

The Geography of Transport Systems

Jean-Paul Rodrigue

Sixth Edition



Trade, Logistics and Freight Distribution

CHAPTER 7

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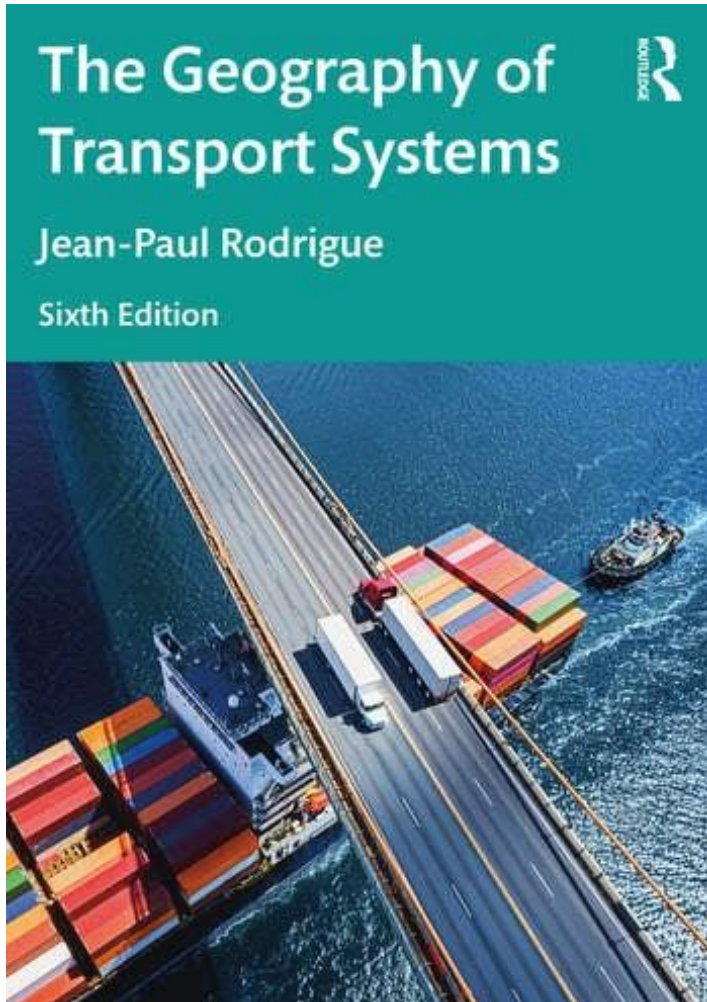
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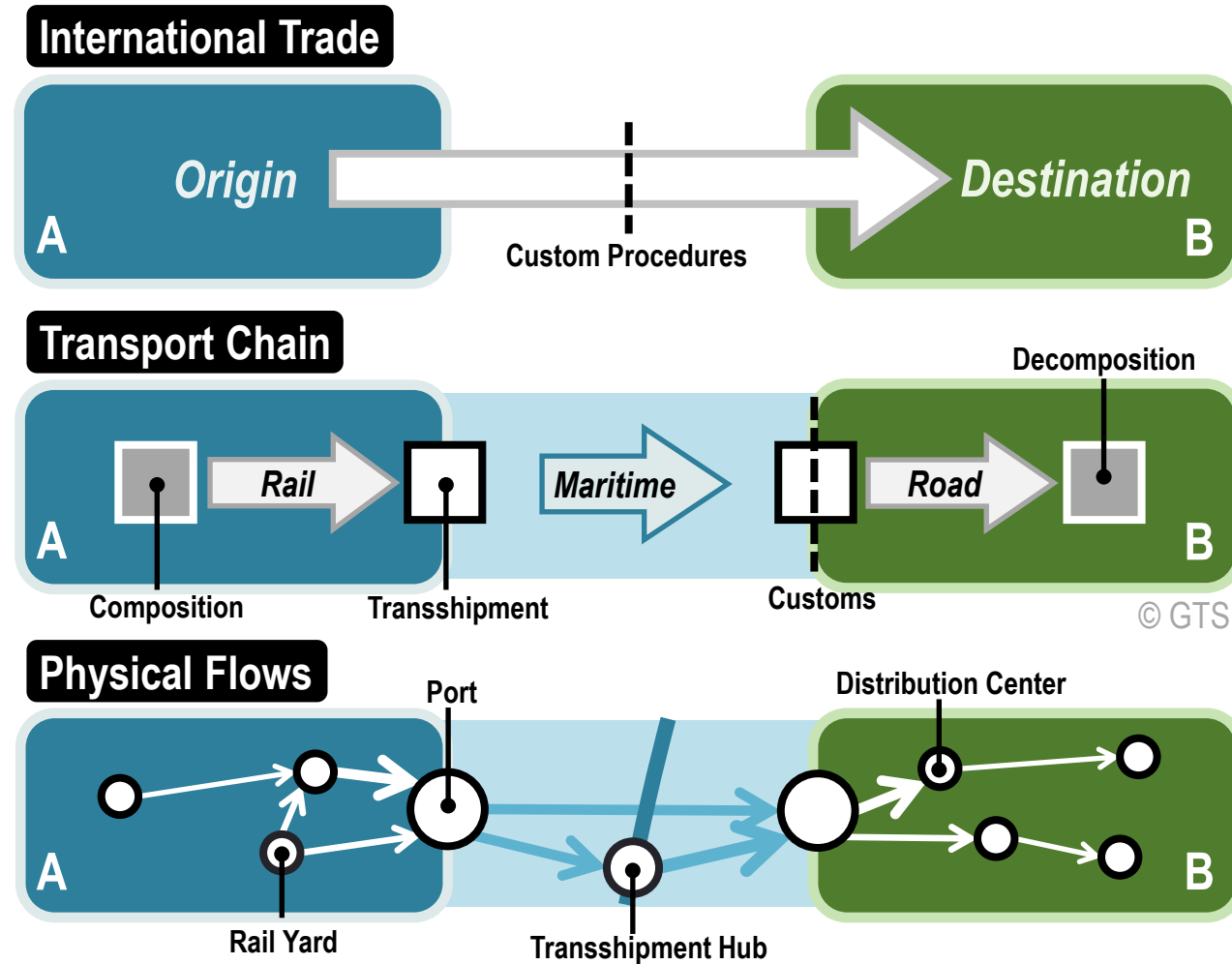
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- 7.4 - Logistics and Freight Distribution



Transborder Transportation

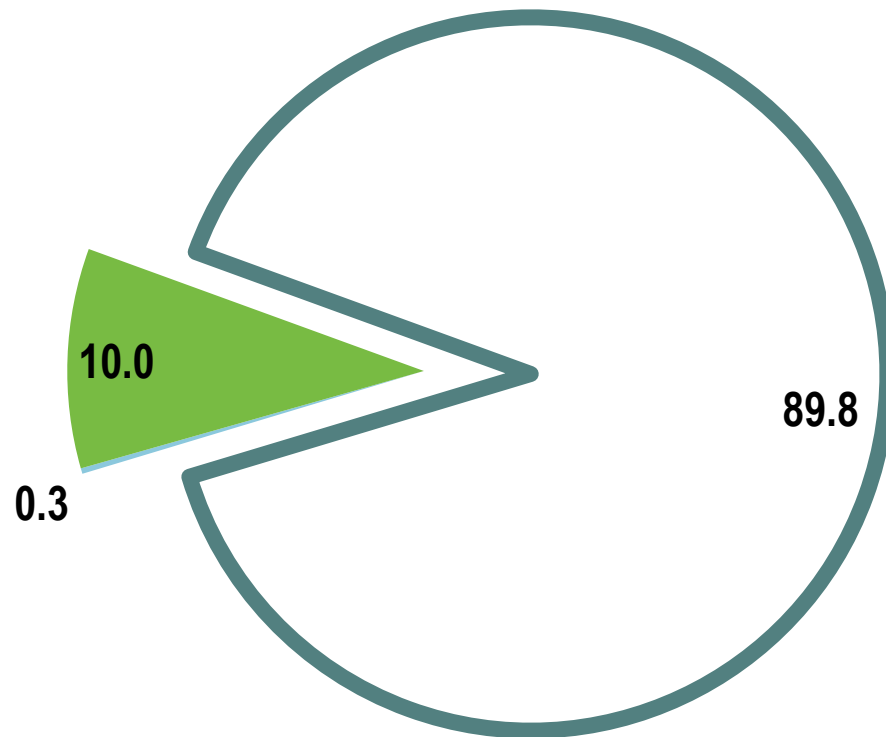
Chapter 7.1

International Trade, Transportation Chains and Logistics



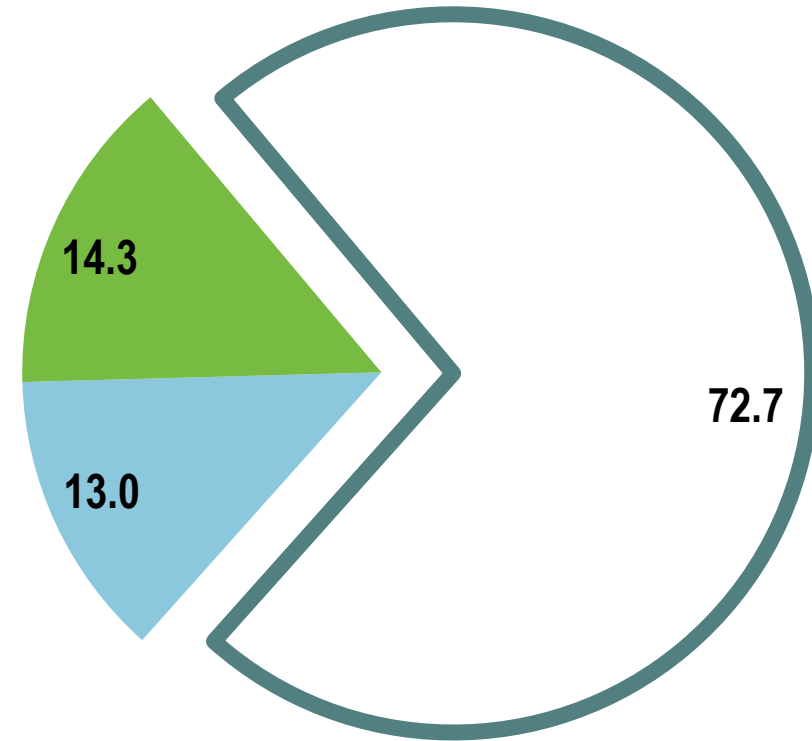
Modal Shares of World Trade by Volume and Value, 2008

Volume of World Trade



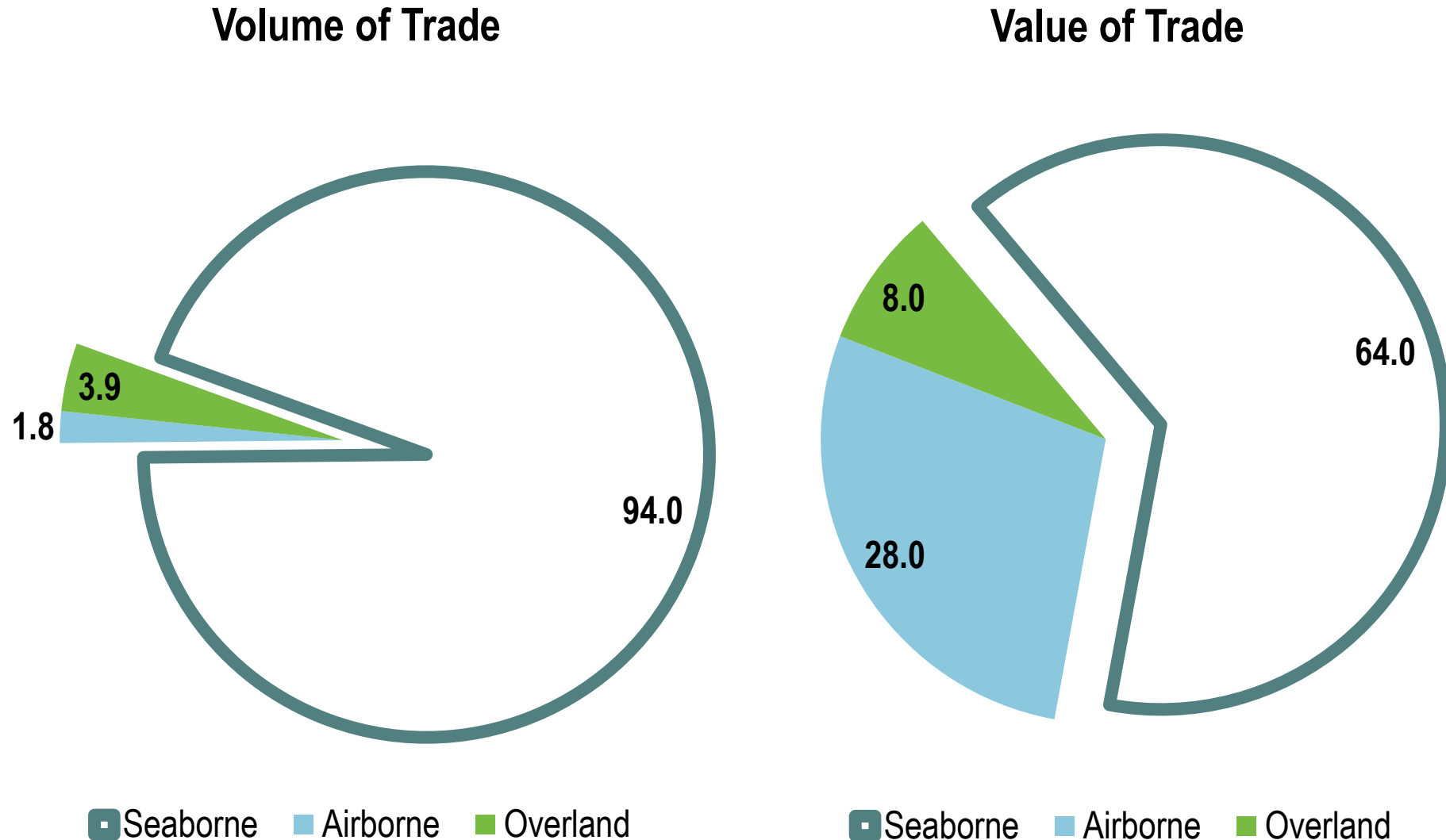
■ Seaborne ■ Airborne ■ Overland

Value of World Trade



■ Seaborne ■ Airborne ■ Overland

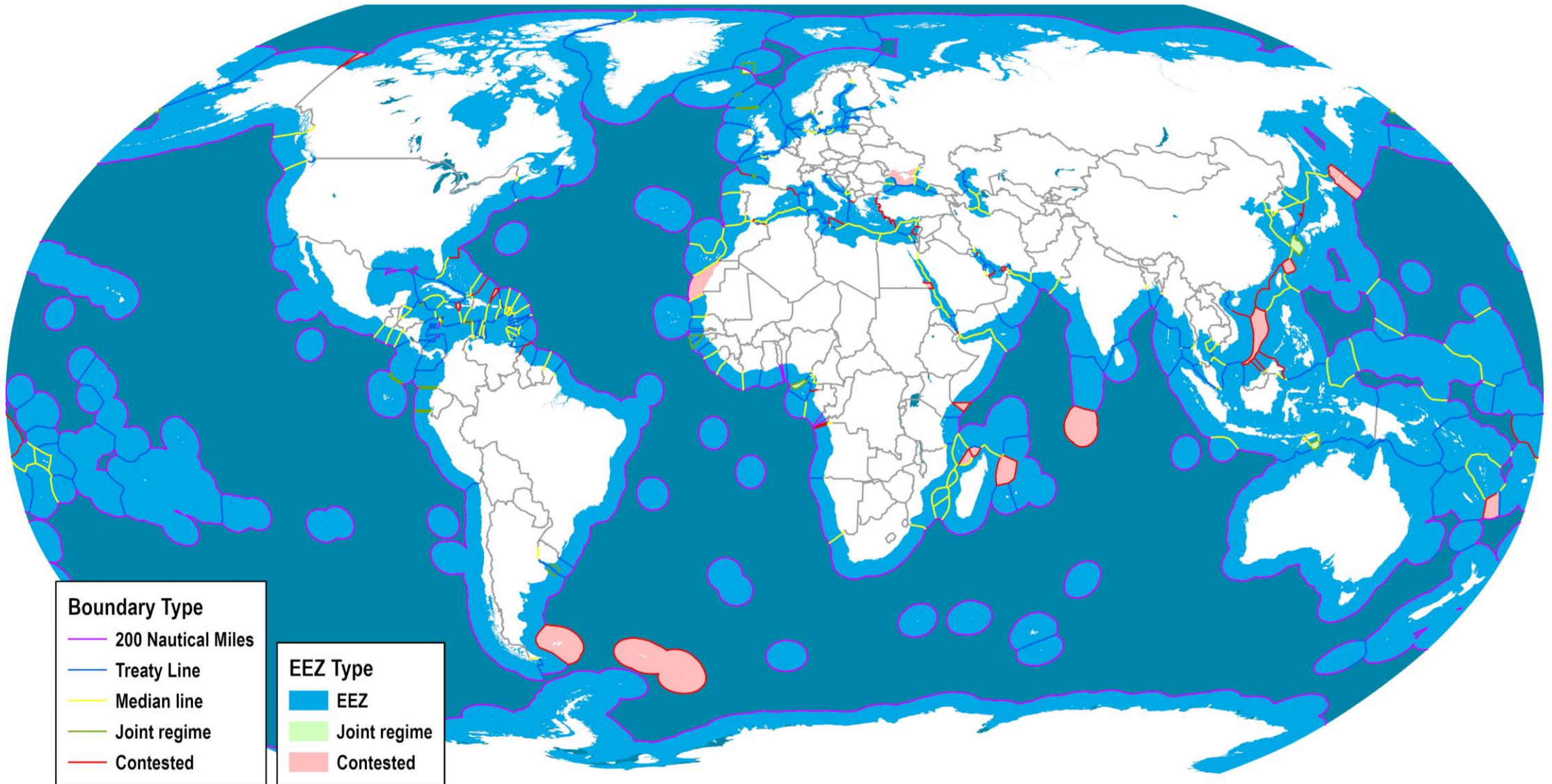
Modal Shares of China Trade with Europe by Volume and Value, 2016



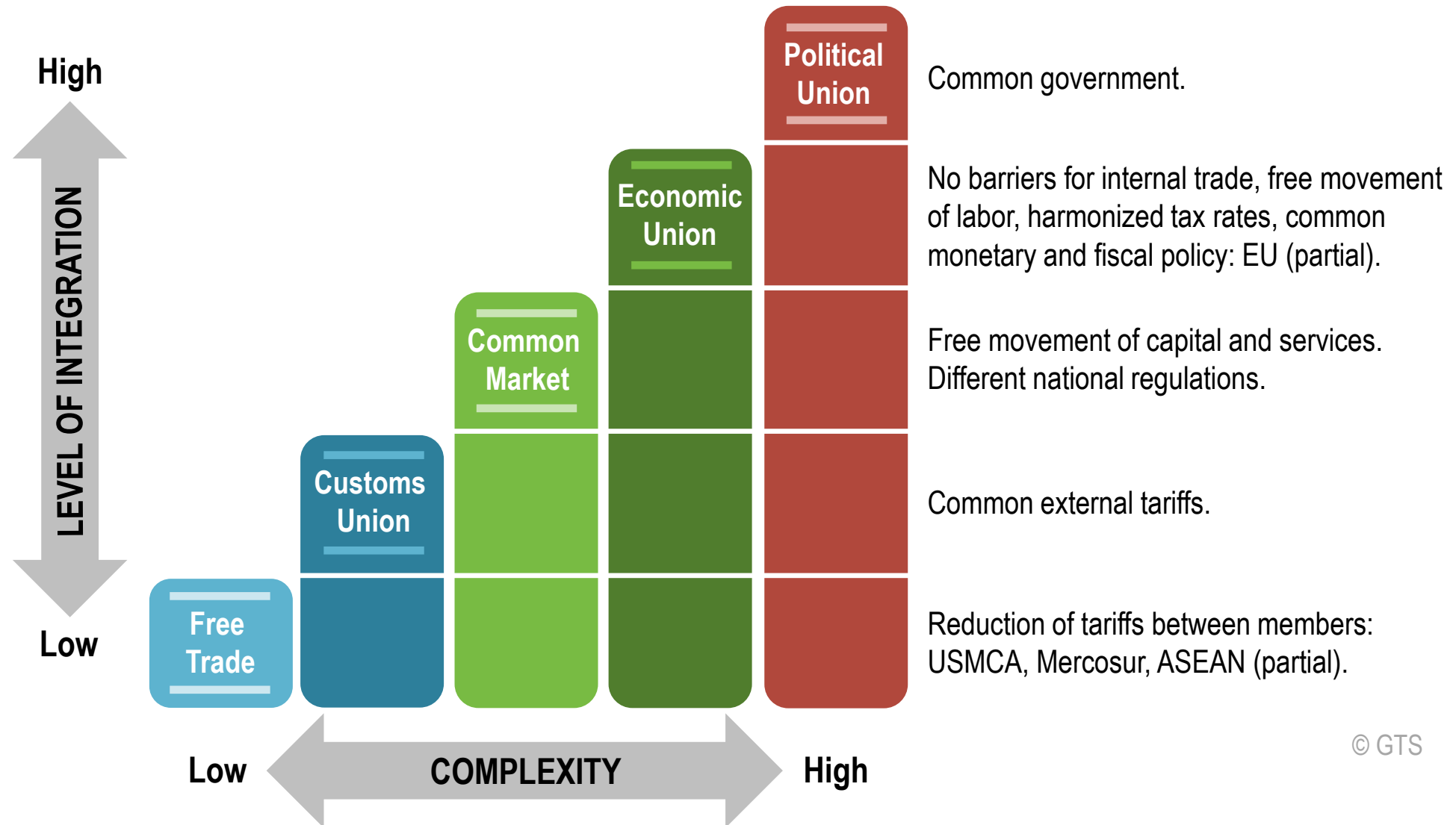
Geostrategy of International Transportation

Perspective	Issues
Conquest	Acquire and conquer oceans, territories and resources. Maritime and railroad technology.
Competition	Mean to compete on the global economy. Prevalent force in shaping modern transportation systems. Right to carry national passengers and freight.
Jurisdiction	Subject to national rules and regulations. Territorial sea (22 km); complete jurisdiction. Exclusive Economic Zone (340 km); access to resources.
Cooperation	Common interests favor agreements. Involving access to infrastructures or setting standards (river navigation, rail gauge, trade agreements, transborder transportation).
Control	Controlling strategic locations. Reduce vulnerability to disruptions.

