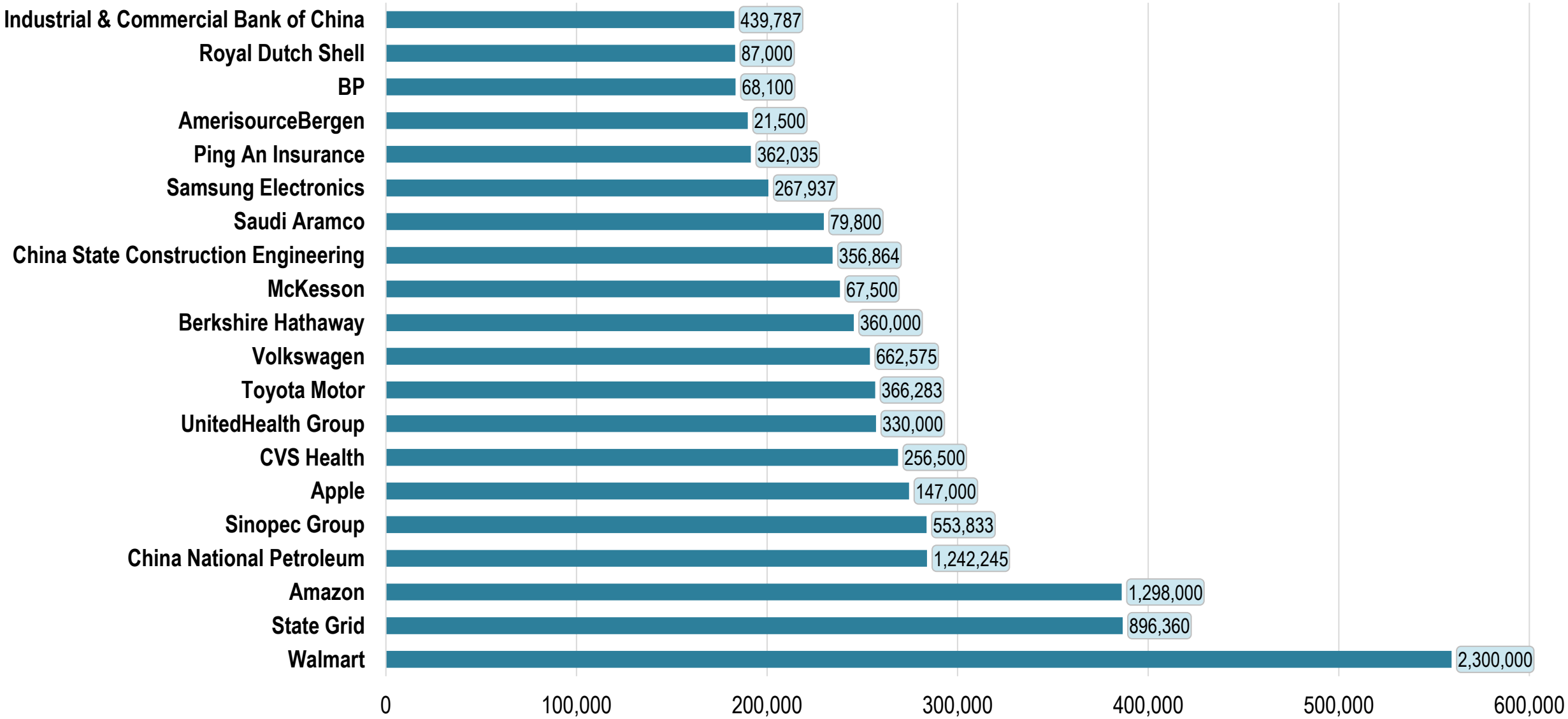
# Value of U.S. Merchandise Trade with Canada and Mexico, 1990-2013



# The World's 20 Largest Corporations by Market Value, 2015 ($US millions)

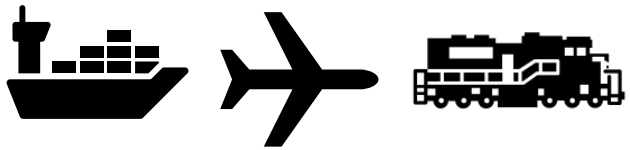


# The World's 20 Largest Corporations by Revenue, 2021 ($US millions)



# Transportation and Logistics Multinationals

## Carriers

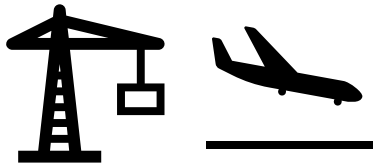


- Transport passengers or freight.
- Own or lease their equipment.
- Contracts or spot rates.