Exclusive Economic Zones

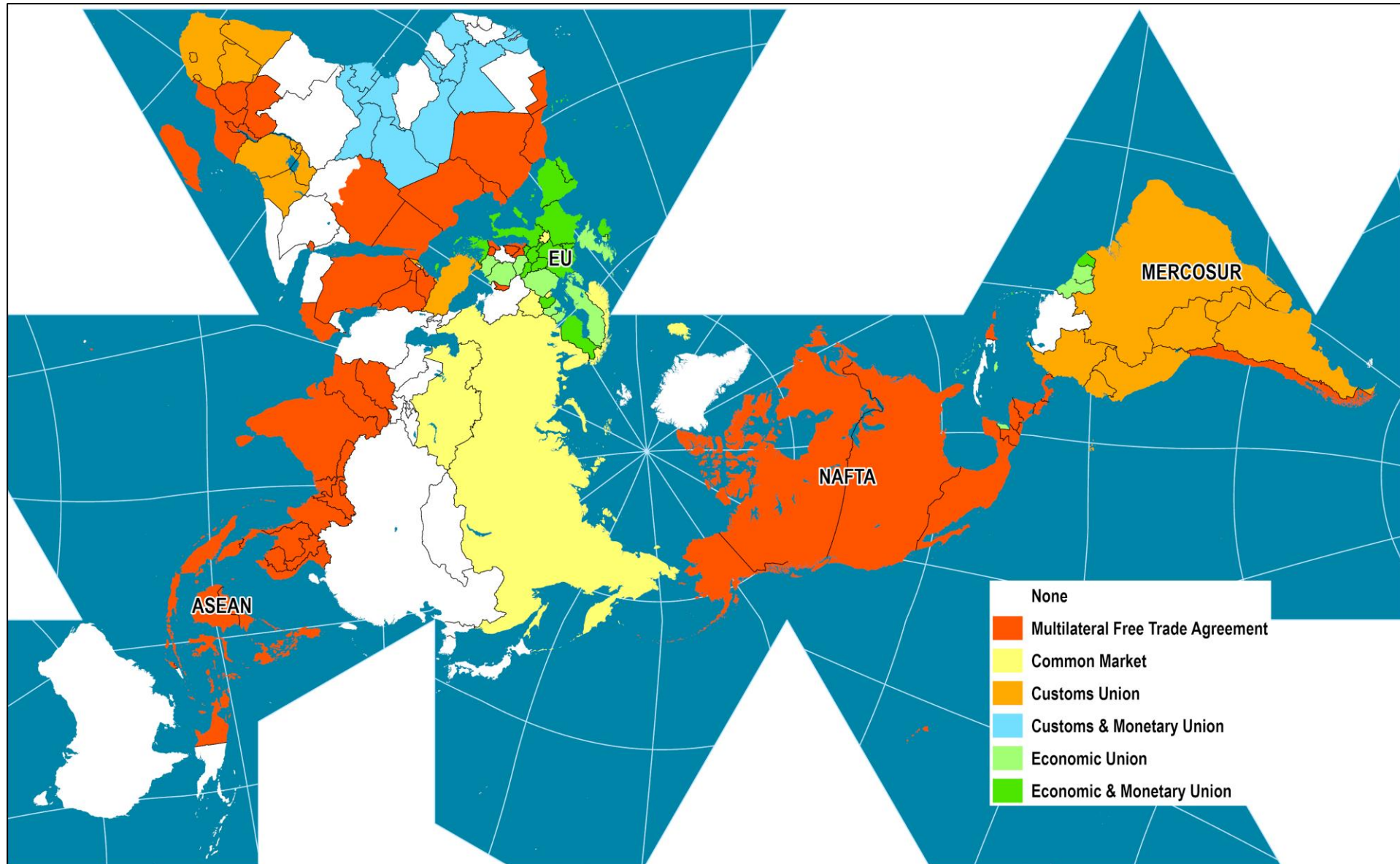


Levels of Economic Integration

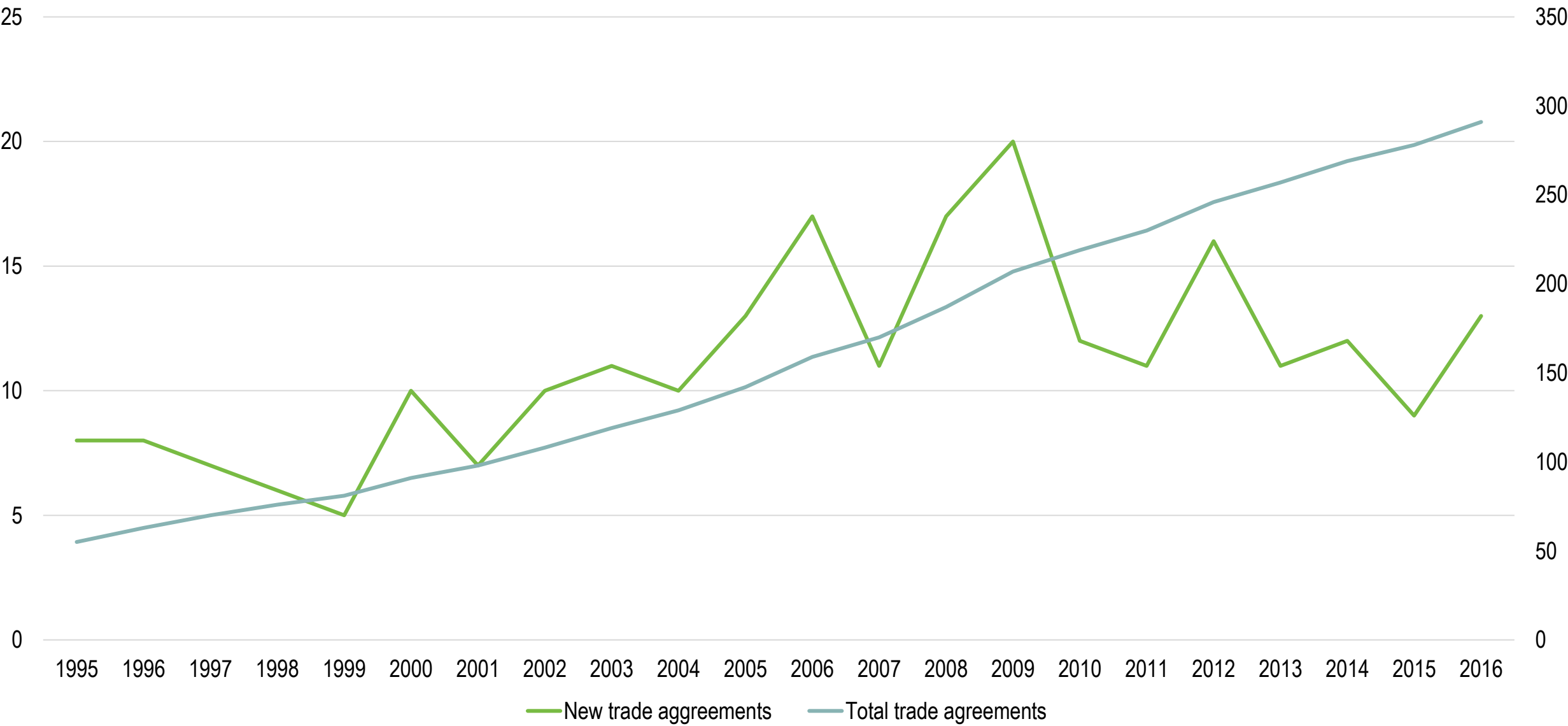


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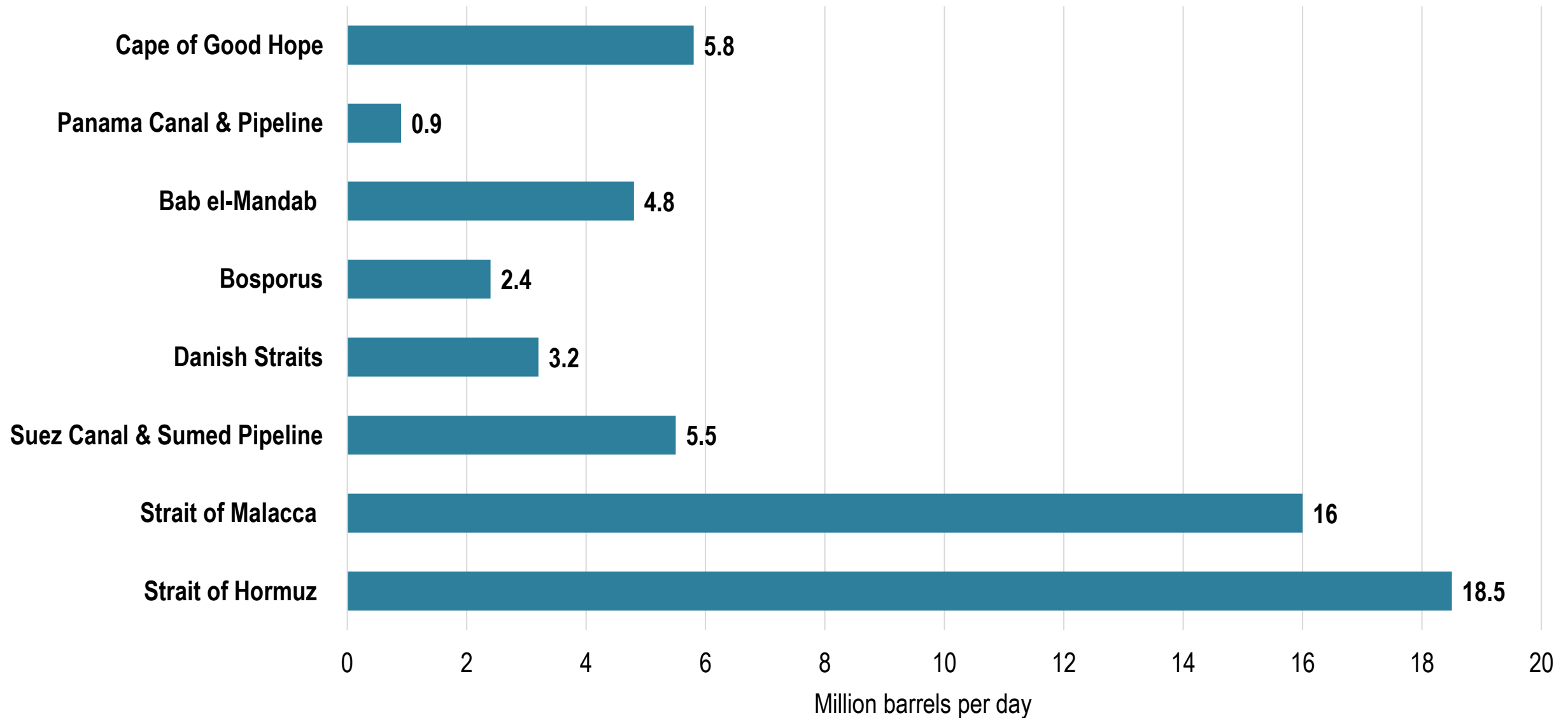
Economic Integration Levels, 2015



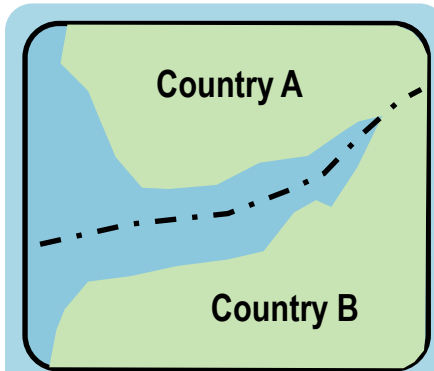
Number of Regional Trade Agreements on Customs and other Trade Facilitation Measures, 1995-2016



Oil Transited at Major Strategic Locations, 2016

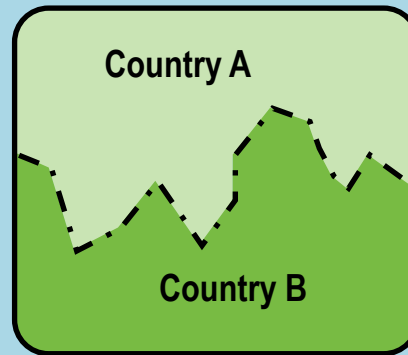


Types of International Boundaries



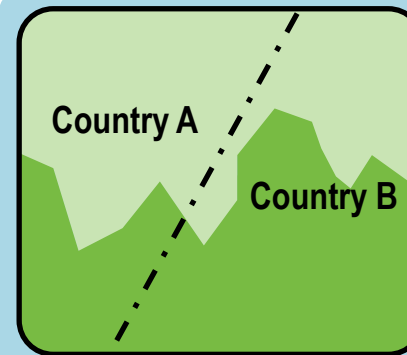
ANTECEDENT

- Pre-existing.
- Commonly corresponds to a physical feature.
- Rivers, Bays, Lakes, Mountains.



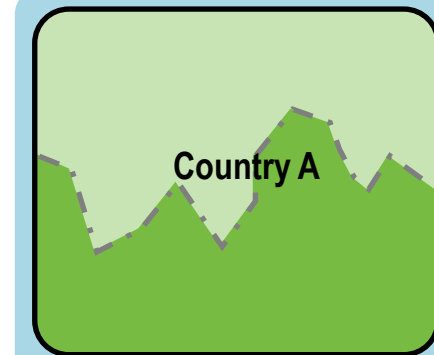
SUBSEQUENT

- Set after the settlements of different groups meet.
- Often correspond to their respective ecumene.



SUPERIMPOSED

- Boundary is imposed by an outside force (treaty).
- May not reflect existing cultural landscape.

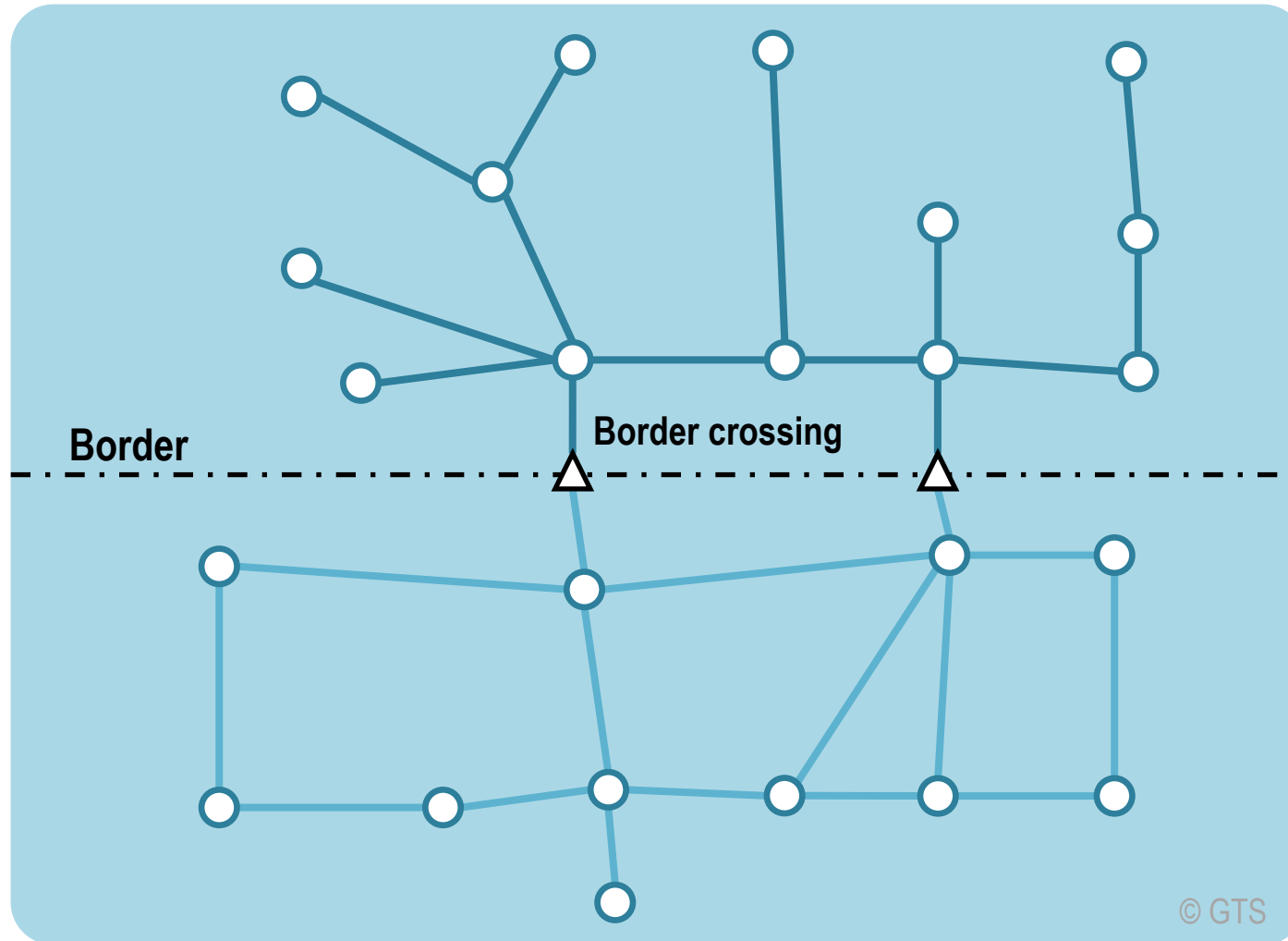


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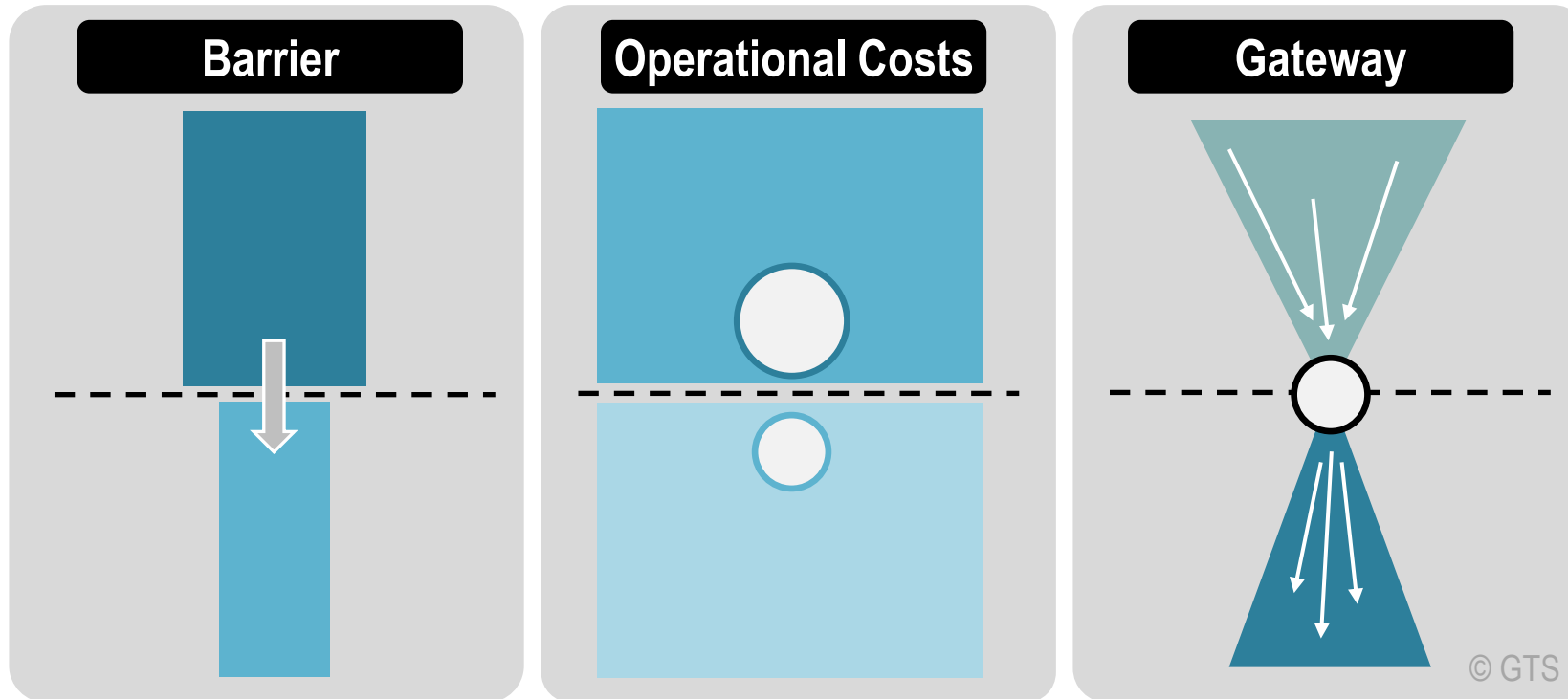
- No longer a boundary.
- Often the outcome of political changes.
- Still a visible imprint on the landscape.