- Maritime shipping (Maersk).
- Air carriers (Emirates).
- Rail carriers (BNSF).



## Terminal Operators



- Transship passengers or freight.
- Own or lease (concessions) terminals.
- Contracts or spot rates.

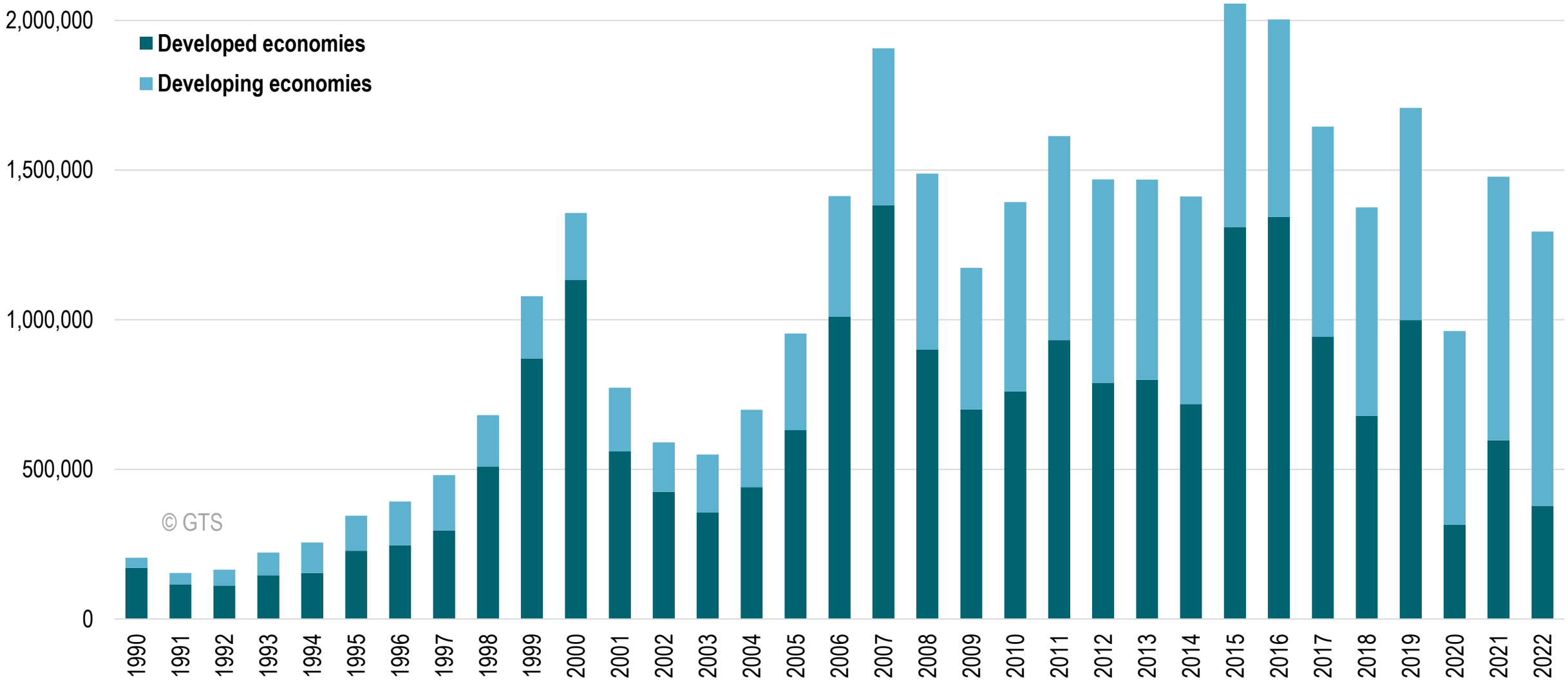
- Container terminals (HPH).
- Airports (Vantage Airport Group).
- Rail (Rail Management Services).

## Logistics Service Providers

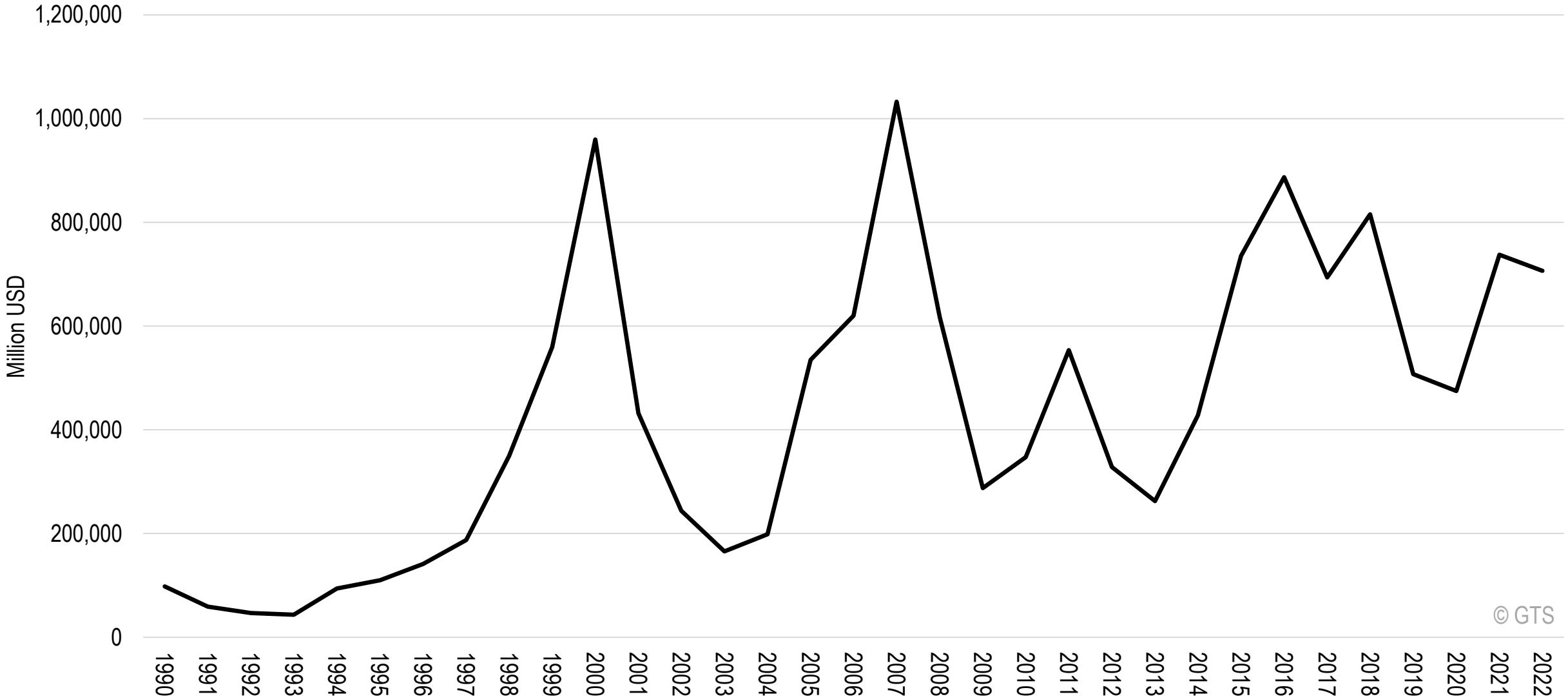
- Offer services such transport, warehousing and supply chain management.
- Arrange transport chains with their own assets or through third parties (carriers and terminal operators).
- Contracts or spot rates.

- Freight forwarders / Third Party Logistics (DHL).
- Logistics real estate (Prologis).