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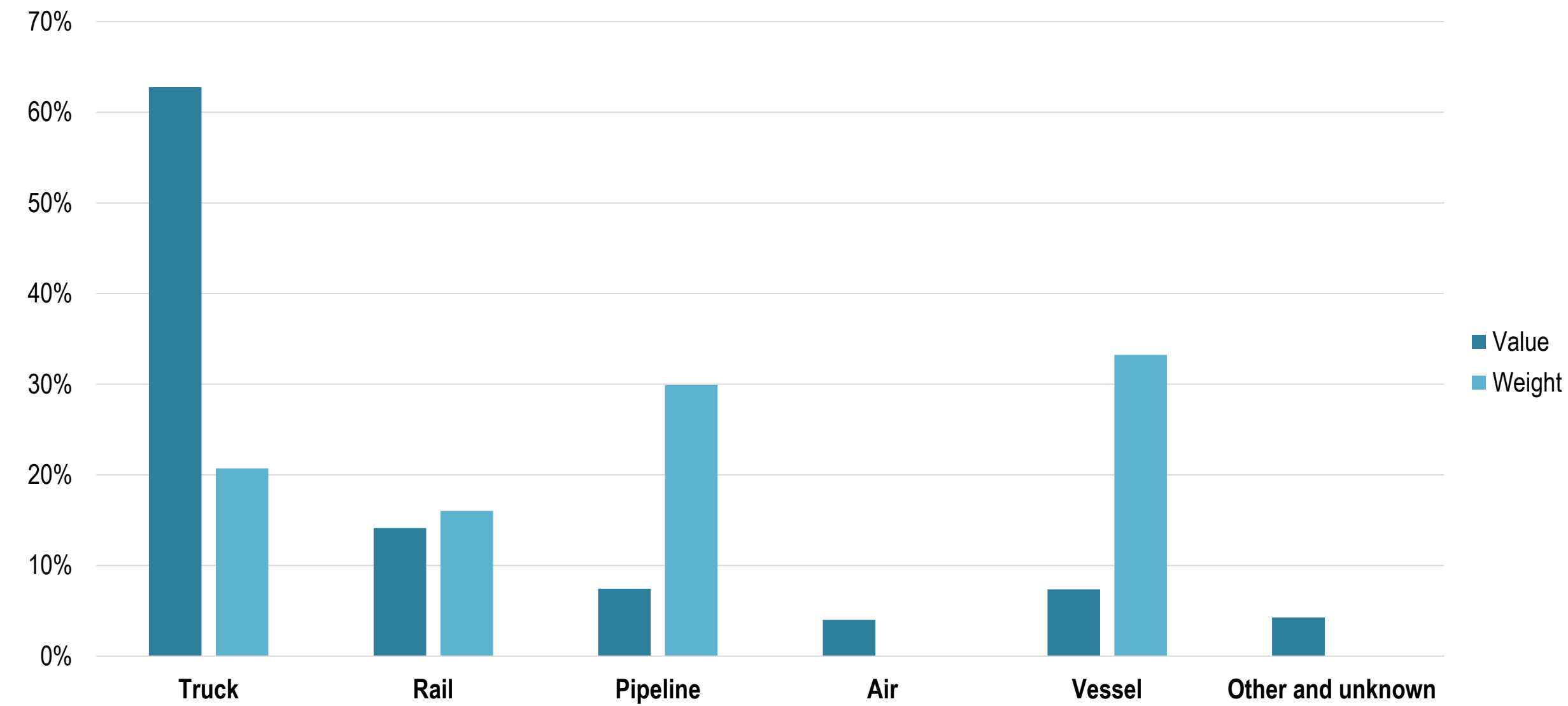
The Effect of a Border on a Transportation Network



The Effect of a Border on Freight Distribution



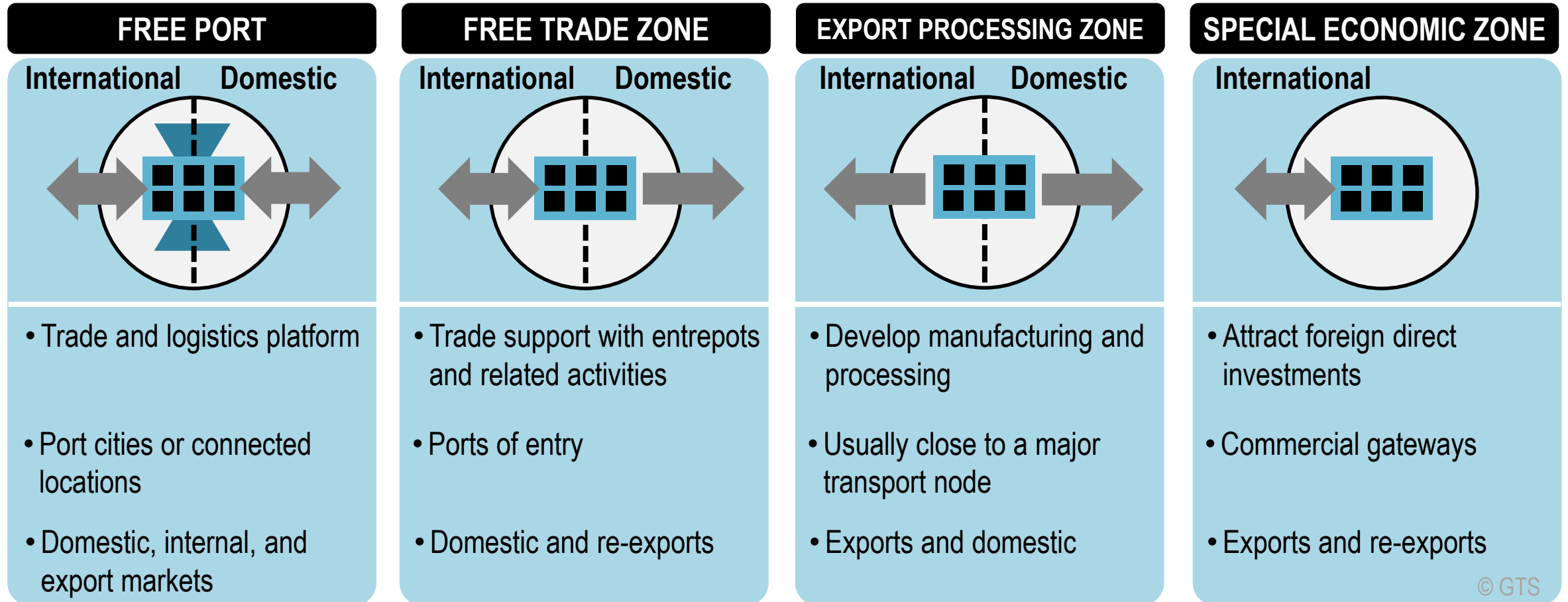
Cross-Border North American Freight by Mode, 2021



Types of Free Zones

Type	Function	Location	Markets
Free Port	Trade and logistics platform	Port cities or connected locations	Domestic, internal and export markets
Free Trade Zone	Trade support with entrepots and trade-related activities.	Ports of entry	Domestic and re-exports
Export Processing Zone	Develop manufacturing and processing	Varied, usually close to a major transport node	Exports and domestic
Special Economic Zone	Attract foreign direct investments	Commercial gateways	Exports and re-exports

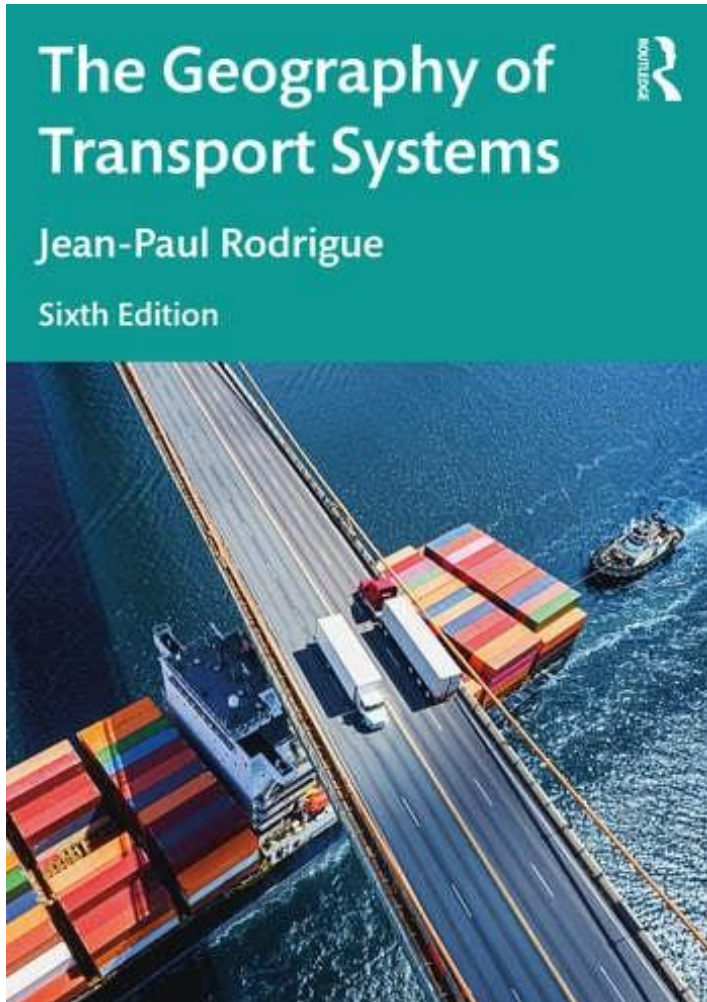
Types of Free Zones



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Specialized Free Zones

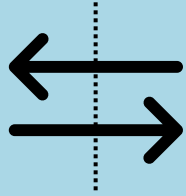
Type	Function	Location	Markets
Technology or Science Parks	Promote technology and scientific industries	Adjacent to universities and research institutes	Domestic and export
Energy Zones	Promote energy industries	Petrochemical hubs or energy sources	Domestic and export
Financial Services	Development of off-shore financial services	Varied	Export
Software and Internet	Development of information technologies	Adjacent to universities, urban areas	Export
Airport-based	Air cargo trade and handling	Connected airports	Re-export and domestic
Tourism	Integrated tourism development	Touristic amenities	Export and domestic
Logistics Parks	Support warehousing and transshipment	Near transport hubs	Re-export



Globalization and International Trade

Chapter 7.2

The Concept of International Trade



EXCHANGE

- Exchange of goods or services across national jurisdictions.
- Trade between US states is not international trade.



DIRECTIONAL

- Inbound trade: imports.
- Outbound trade: exports.

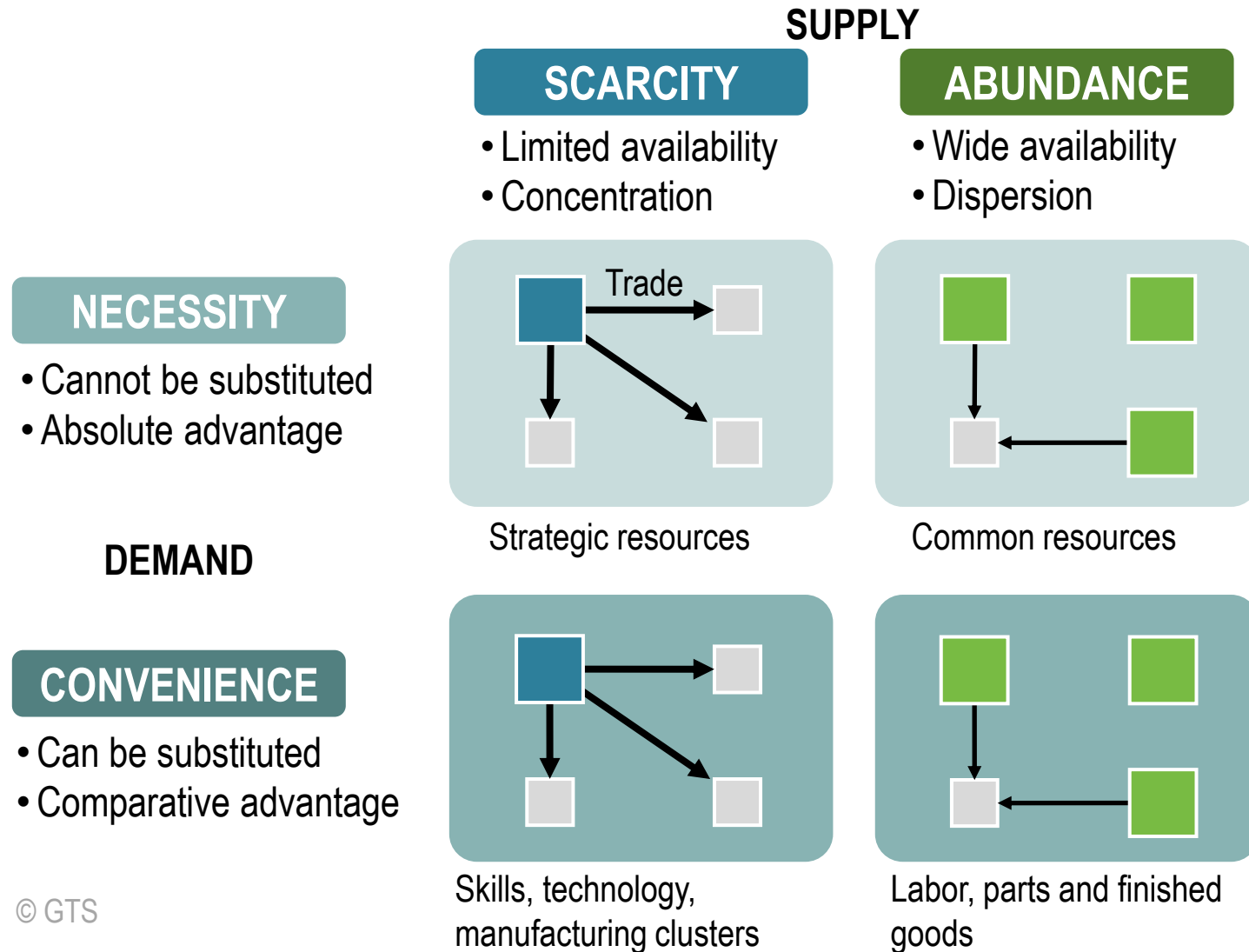


REGULATORY OVERSIGHT

- Customs and tariffs.
- States control what crosses their borders.

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The Rationale for Trade



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The Benefits of Trade in a Global Economy



ECONOMIC EFFICIENCY

- Sell what is produced in surplus and acquire what is lacking.
- Lower productions costs (cheaper inputs).
- Achieve economies of scale (larger markets).



ACCESSIBILITY

- Large variety of resources being made accessible.
- Raw materials, energy, goods, food and labor.
- Exchanges of capital, goods, raw materials and services.

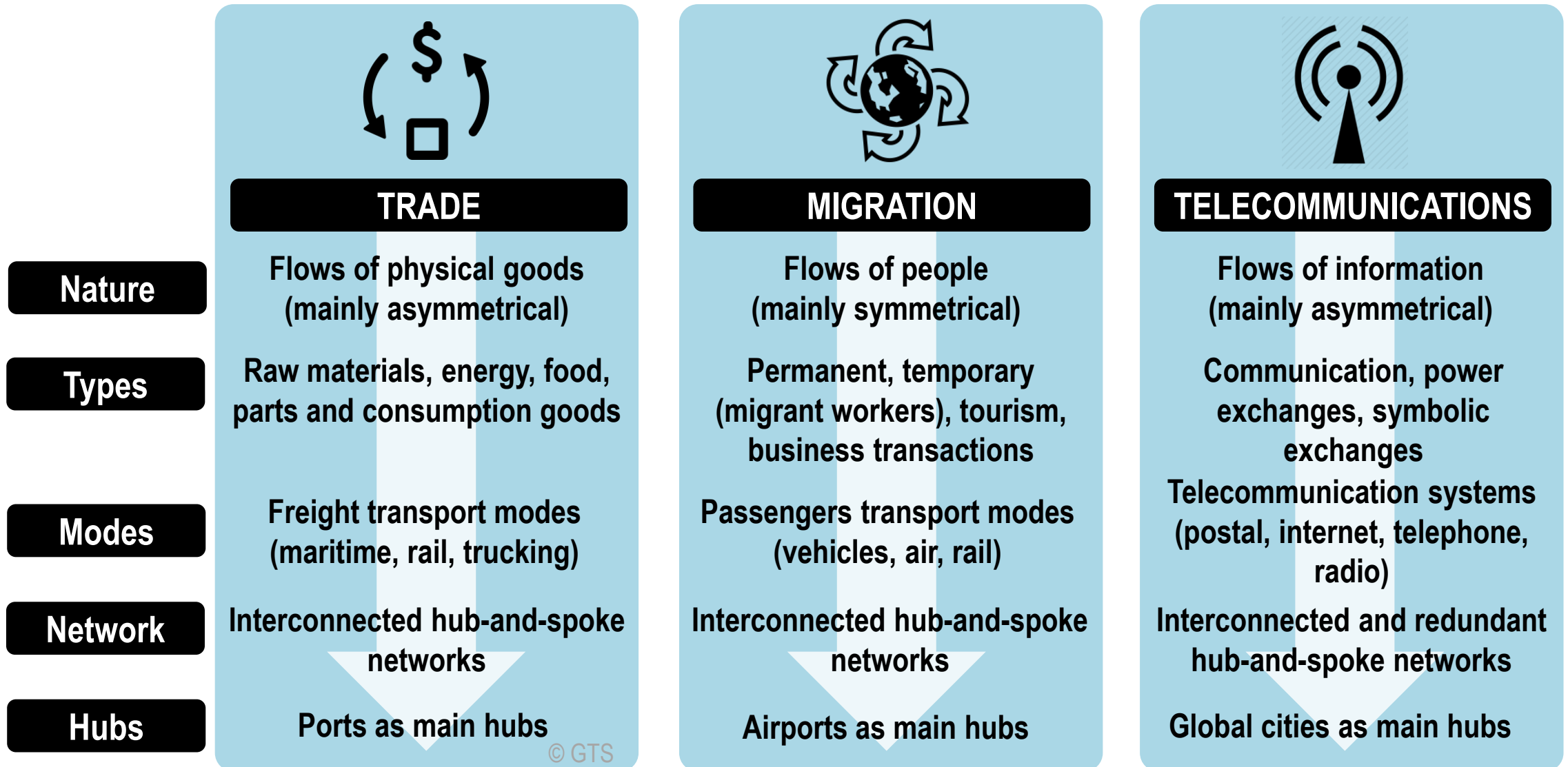


INTERDEPENDENCIES

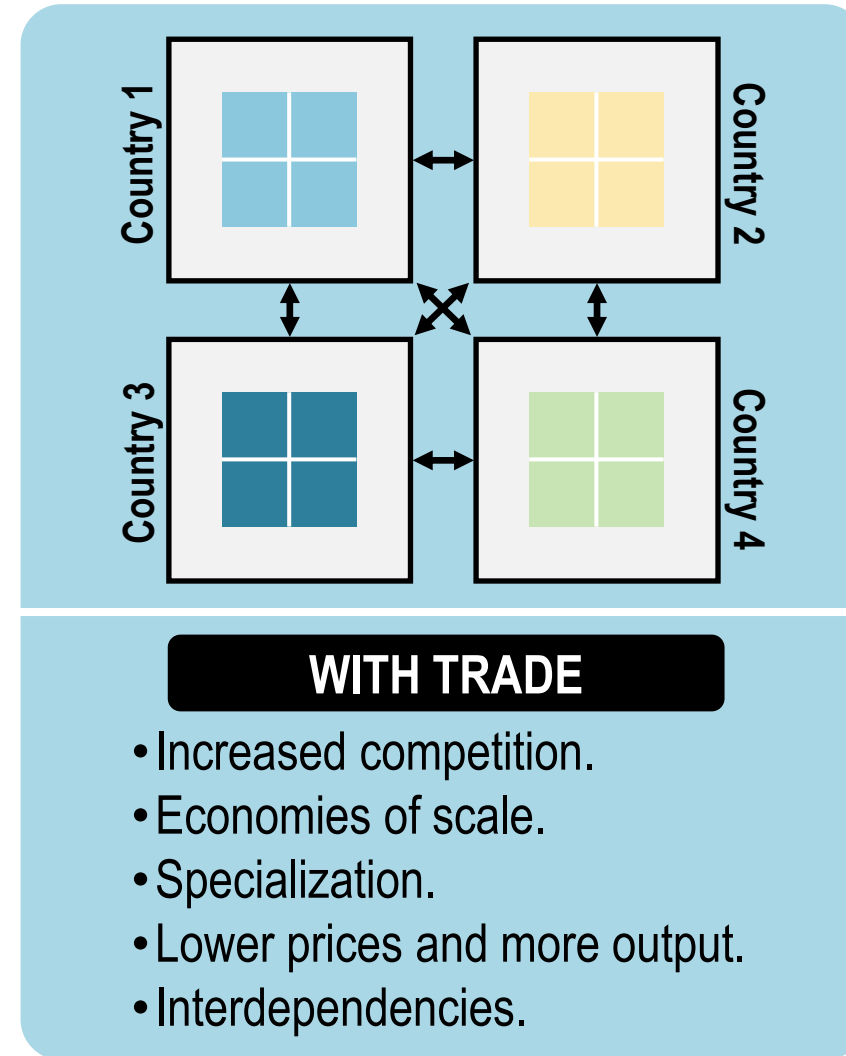
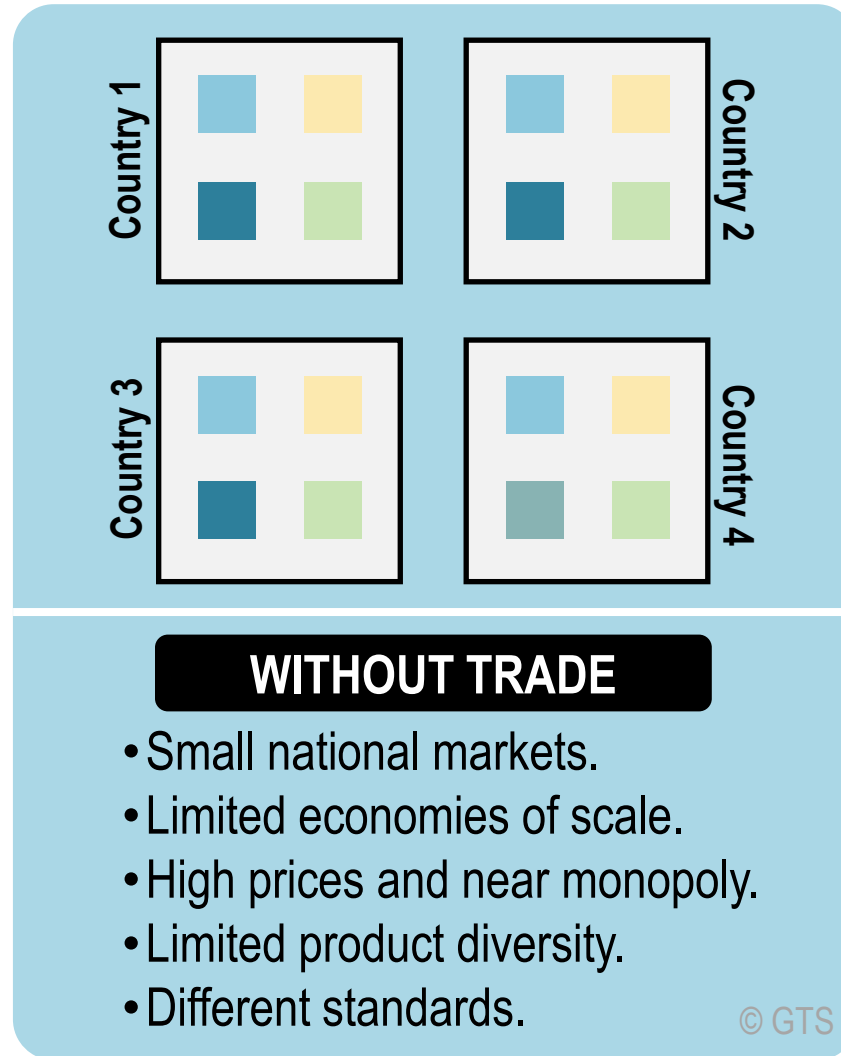
- Spatial interdependencies between elements of the world-system.
- The more integrated economies are, the more they trade.
- Promote harmonious relations / Risk of dependency.