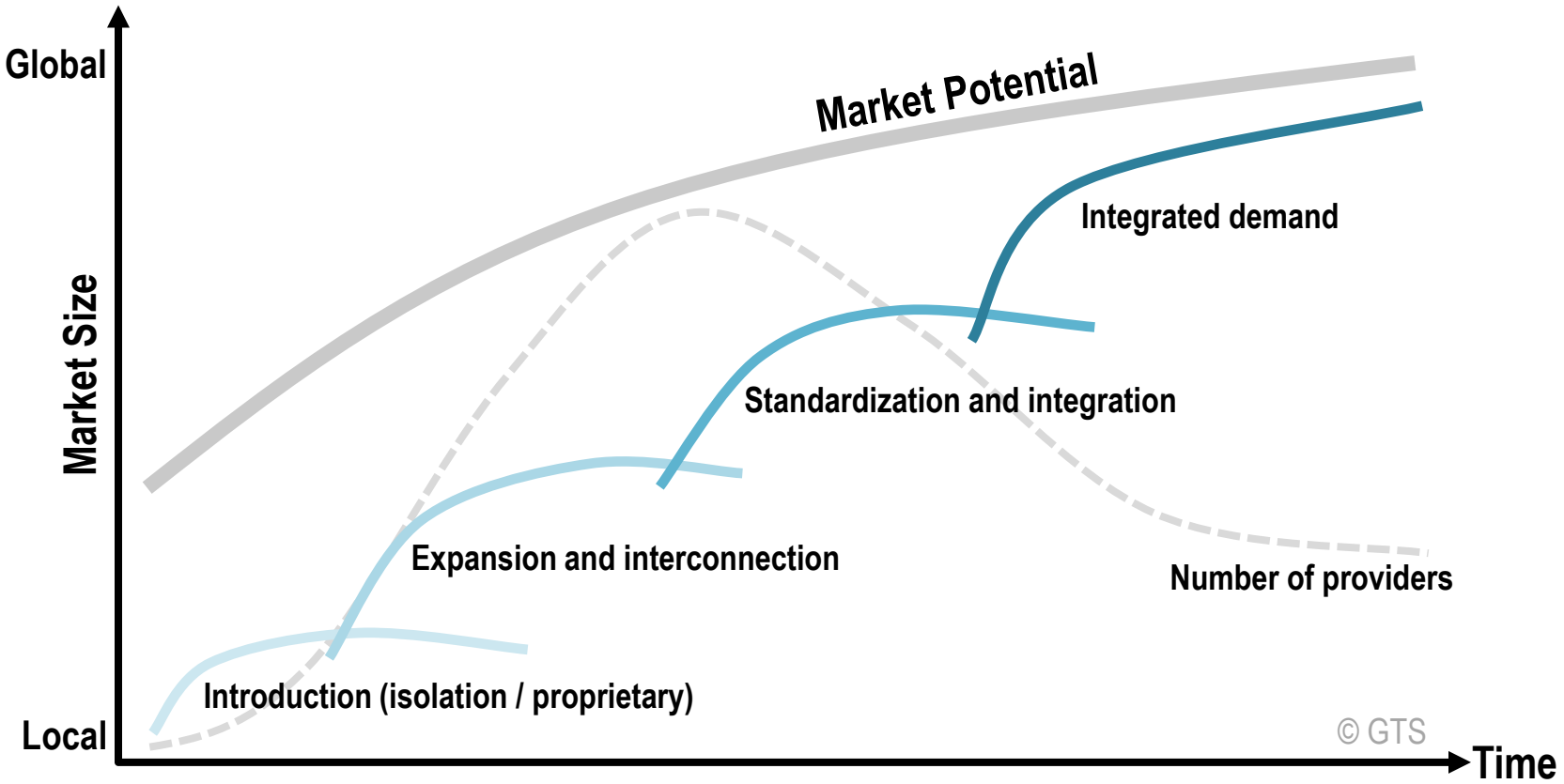
# Global Inflows of Foreign Direct Investments, 1990-2022



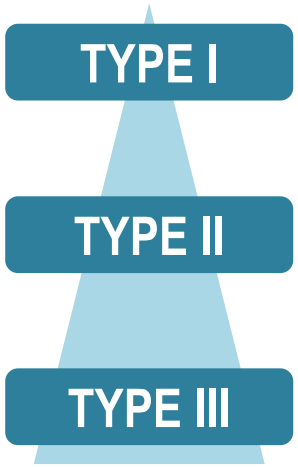
# Worldwide Mergers and Acquisitions, 1990-2022



# The Commercialization of Transportation



# Transport Route Selection




| PASSENGERS | FREIGHT |
| --- | --- |
| • Individual selects route (private transport). | • Beneficial cargo owner selects route (own account). |
| • Charterer selects route. | • Freight forwarder selects route. |
| • Carrier selects route. | • Carrier selects route. |

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# Major Commercial Actors in Freight Distribution

## Maritime Shipping Lines

- Control long-distance segments of global freight distribution linking major markets.
- Highly capital-intensive industry.
- Plan network configuration (ports of call).

## Port Terminal Operators

- Own or lease terminals within the world's largest container ports.
- Strong linkages with maritime shipping companies.

## Port Authorities

- Manage and plan port infrastructures.
- Tend to lease terminal operations.
- Intermediaries for regional distribution (hinterland).

## Commercial Real Estate Developers

- Develop logistics zones (build to lease, build to suit), often in coordination with terminals operators.
- Real estate portfolio of distribution centers (leases).

## Maritime Lock and Canal Operators

- Operate strategic passages in global and national distribution (e.g. Panama Canal, Suez Canal or St. Lawrence Seaway).

## Truck Carriers

- Control vast and diverse assets, including critical segments of freight distribution.
- Short and medium-haul transport.

## Rail Carriers and Terminal Operators

- Strategic inland freight carriers transporting a wide array of raw materials and commodities.
- Responsible for the transshipments between rail and road, (particularly for containerized freight).

## Third-Party Logistics Providers

- Provide managerial and organizational skills within supply chains.
- Often act as brokers between transport customers and service providers.
- Some own and operate transport assets.

## Air Freight Carriers

- Important assets for the rapid distribution of high added value freight.
- Network configuration (airports serviced).

## Freight Forwarders

- Perform tasks such as packaging, labeling, and the consolidation of shipments on behalf of their customers.
- Operate distribution centers.
- Define how markets are serviced.
- Can subcontract to third-party providers.

# The Relevance of Logistics

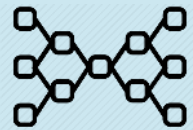
**Costs** ➡ **Friction of distribution**

- Efficient logistics has commercial benefits (costs, time and reliability).
- Logistics cost 10-15% of national GDP.

**Growth** ➡ **Growing material demand**

- Growth of global consumption and income.
- Diversity of consumption patterns.

**Complexity** ➡ **Complex value chains**



- Goods are getting more complex (parts and processes).
- Embeddedness of design, manufacturing, distribution and marketing.

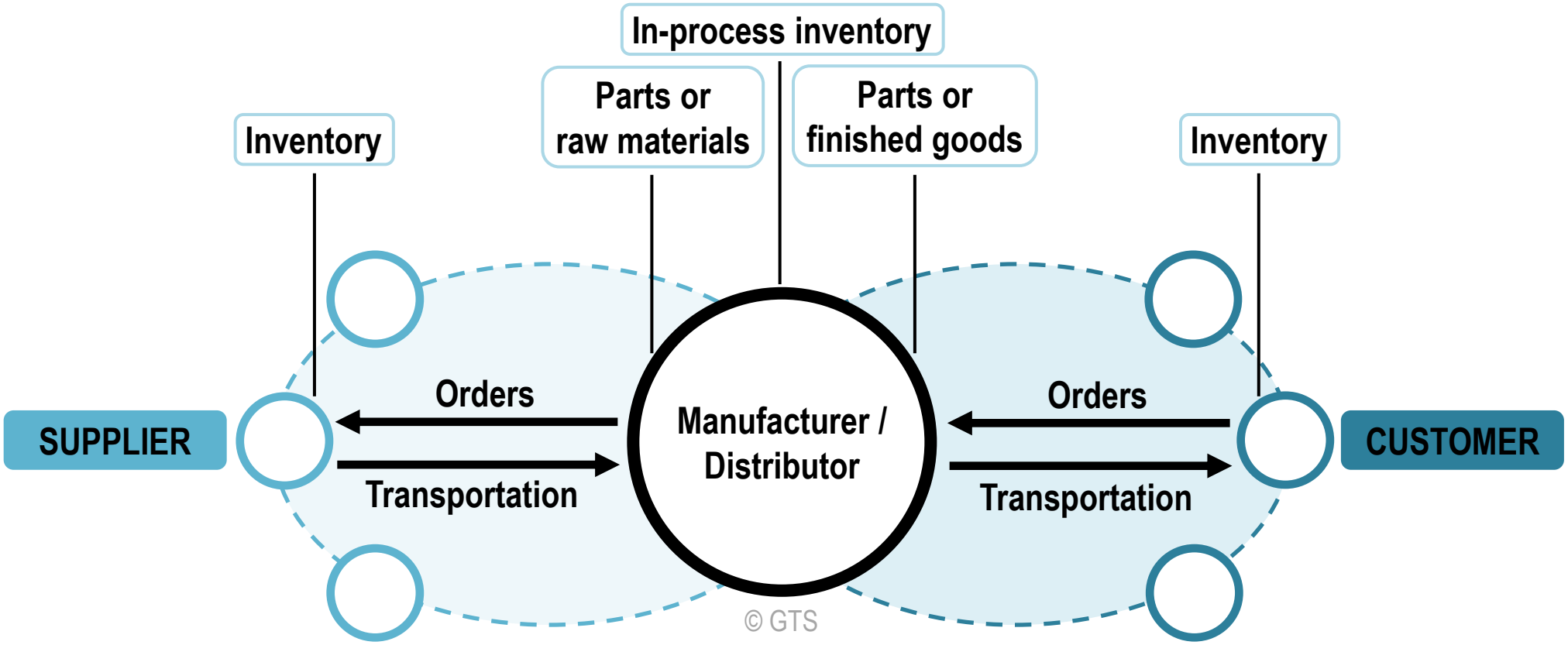
**Geography** ➡ **Spatial division of manufacturing**