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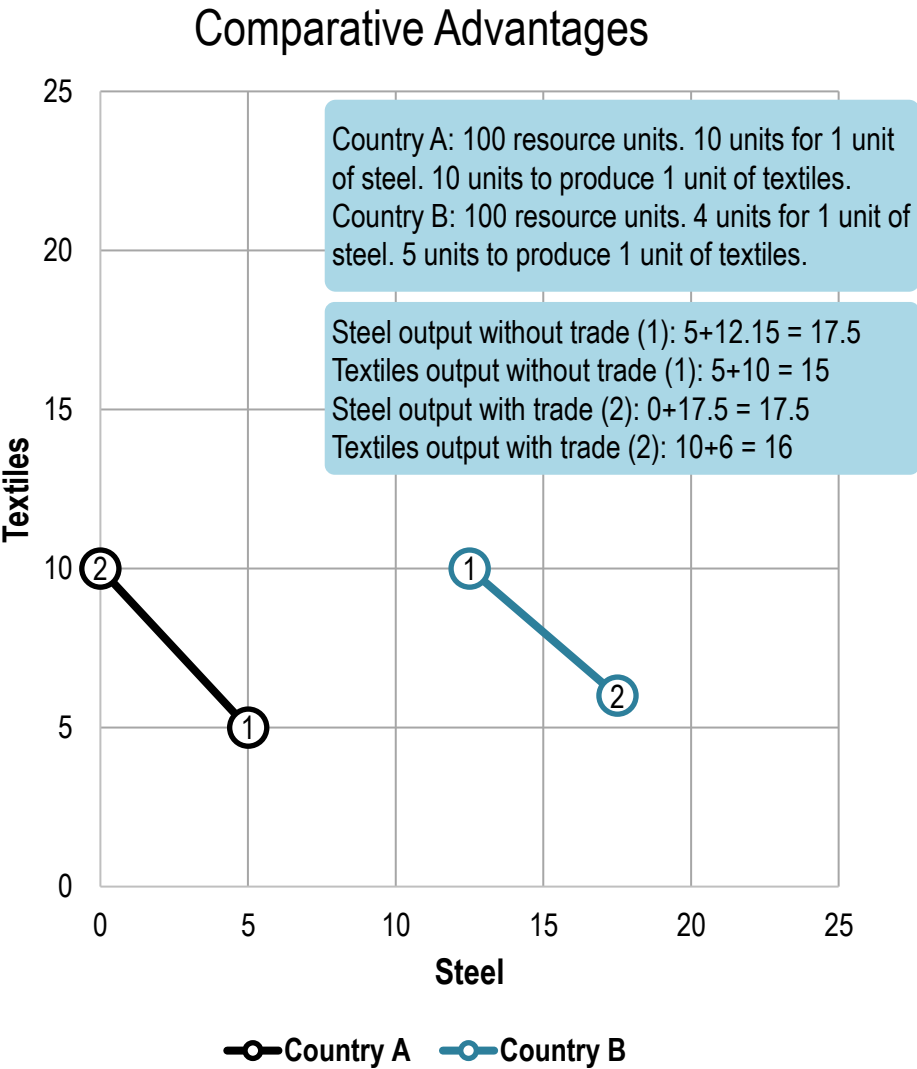
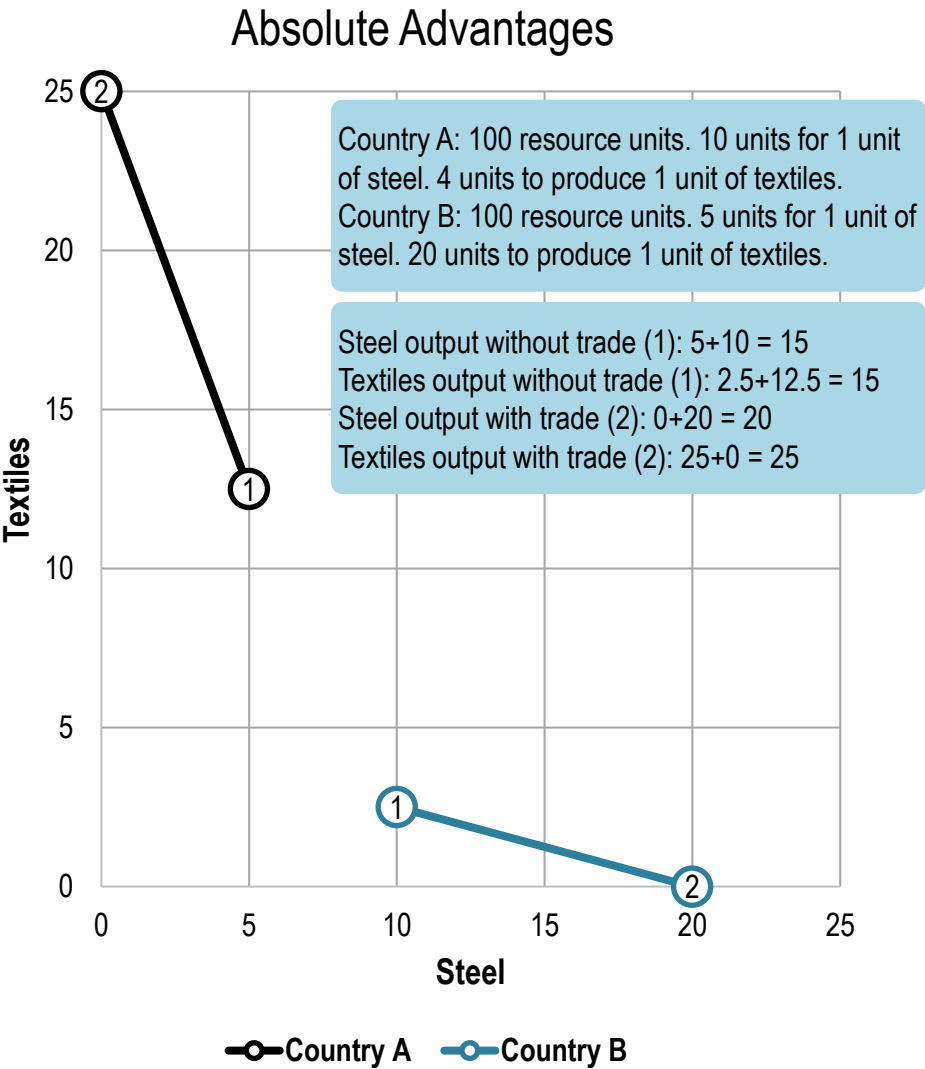
The Flows of Globalization



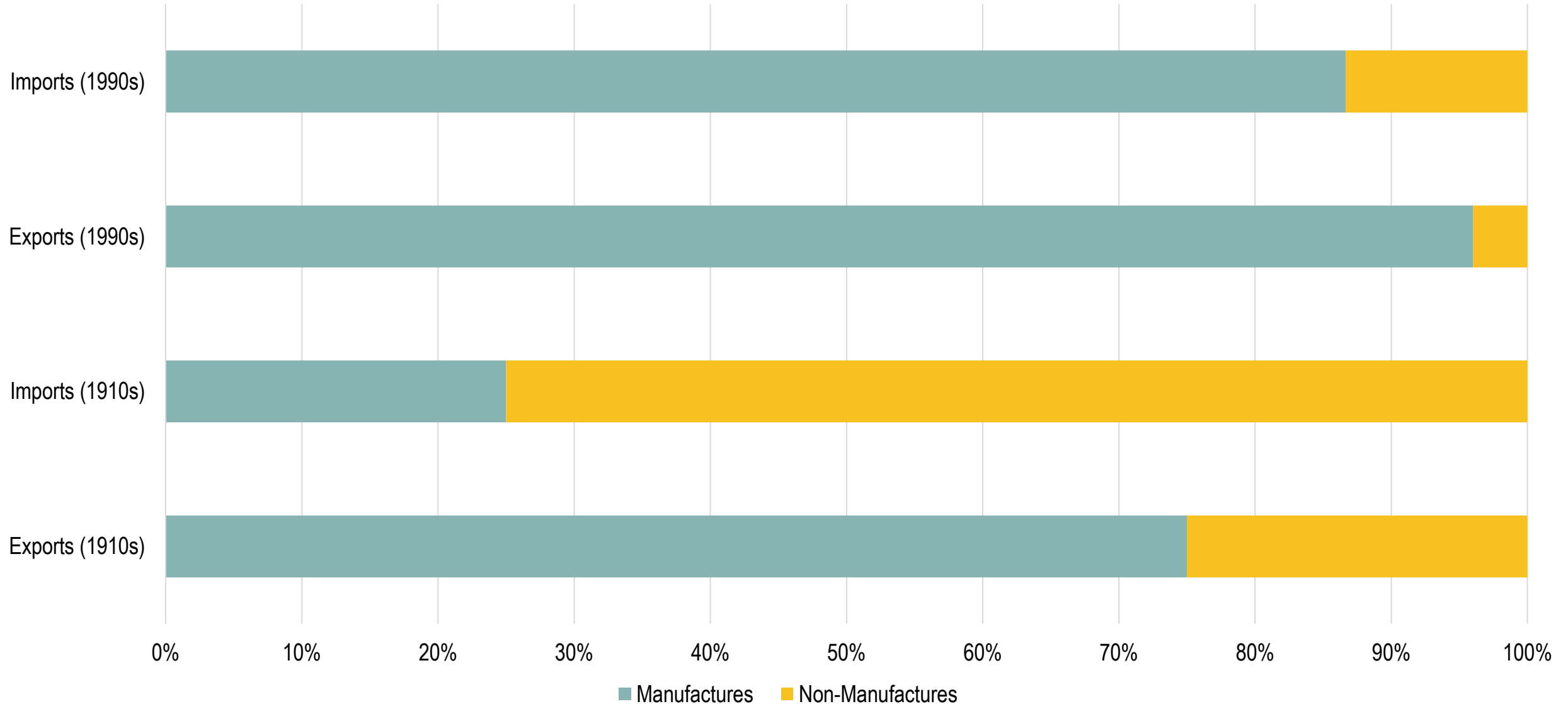
Economic Rationale of Trade



Absolute and Comparative Advantages



Composition of British Trade, 1910s and 1990s



The Main Theoretical Foundations of International Trade

ABSOLUTE ADVANTAGES

- Produce more effectively in an economic sector while using less resources.
- A nation can focus on its absolute advantages, trade its surplus and import what it lacks.
- Mostly relates to resources such as energy.

COMPARATIVE ADVANTAGES

- A nation can focus on the sectors it has the highest comparative advantages.
- A nation having no absolute advantages can focus on sectors where the total productivity gains are the most significant.
- Mostly relates to the manufacturing sector.

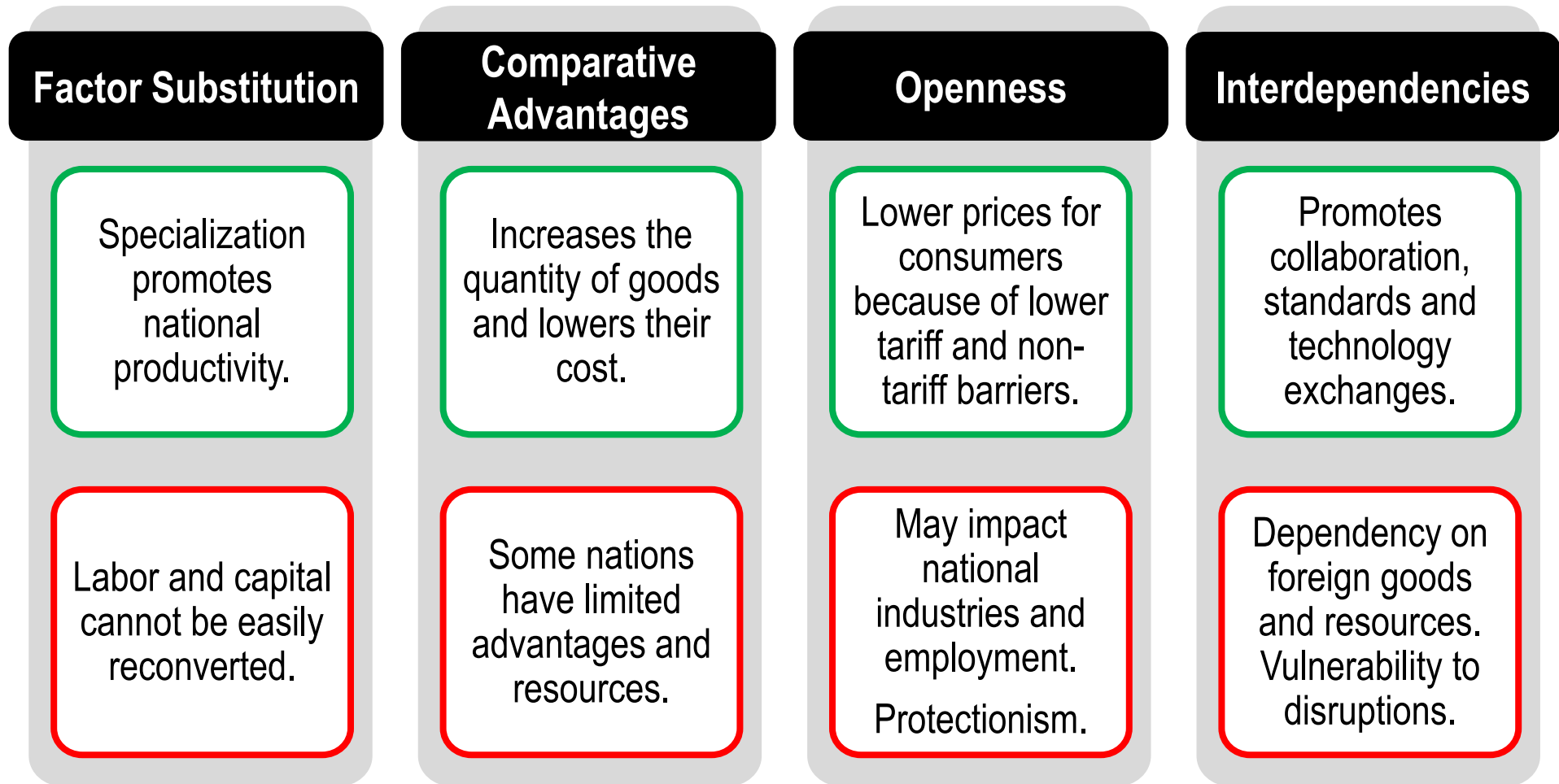
FACTORS ENDOWMENTS

- Trade related to endowments such as capital, land and labor.
- Export goods to which it has notable factor endowments and imports goods in which it has scarce factor endowments.
- Factors can be improved through policy and investments.

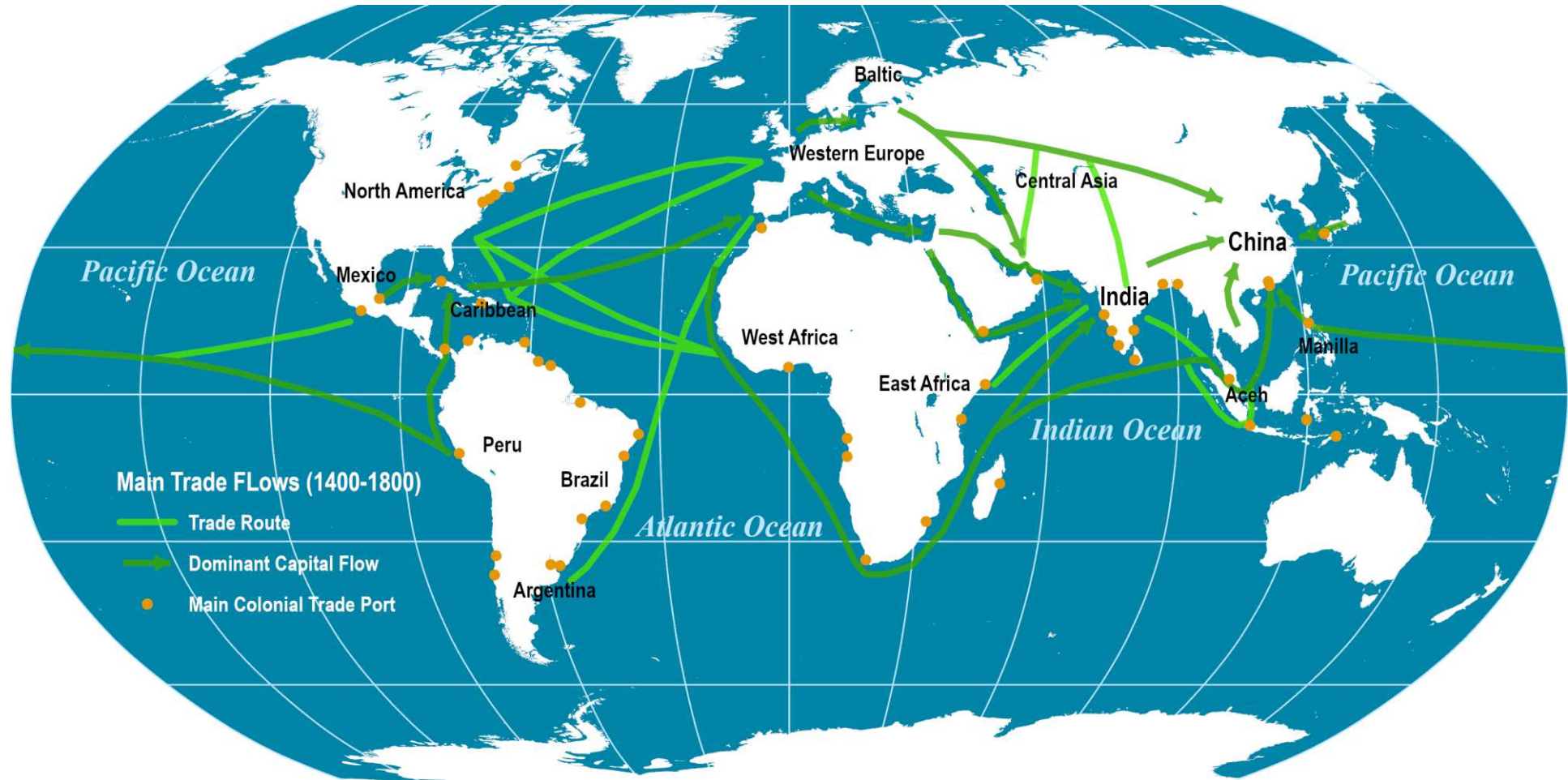
NEOMERCANTILISM

- Controlling trade to meet economic development goals.
- Tariff and non-tariff measures regulating trade and protecting national commercial sectors and enterprises.
- Strategy pursued by several export-oriented economies (Japan, Korea, China).