- Stages of production are spatially separated.
- Final production and markets are spatially separated.

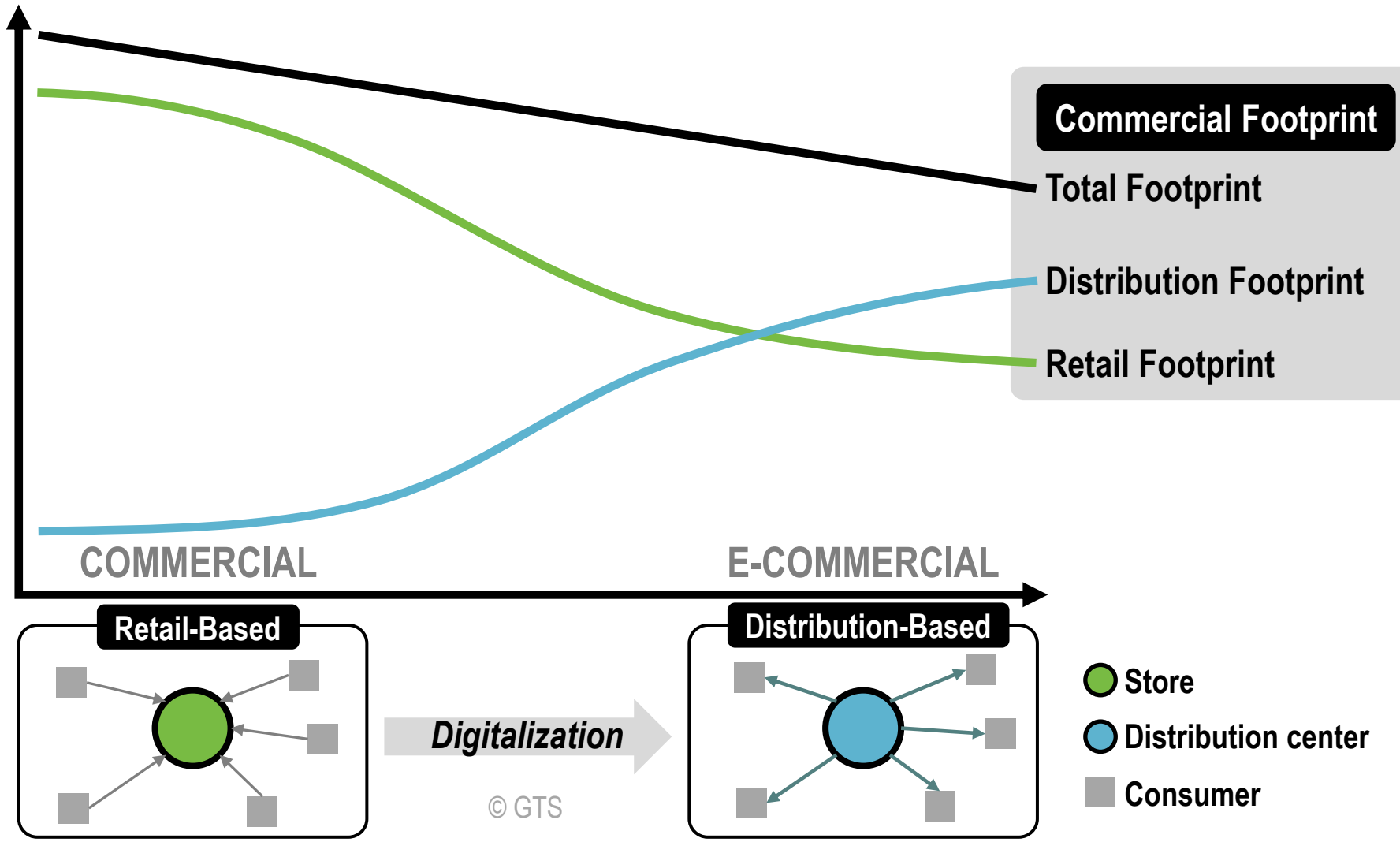
**Environment** ➡ **Sustainability**

- Energy and material efficiency.
- Reverse logistics / recycling.

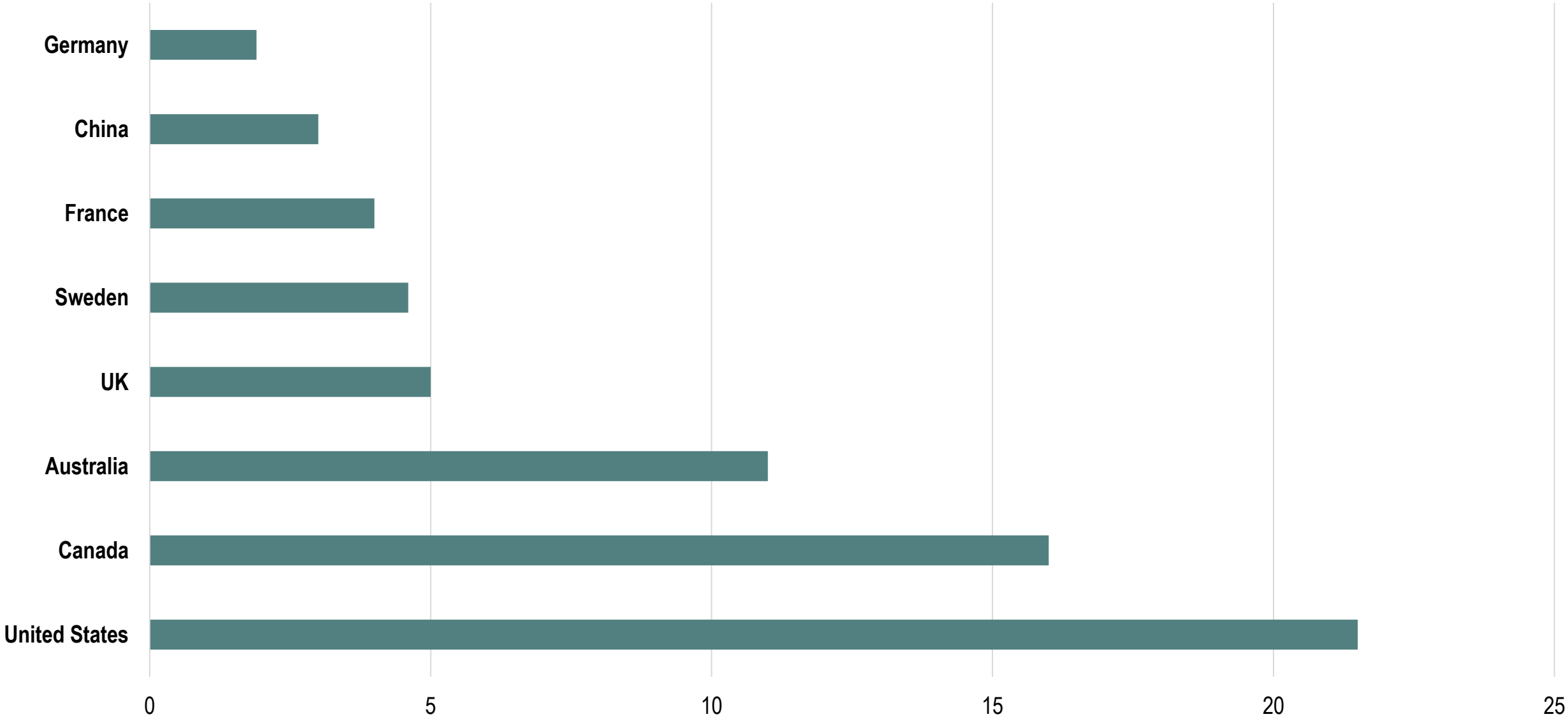
# The Nature of a Supply Chain



# Footprint of Retail-Based and Distribution-Based Commercial Activities



# Retail Space per Capita, 2017 (in square foot)



# Factors behind Empty Transport Flows