Favorable and Contentious Factors in International Trade



Major Global Trade Routes, 1400-1800



Standard International Trade Classification (SITC)

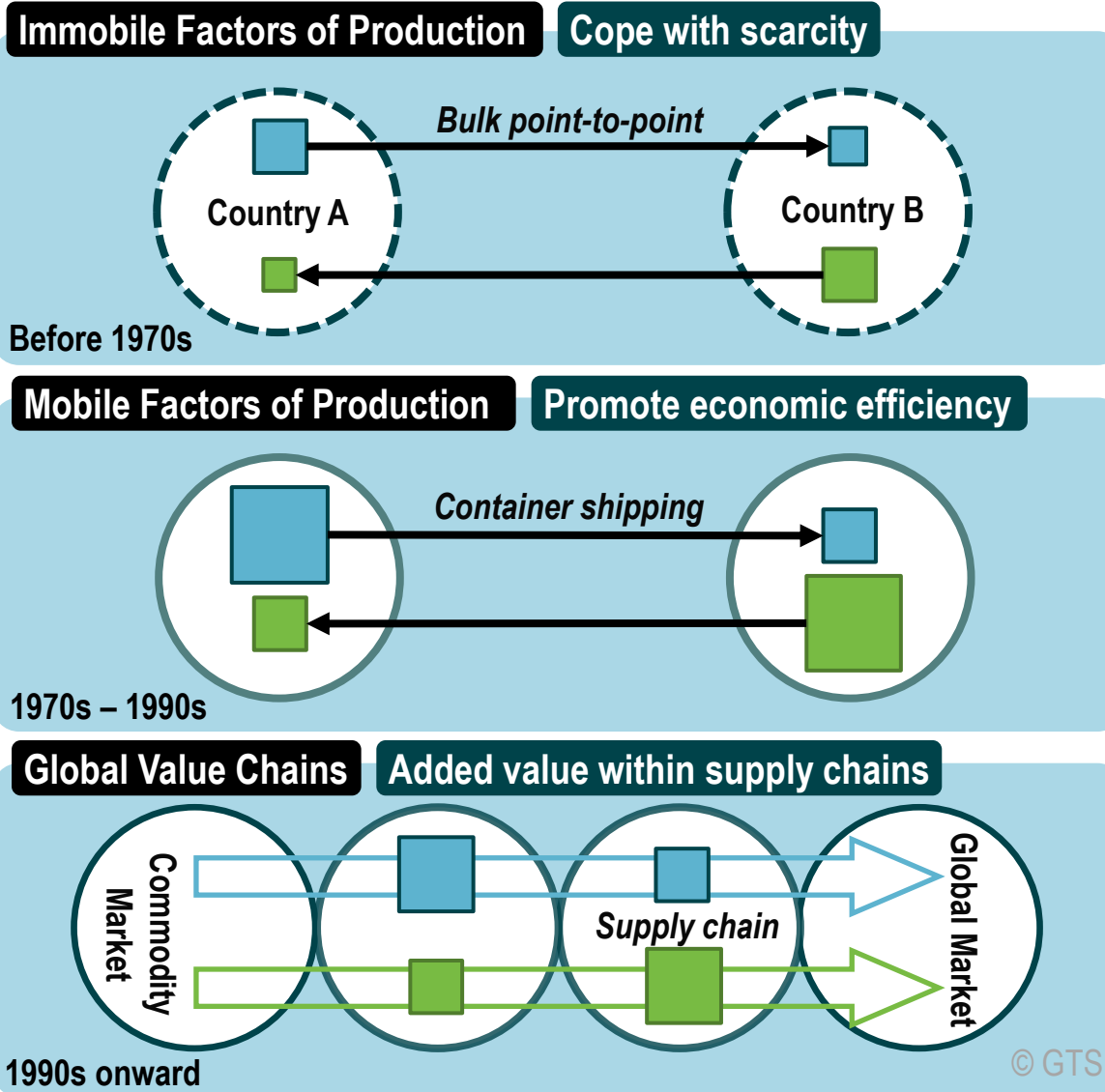
SITC Class	Category	Examples
0	Food & Live Animals	Meat (01), Fish (03), Wheat (041), Rice (042), Corn (044), Orange juice (0591), Sugar (0611), Coffee (071), Cocoa (072), Tea (0741)
1	Beverages & Tobacco	Wine (1121), Beer (1123), Tobacco (12)
2	Raw Materials	Rubber (23), Cotton (263), Iron ore (281)
3	Fuels & Lubricants	Coal (32), Crude oil (333), Kerosene (3342), Natural gas (343)
4	Animal & Vegetable Oils	Olive oil (4214), Corn oil (4216)
5	Chemicals	Salt (52332), Fertilizers (56), Plastics (57)
6	Manufactured Goods	Paper (64), Textiles (65), Cement (661), Iron & Steel (67), Copper (682)
7	Machinery & Transport Equipment	Computer equipment (752), Televisions (761), Cars (781)
8	Miscellaneous Manufactures	Furniture (82), Clothes (84), Footwear (85), Cameras (88111), Books (8921), Toys (894)
9	Others	Postal packets (91)

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Changes in the Global Trade Environment

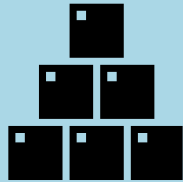


Main Trends in the Structure of Global Trade



GLOBAL VALUE CHAINS

- Trade in intermediary goods (parts) increasing.
- Growing share of developing economies.



MANUFACTURED GOODS

- Growing share of manufactured goods, including parts.
- Trade cycles impacted by recessions.



REGIONALISM OF TRADE

- The dominance of the “triad” (USA / Western Europe / Japan).
- The rise of China.

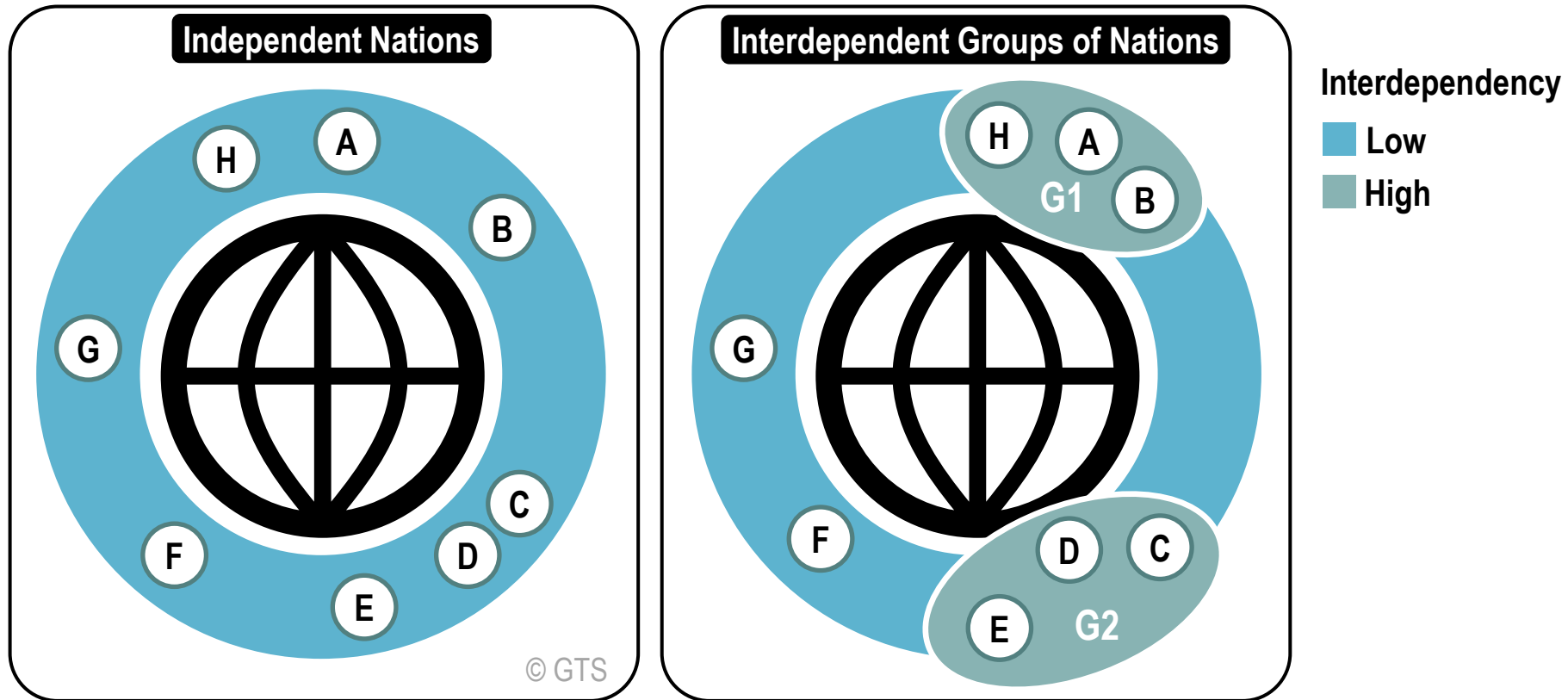


NEO-MERCANTILISM

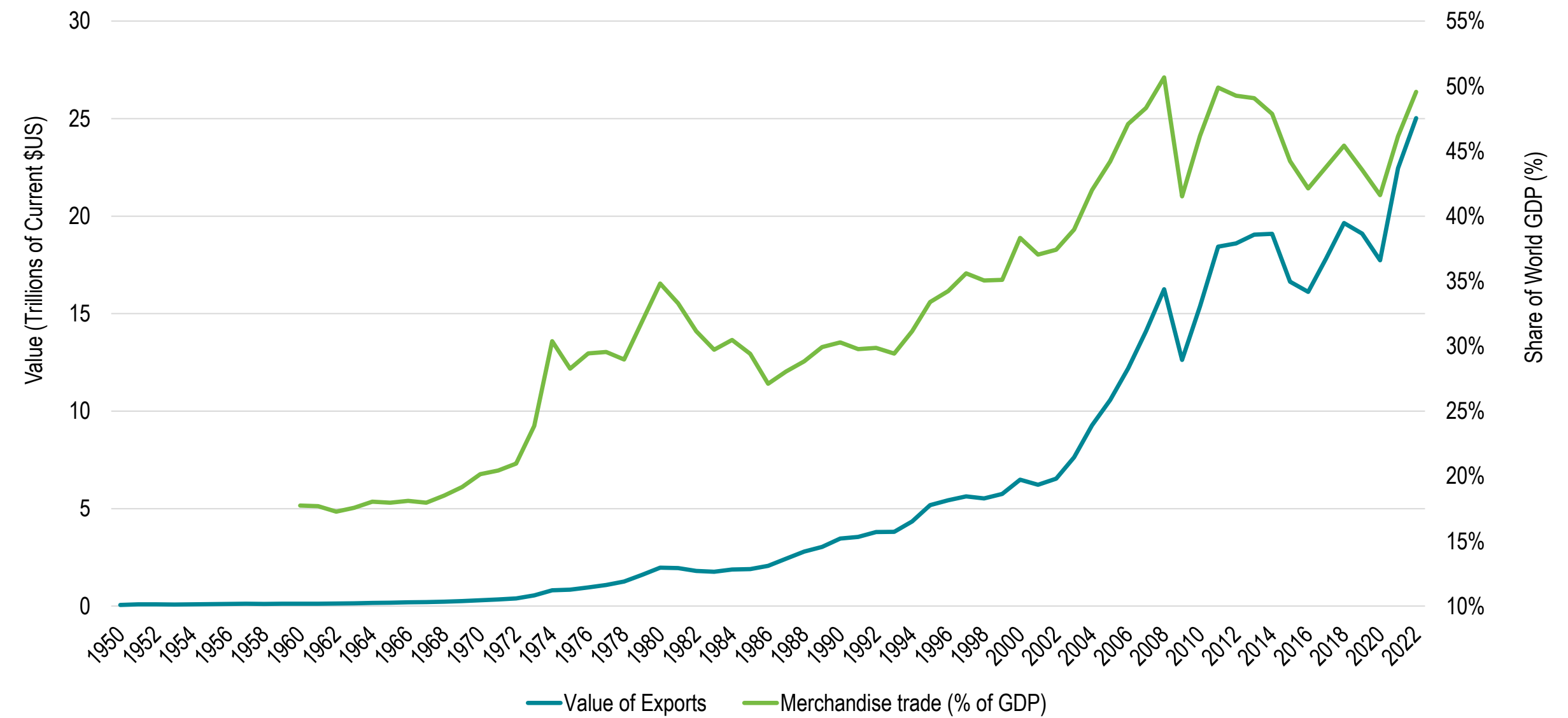
- Export-oriented strategies.
- Trade imbalances.

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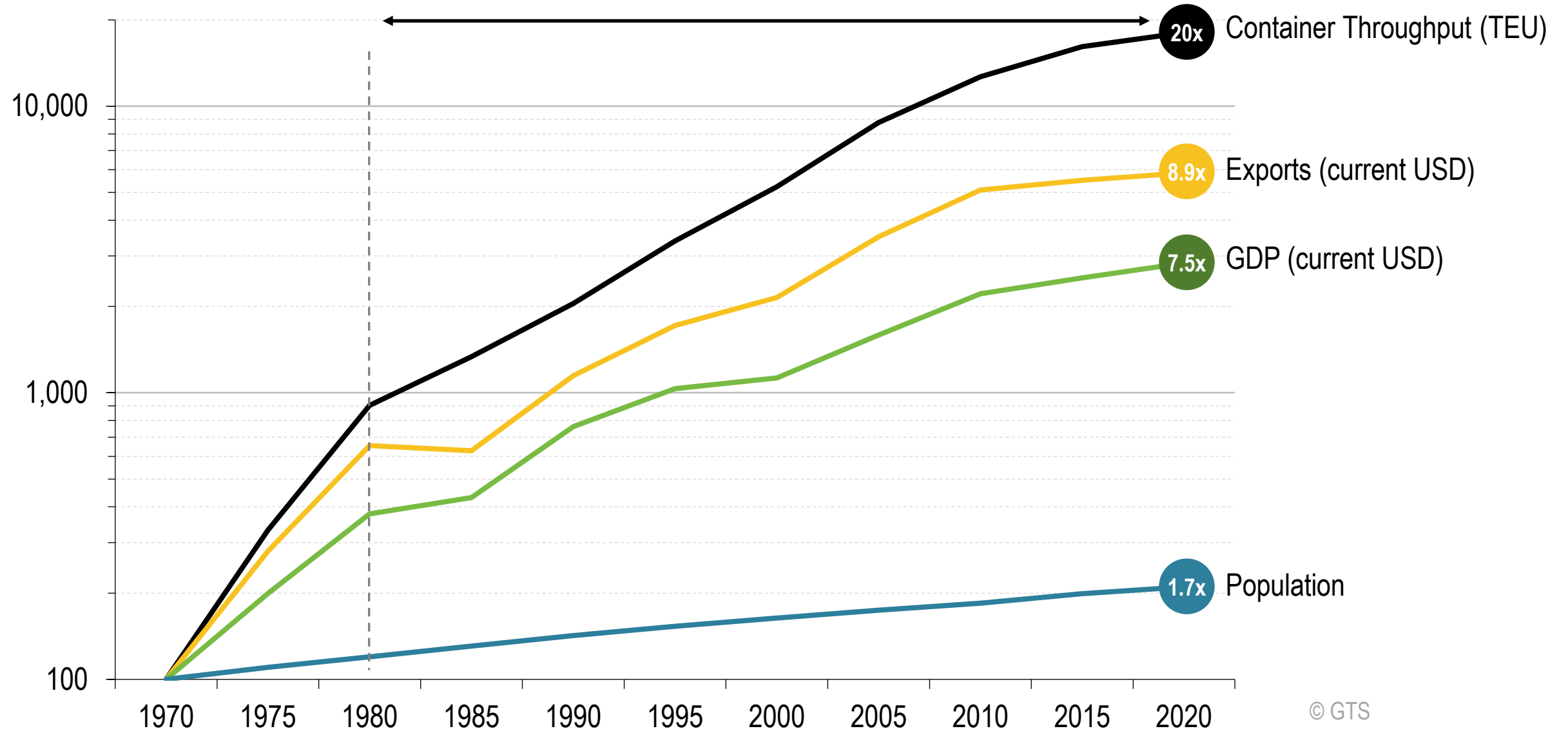
Economic Integration and Interdependencies



World Merchandise Trade, 1960-2022

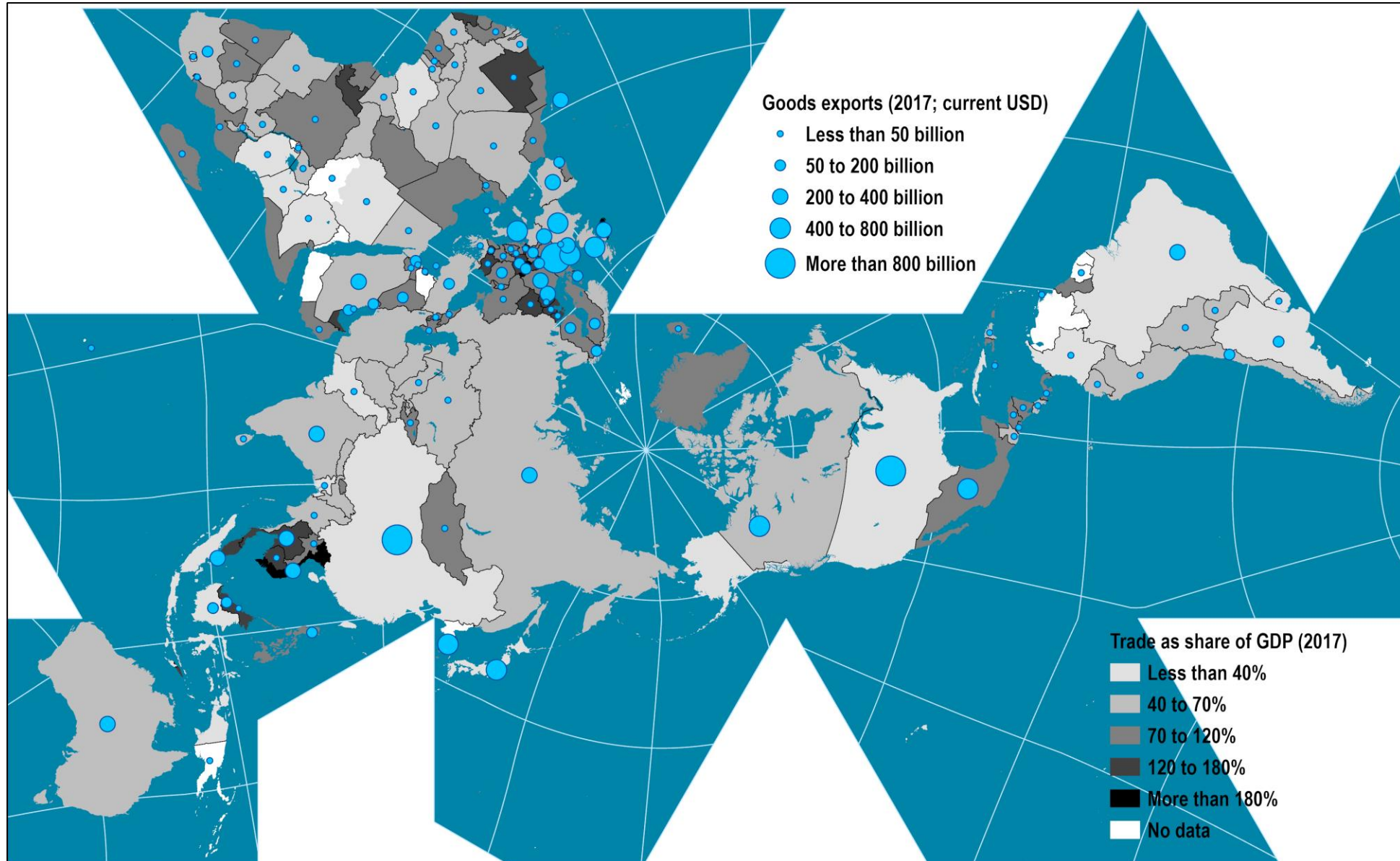


Global Trade and Container Throughput (1970=100)

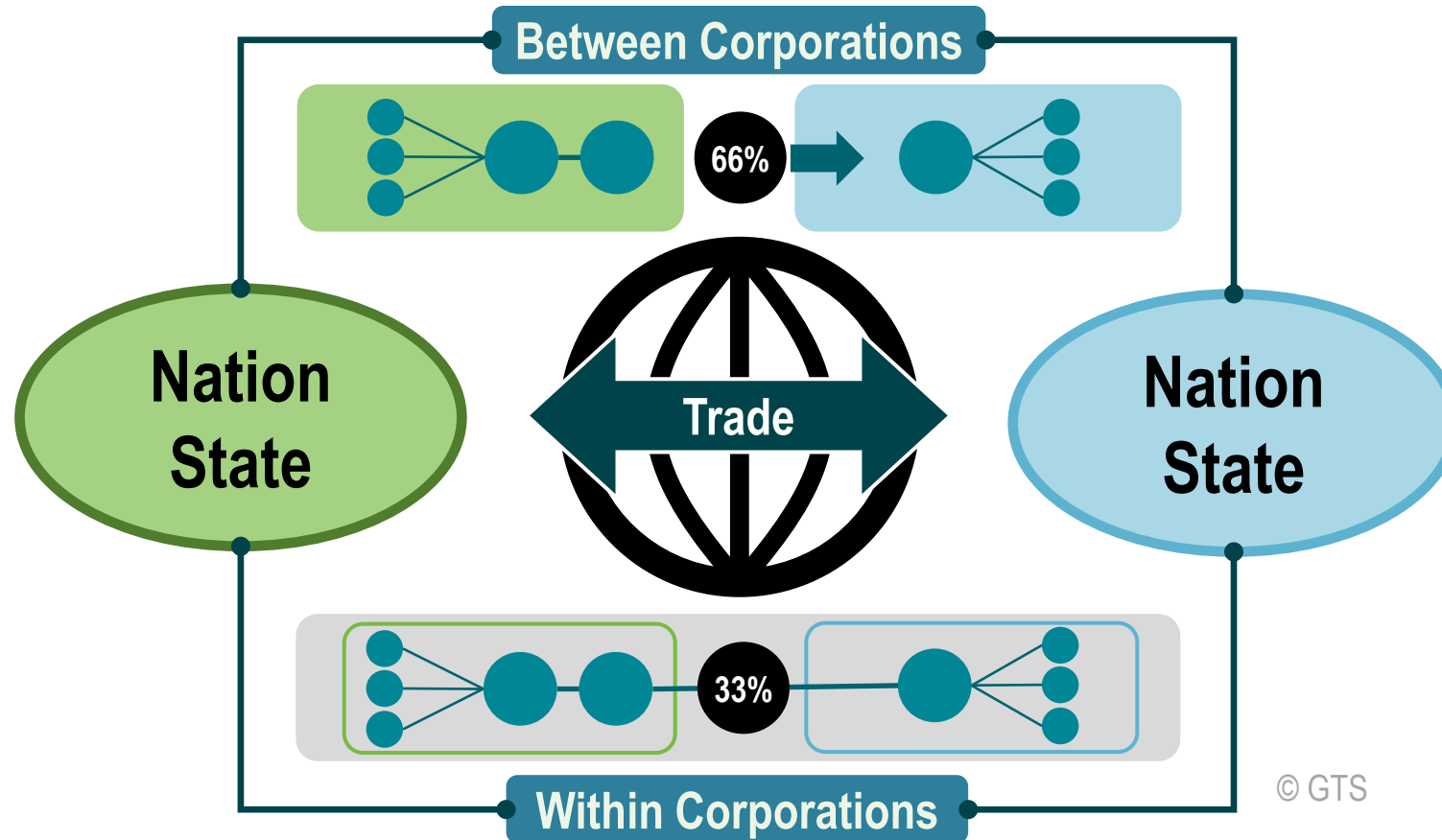


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Global Trade, 2017



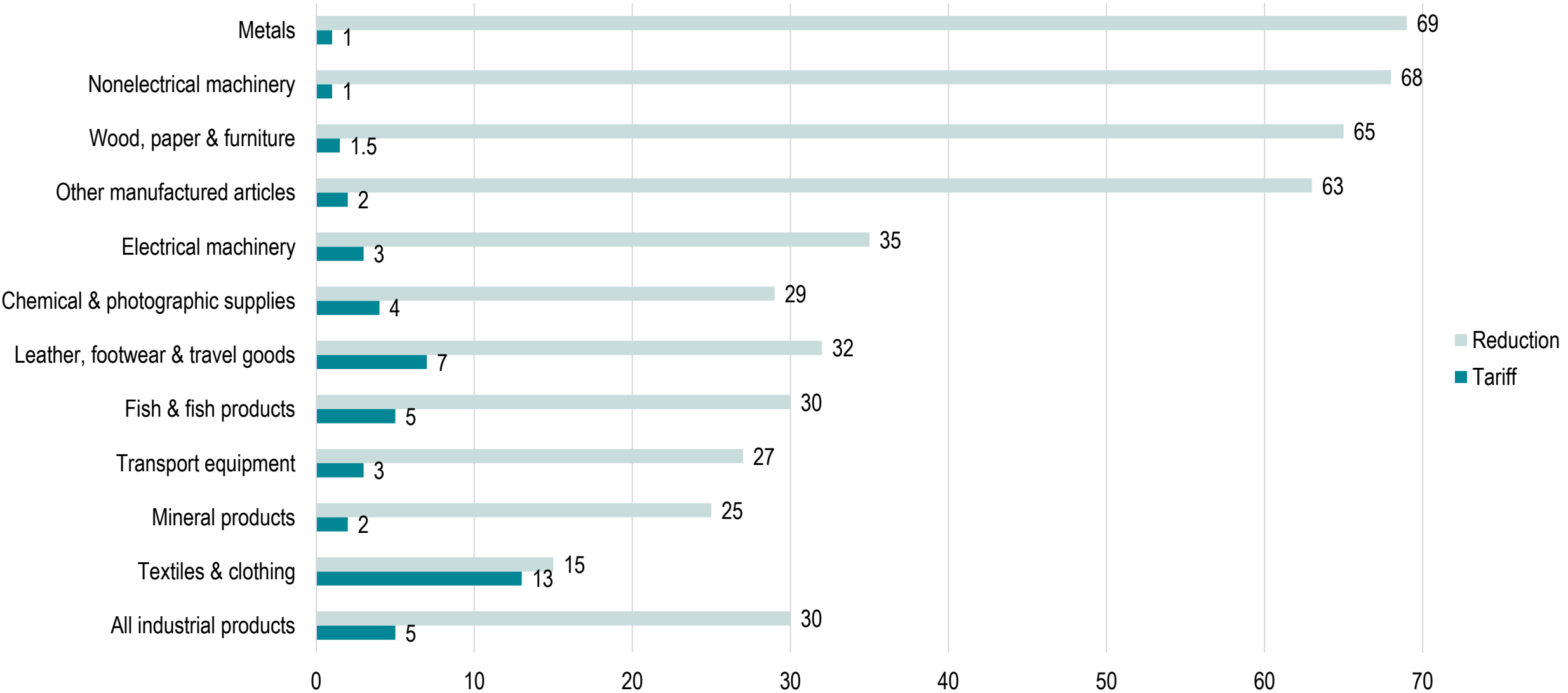
Trade Within and Between Corporations



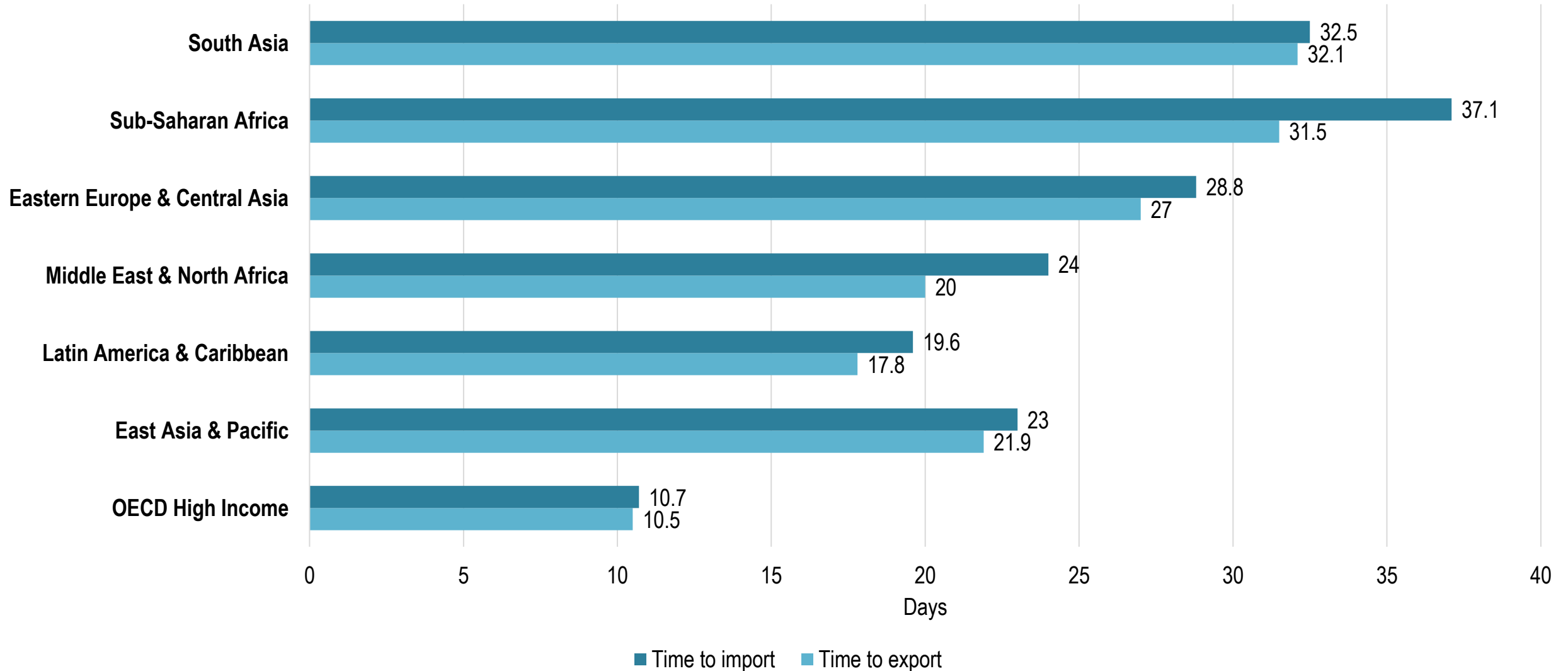
GATT Rounds

Year	Round	Action
1947	Geneva	45,000 reductions in bilateral tariffs covering 20% of world trade.
1949	Annency, France	5,000 reductions in bilateral tariffs.
1951	Torquay, England	8,700 reductions in bilateral tariffs covering a new range of goods.
1955-56	Geneva	Reductions in bilateral tariffs.
1960-62	Dillon Round	Reductions in bilateral tariffs. EEC talks begin.
1964-67	Kennedy Round	Reductions in bilateral tariffs. Negotiation rules established.
1973-79	Tokyo Round	Reductions in bilateral tariffs. Procedures on dispute resolution, dumping and licensing.
1986-93	Uruguay Round	Additional tariff reductions. Stalemate for agricultural tariffs.
1995	WTO established	WTO replaced the GATT.
2001-08	Doha Round	Divergences between developing and developed countries. Issues over agricultural subsidies.

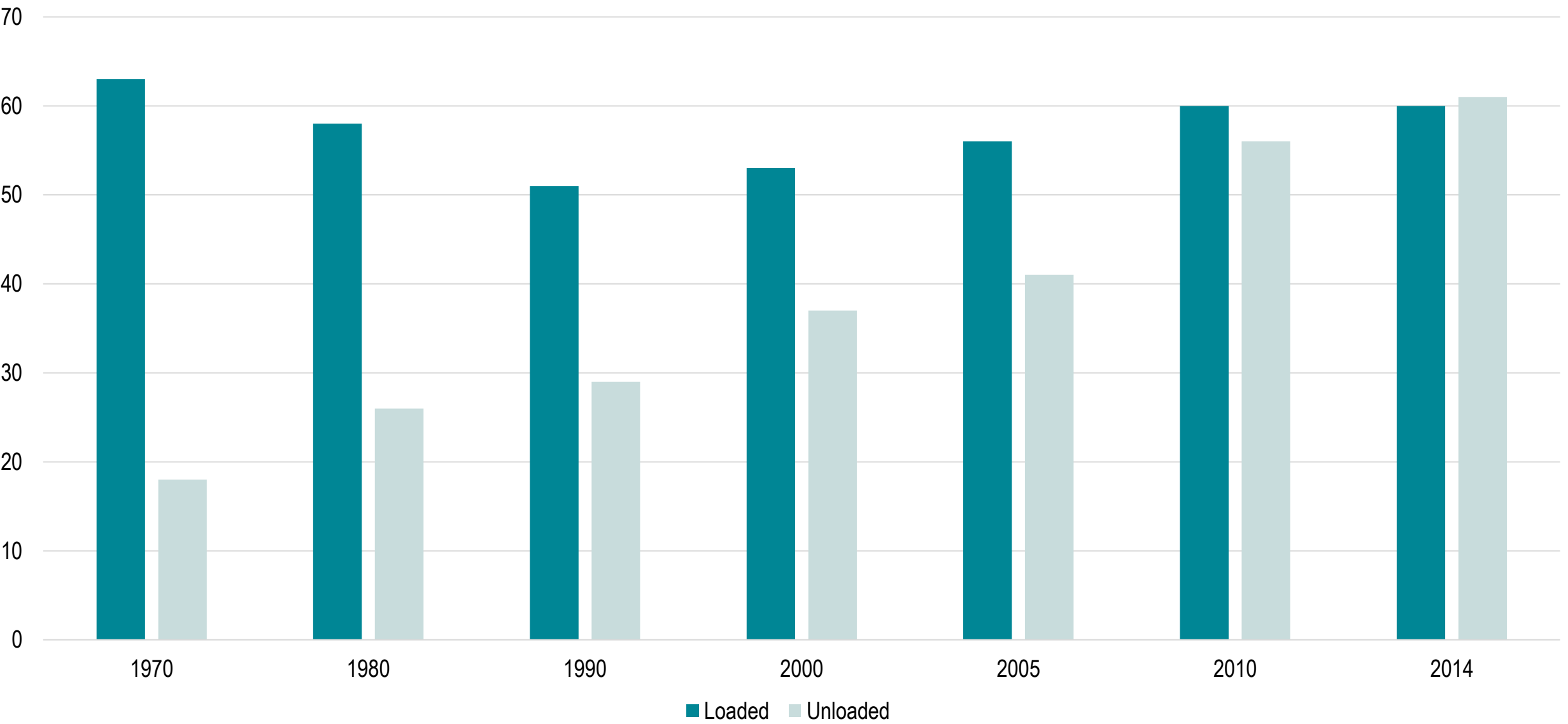
Average Tariffs after the Uruguay Round (%)



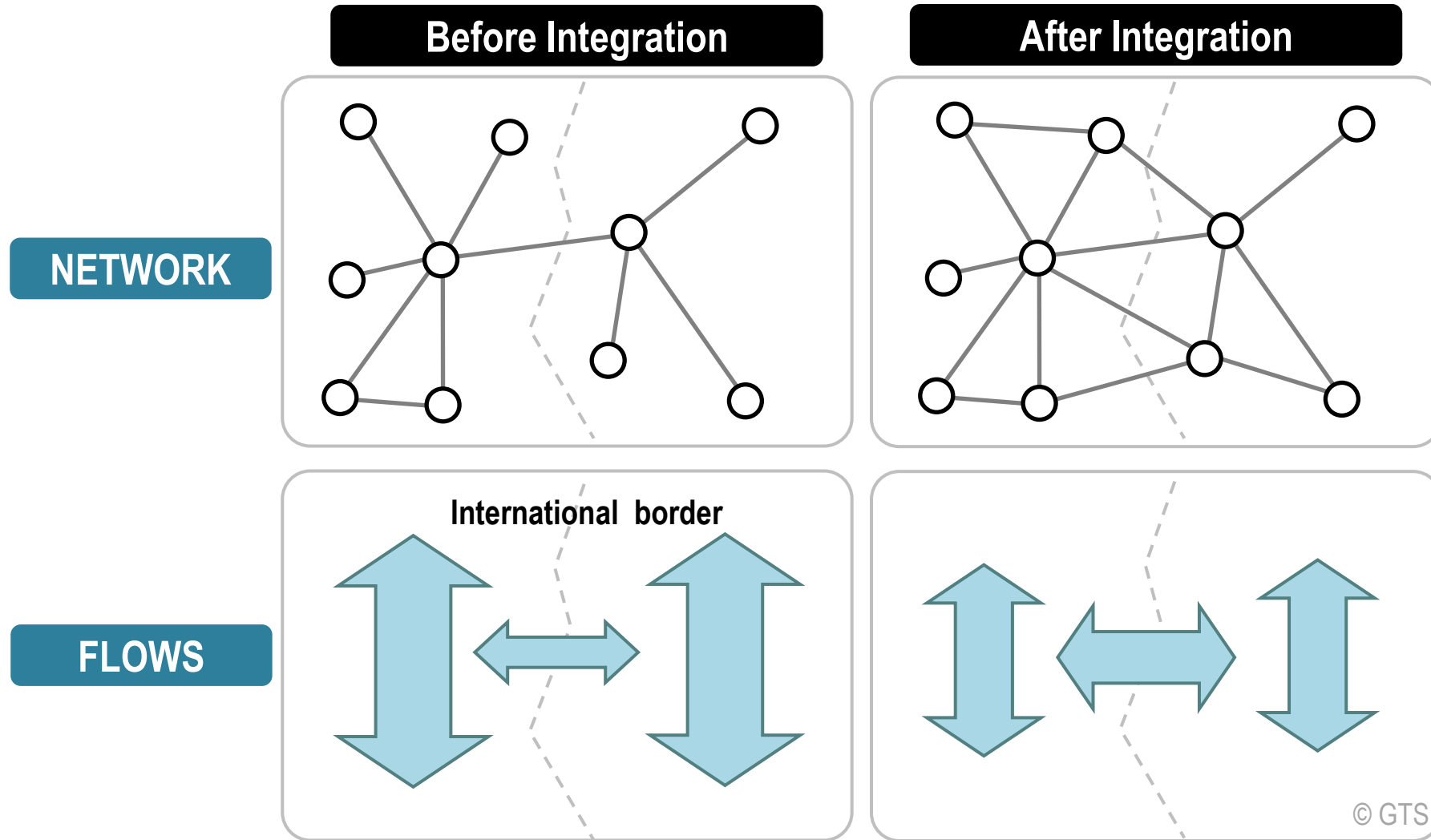
Regional Averages in Trading Across Borders, 2012



Participation of Developing Economies in Global Seaborne Trade (% of World Tonnage)



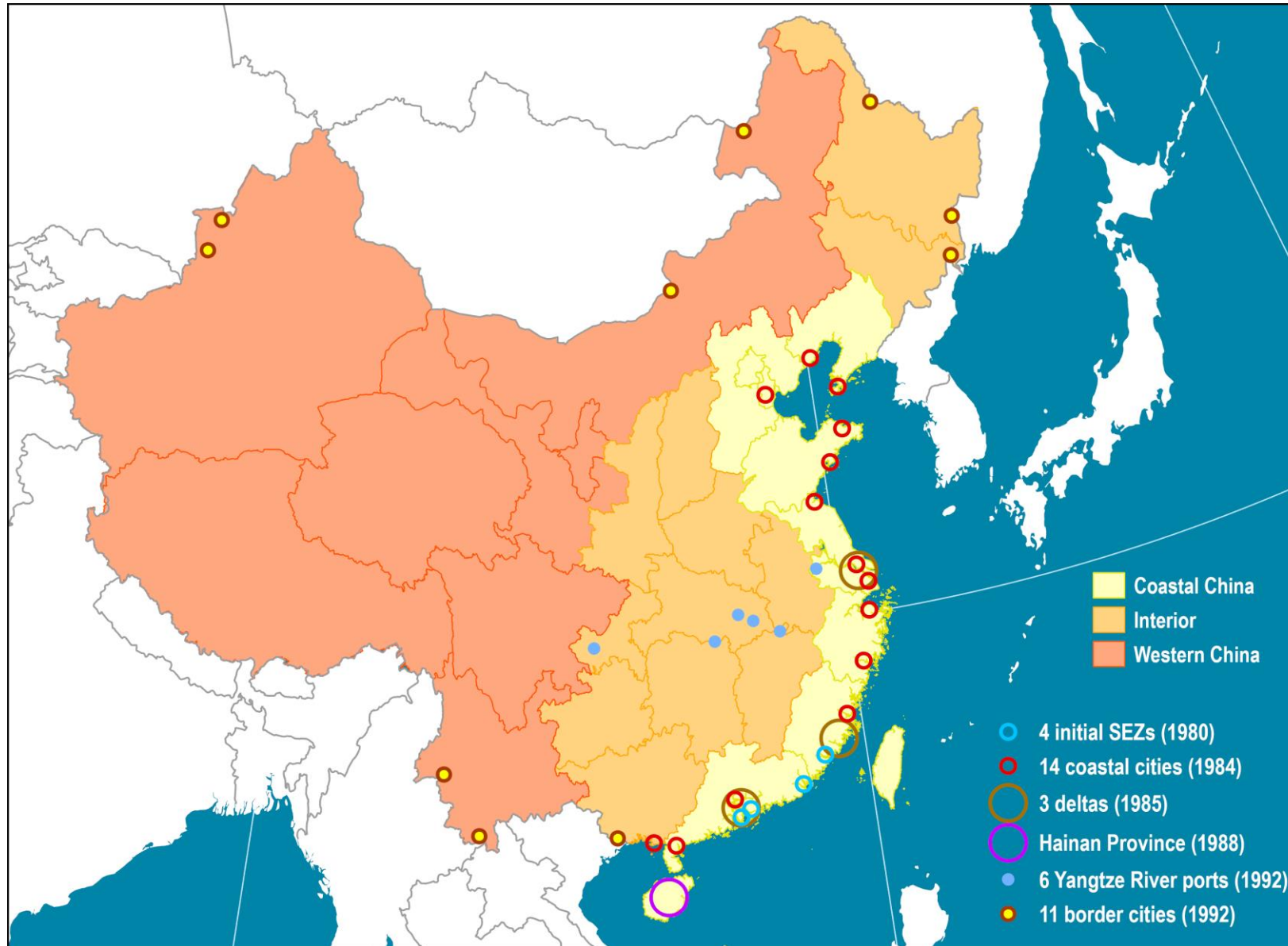
Impacts of Integration Processes on Networks and Flows



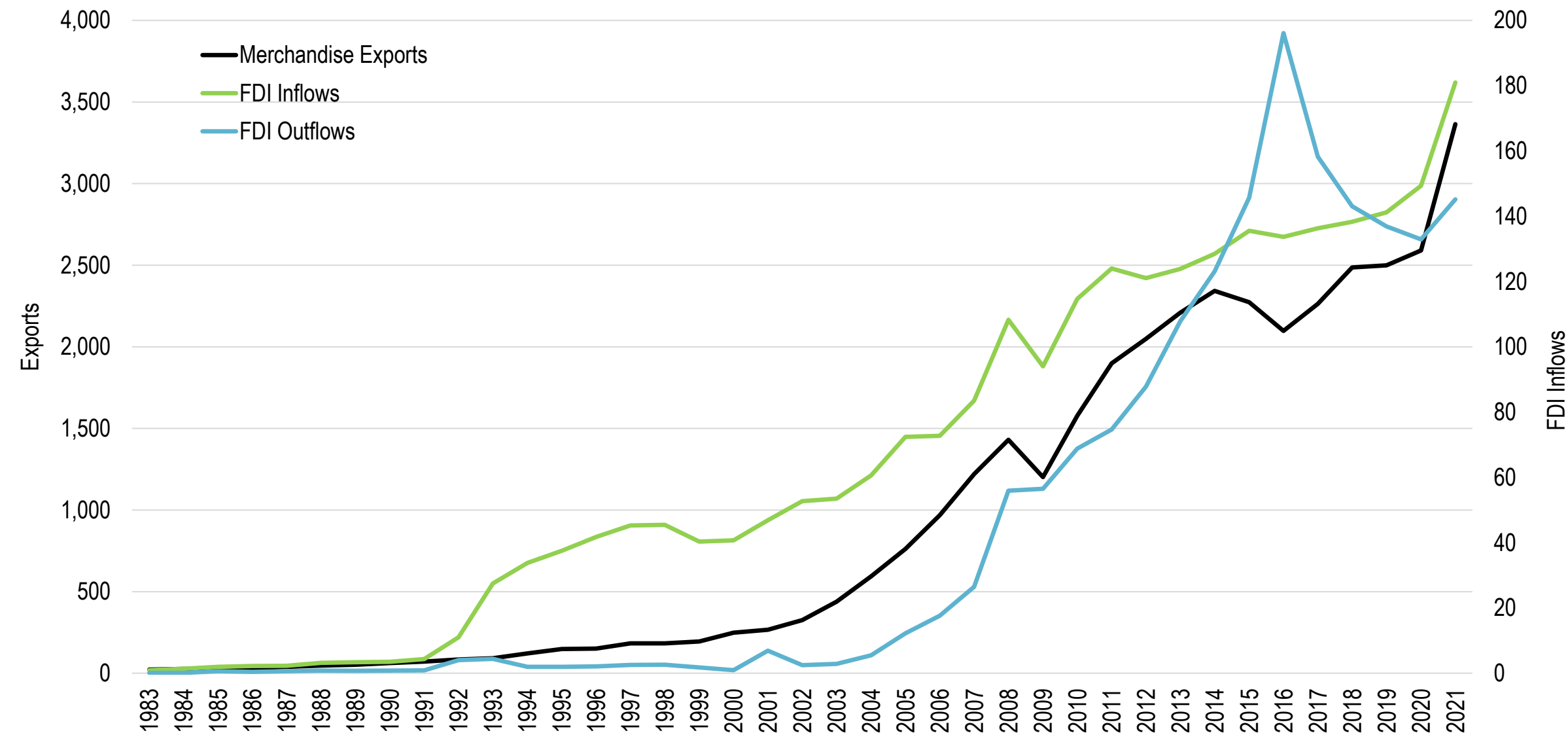
Characteristics of Free Trade Zones

Infrastructures	High level of infrastructure, such as land, transport, office space, utilities, logistics services, business services and other facilities.
Regulations	Streamlined to improve efficiency, including custom services, labor regulation and permits.
Location	High accessibility location, often close to major terminal facilities such as a port, inland terminal or an airport. Location often away from conventional industry.
Export-oriented	Activities operating within the zone produce mainly or exclusively for foreign markets.
Incentives	Variety of incentives, including low cost land, infrastructures, tax and duty exemptions or various subsidies.

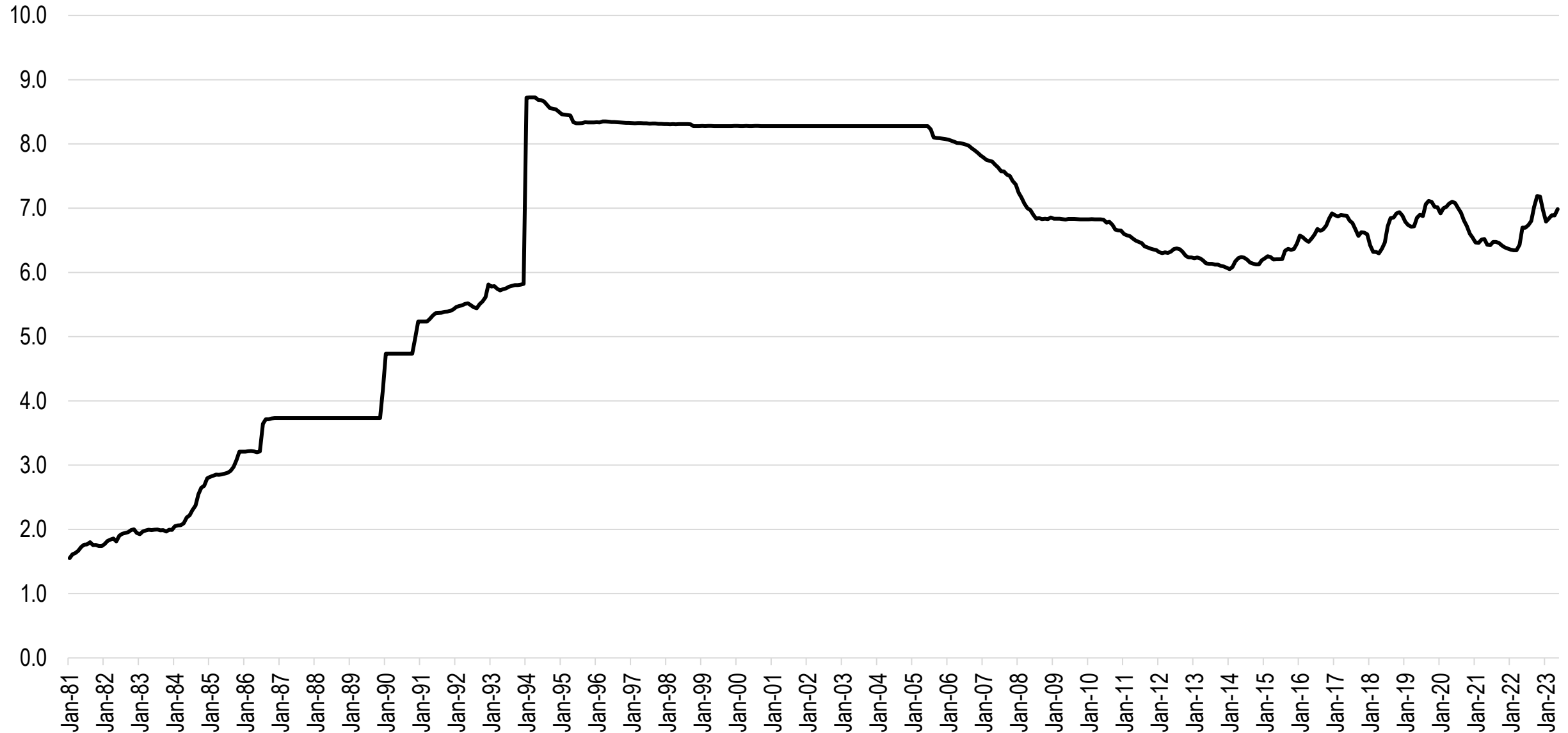
China's Special Economic Zones



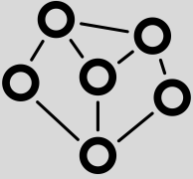

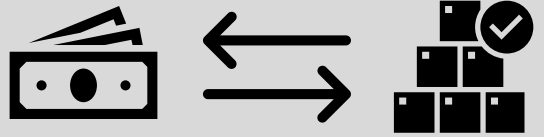
Value of Chinese Exports and FDI, 1983-2021 (Billions of \$US)



Yuan Exchange Rate (per USD), 1981-2023 (Monthly)

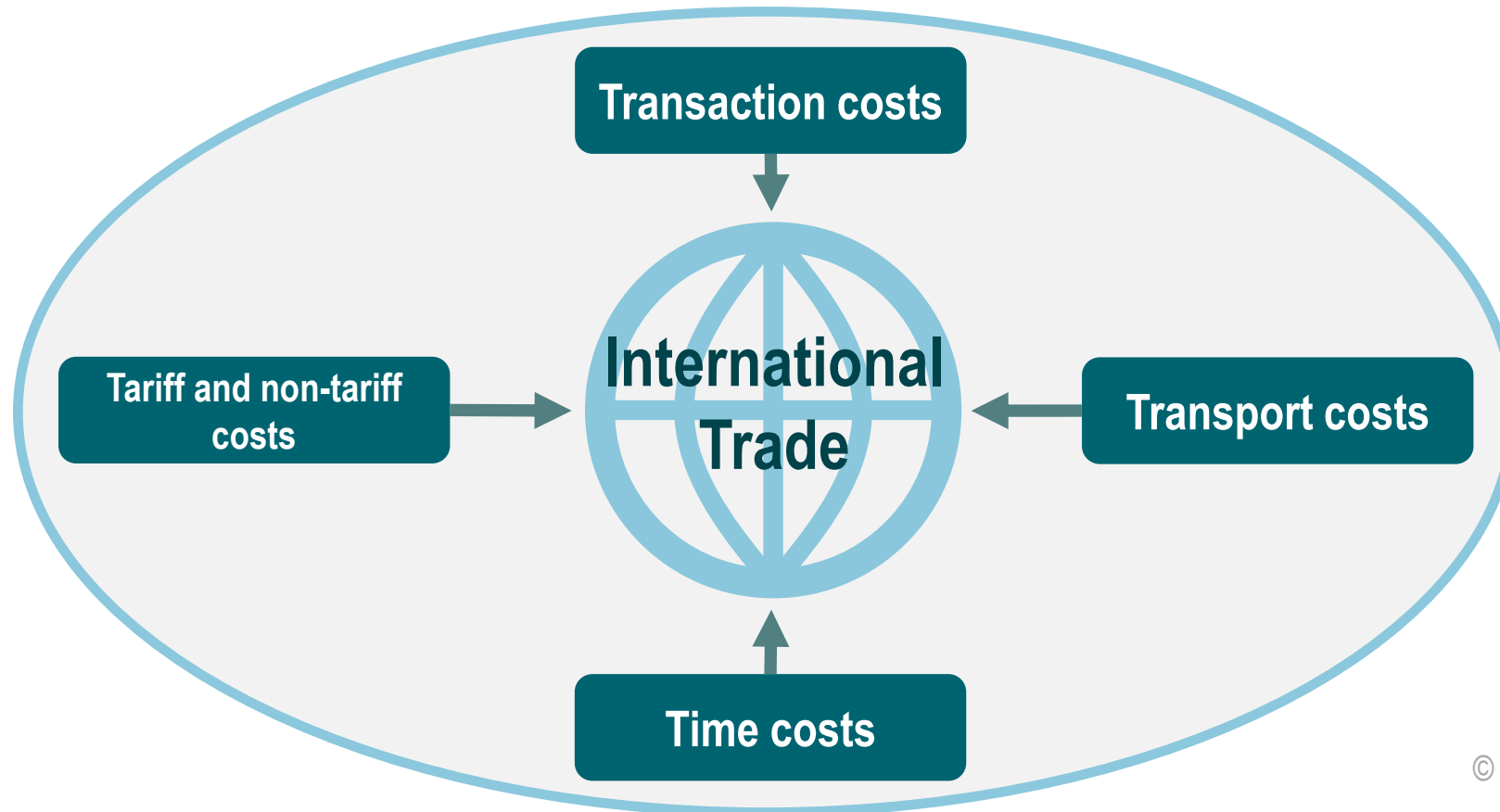


The Main Dimensions of Trade Facilitation

	INTEGRATION-BASED	DISTRIBUTION-BASED	TRANSACTIONS-BASED
			
Nature	Compliance to rules and regulations.	Physical capacity to support trade.	Setting transactions and receiving compensation.
Activities	Customs procedures, regulations and handling of trade documentation.	Multimodal and intermodal freight transport systems. Modes, infrastructures and terminals.	Banking, finance and insurance activities where accounts can be settled.

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The “Four Ts” in International Trade



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Separation Factors

Exogenous

- Distance, transportation costs, travel time.
- Part of a trade agreement.

Country Specific Factors

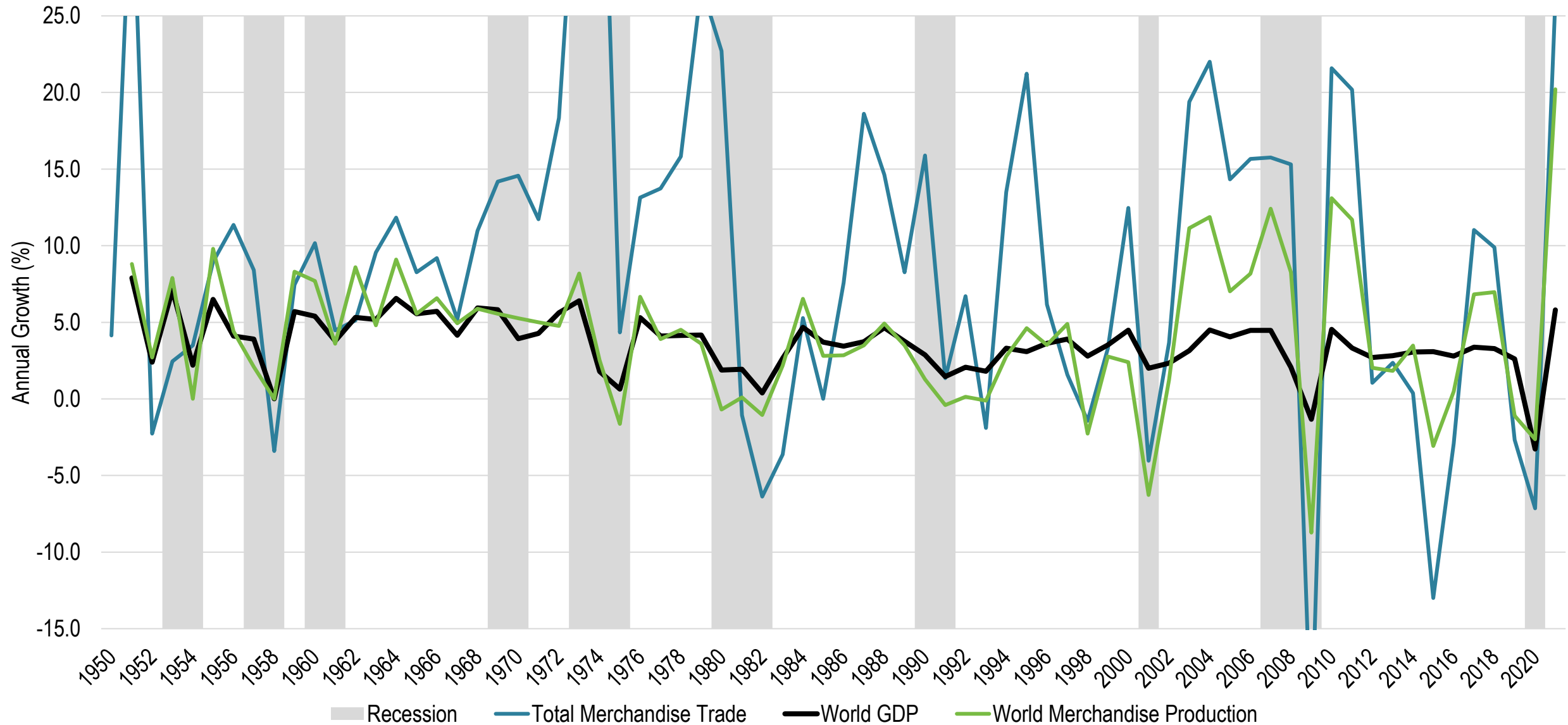
Endogenous

- Customs procedures.
- Performance of national transport and logistics.

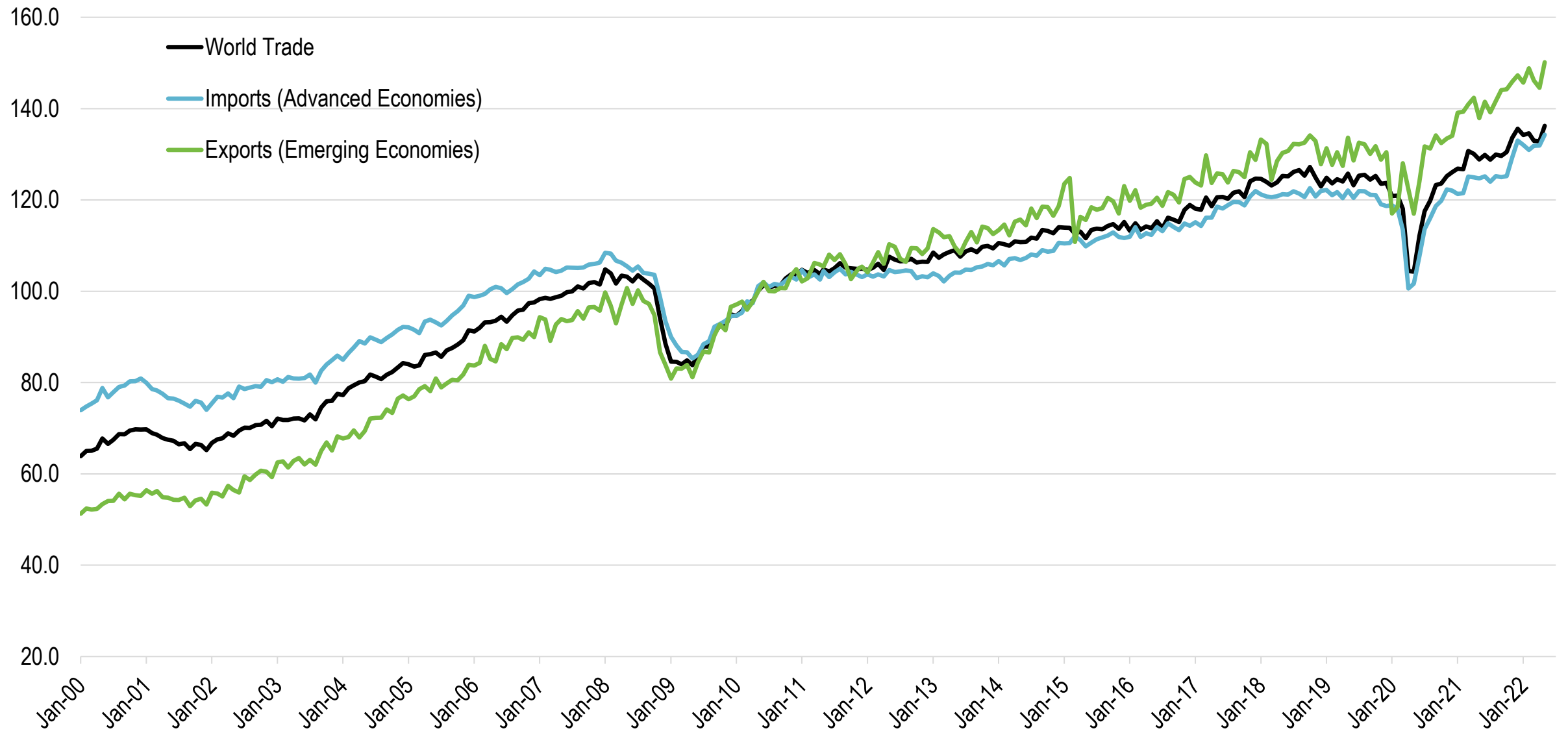
Phases of the Export-Oriented Paradigm

	Phase I	Phase II	Phase III
Capital	Currency devaluation. Mostly Foreign Direct Investments (FDI).	Surge in FDI, but growing share of national capital.	Pressures to revalue currency. Drop in FDI. National capital dominant. Providing FDI to other markets.
Production	Numerous comparative advantage. Focusing on labor intensive activities.	Gradual shift to added value production.	Loss of comparative advantages in labor intensive activities. Growing importance of the national market.
Trade	Growth of exports and widening trade balance (imports versus exports).	Peak trade growth and imbalances.	Re-balancing. Relative decline of the share exports in relation to imports.
Transportation	Modernization of existing gateways.	Massive investments in new transport terminals, mostly ports and airports.	Focus on inland transportation.

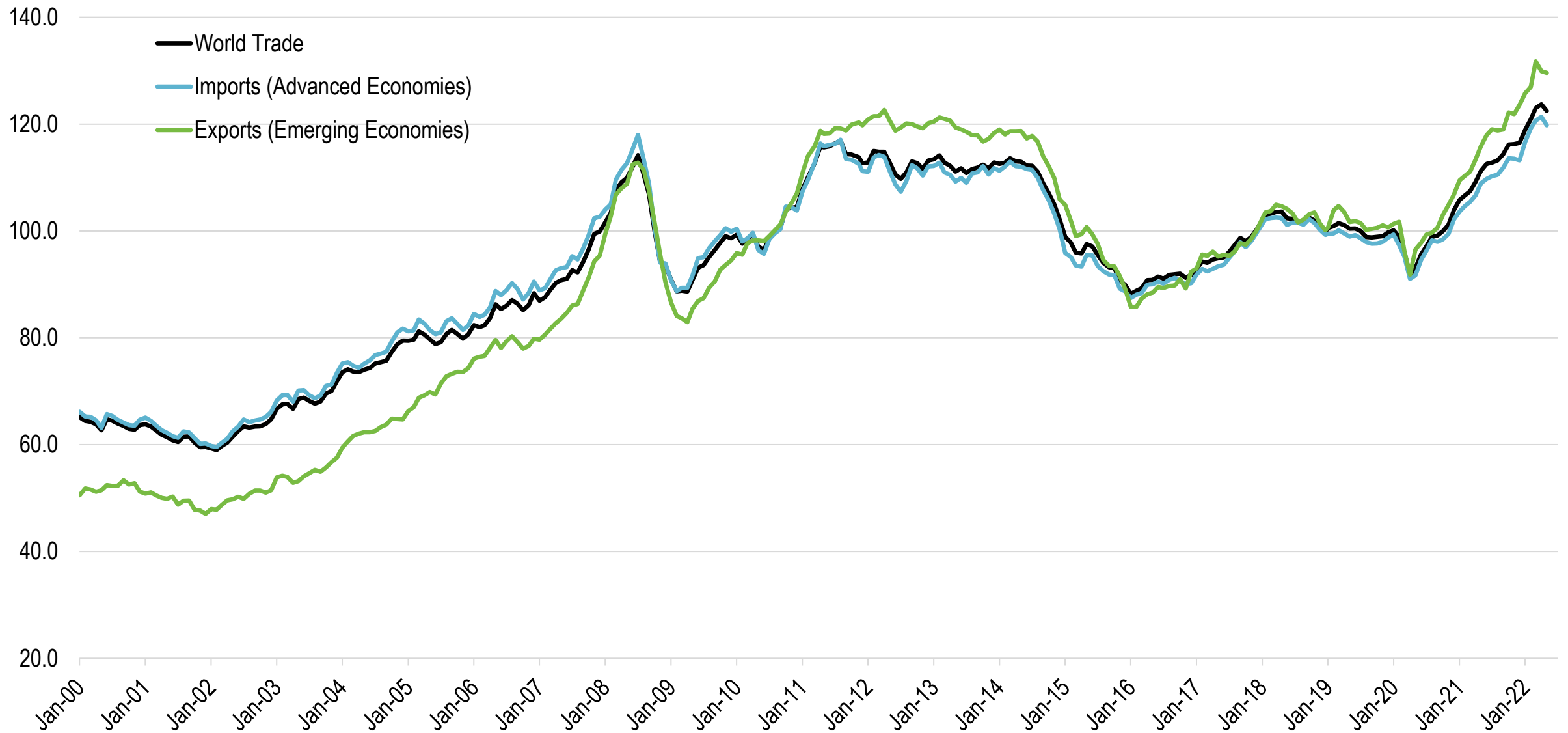
Changes in the Value World's Merchandise Trade, Manufacturing and GDP, 1950-2021



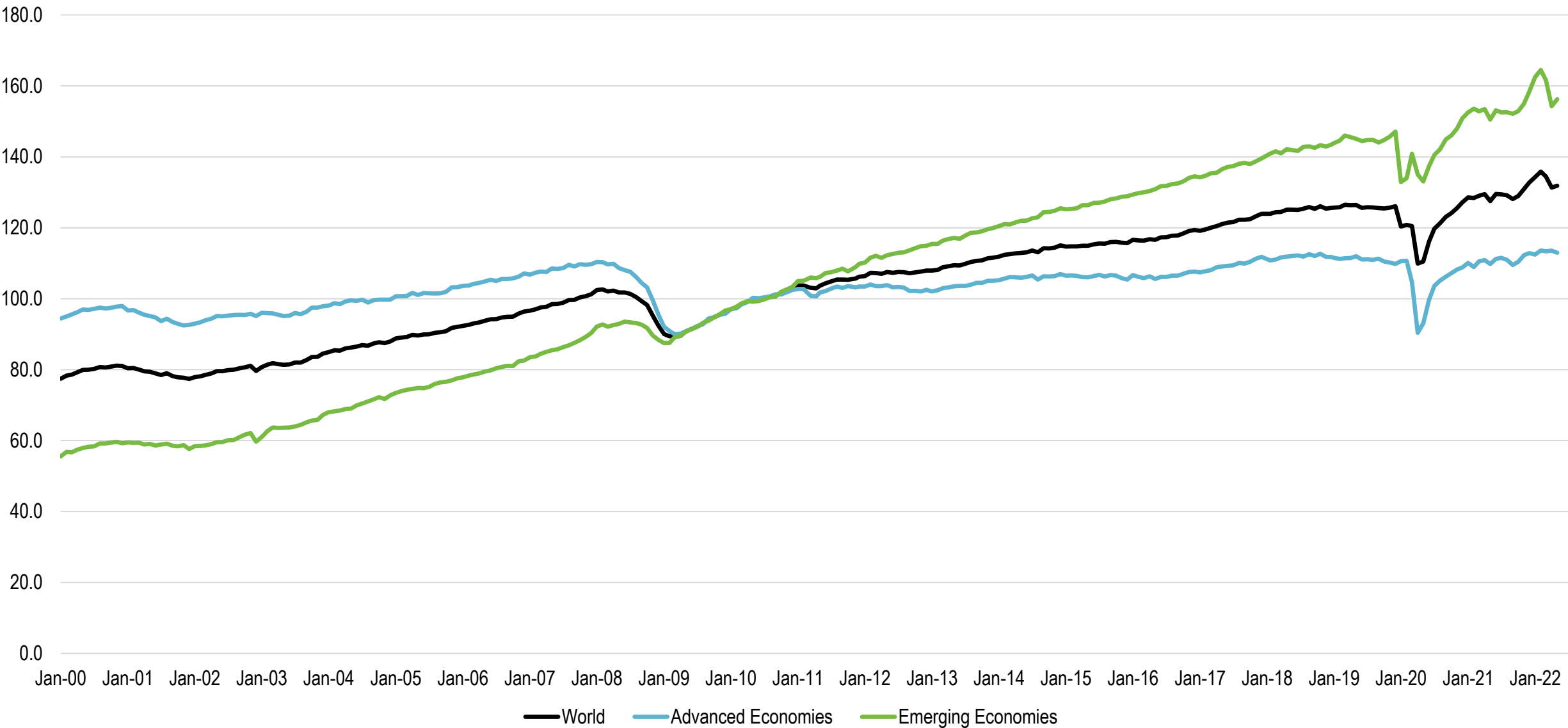
CPB World Trade Index by Volume, 2000-2022 (2010=100)



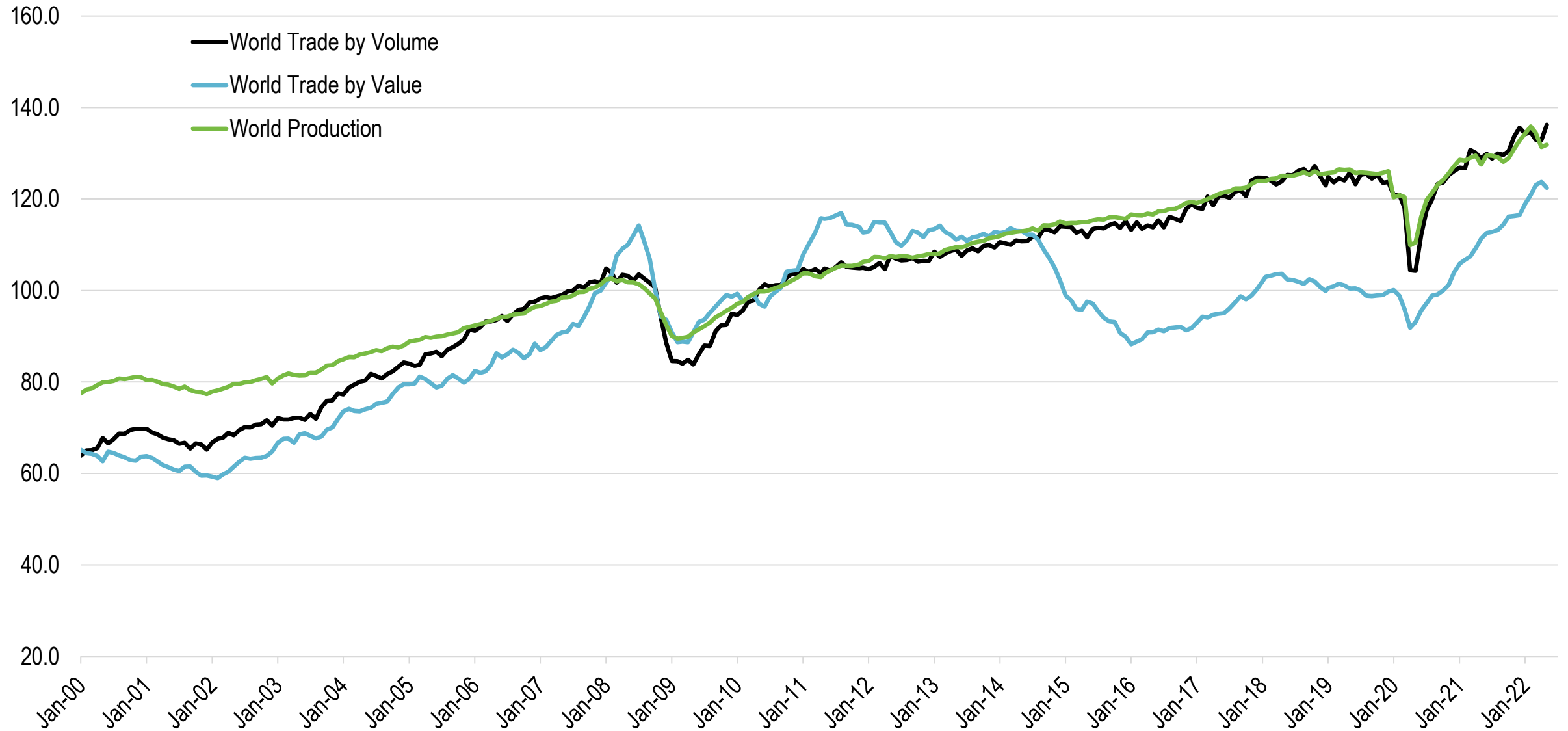
CPB World Trade Index by Value, 2000-2022 (2010=100)



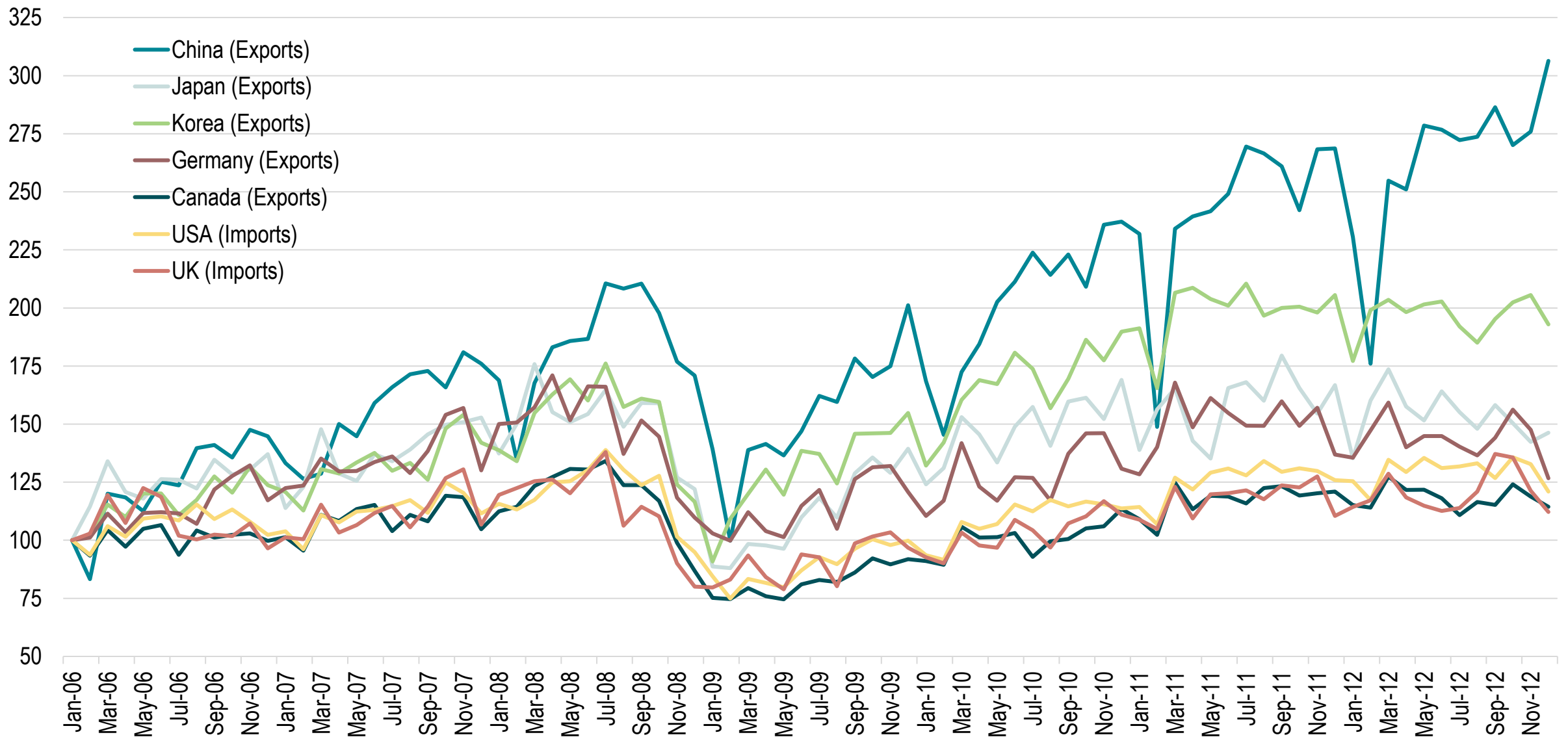
CPB World Production Index, 2000-2022 (2010=100)



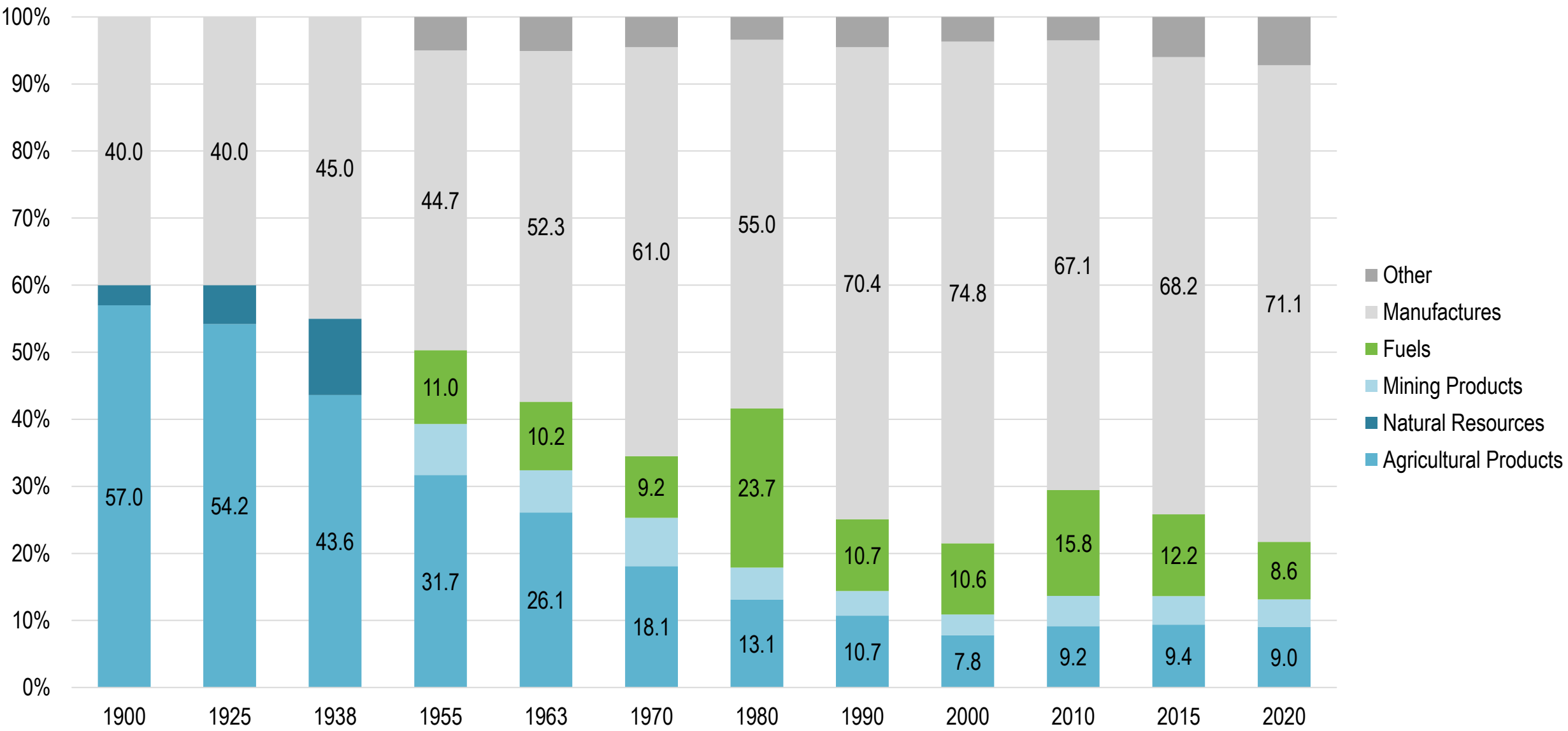
CPB World Trade Index, 2000-2022 (2010=100)



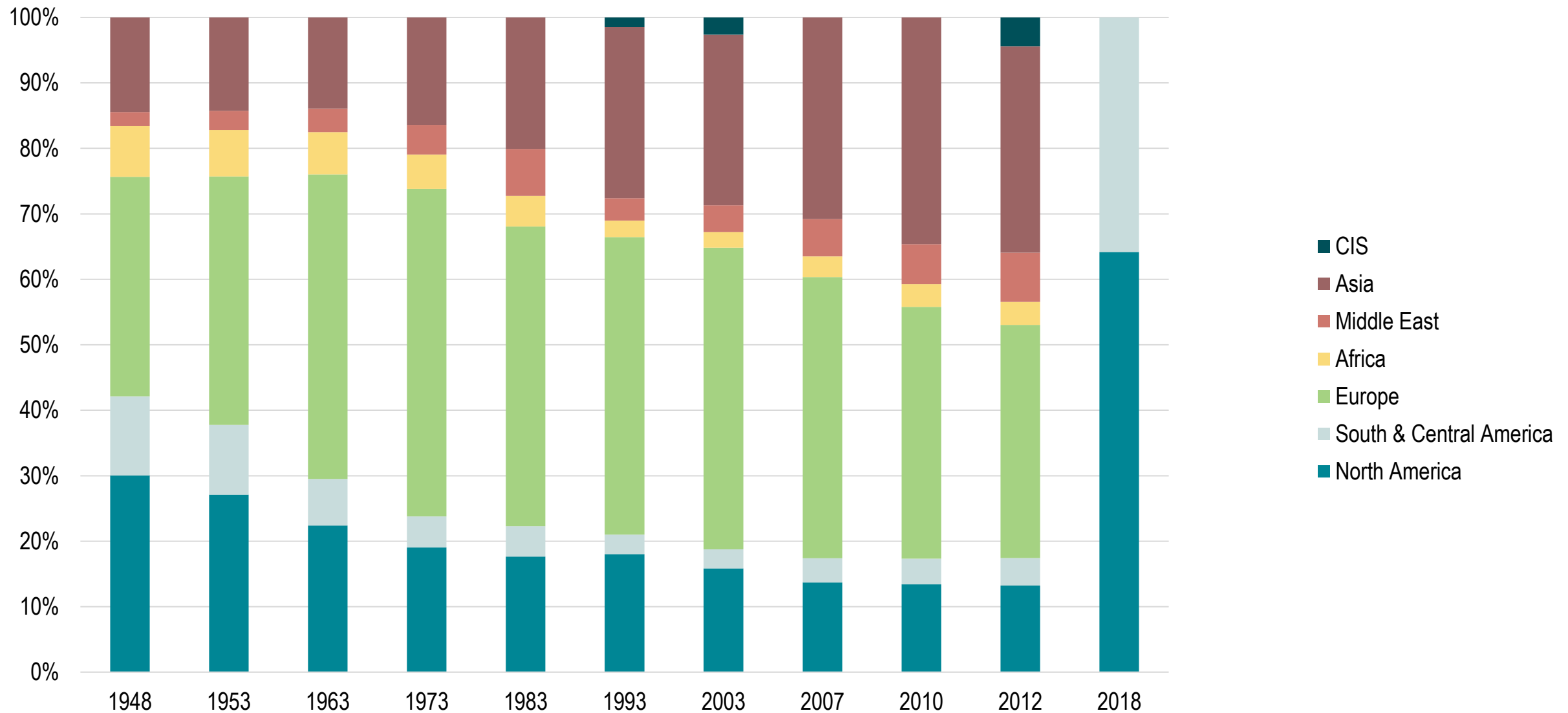
Monthly Value of Exports or Imports, Selected Traders, 2006-2012 (Jan 2006=100)



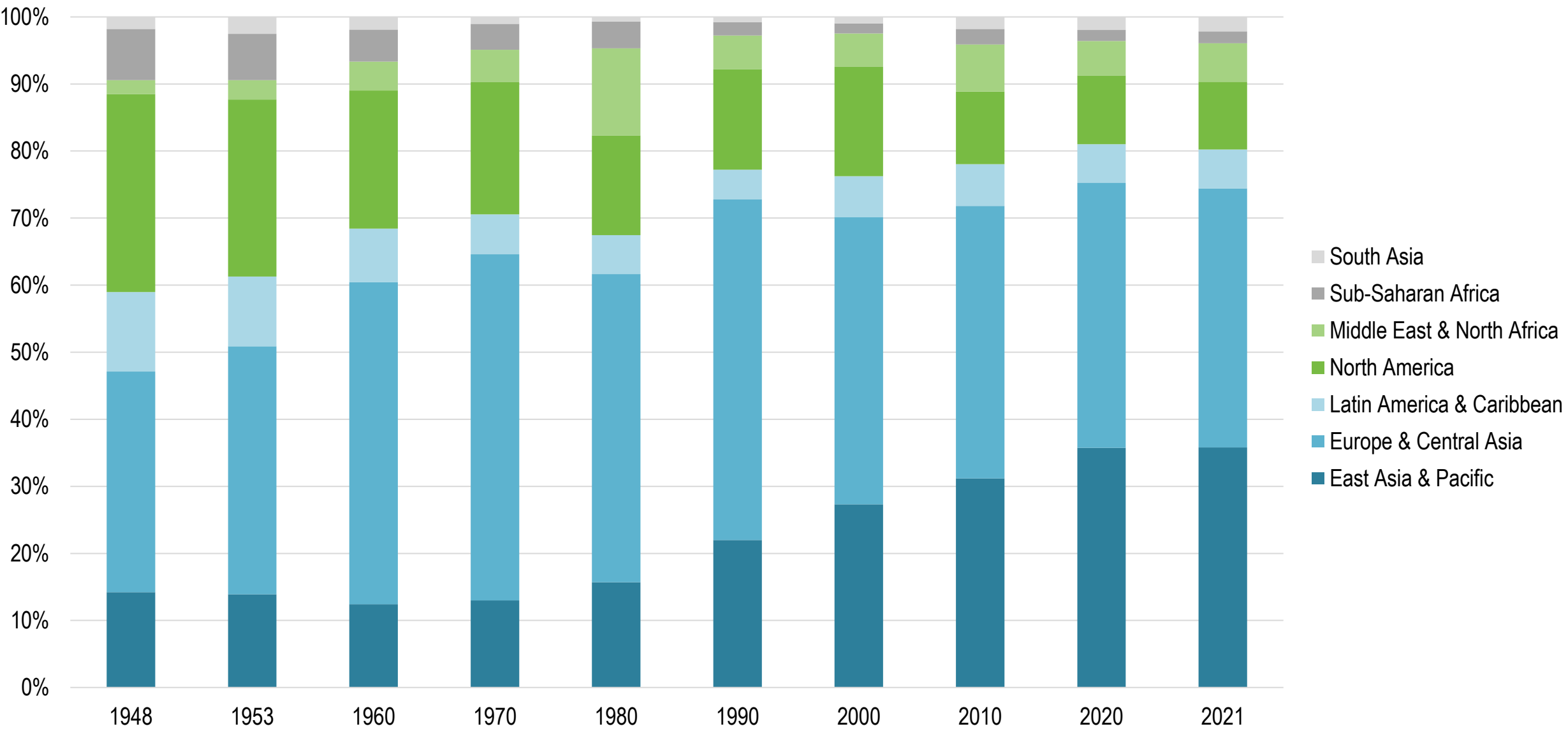
Share of Product Groups in World Merchandise Trade, 1900-2020



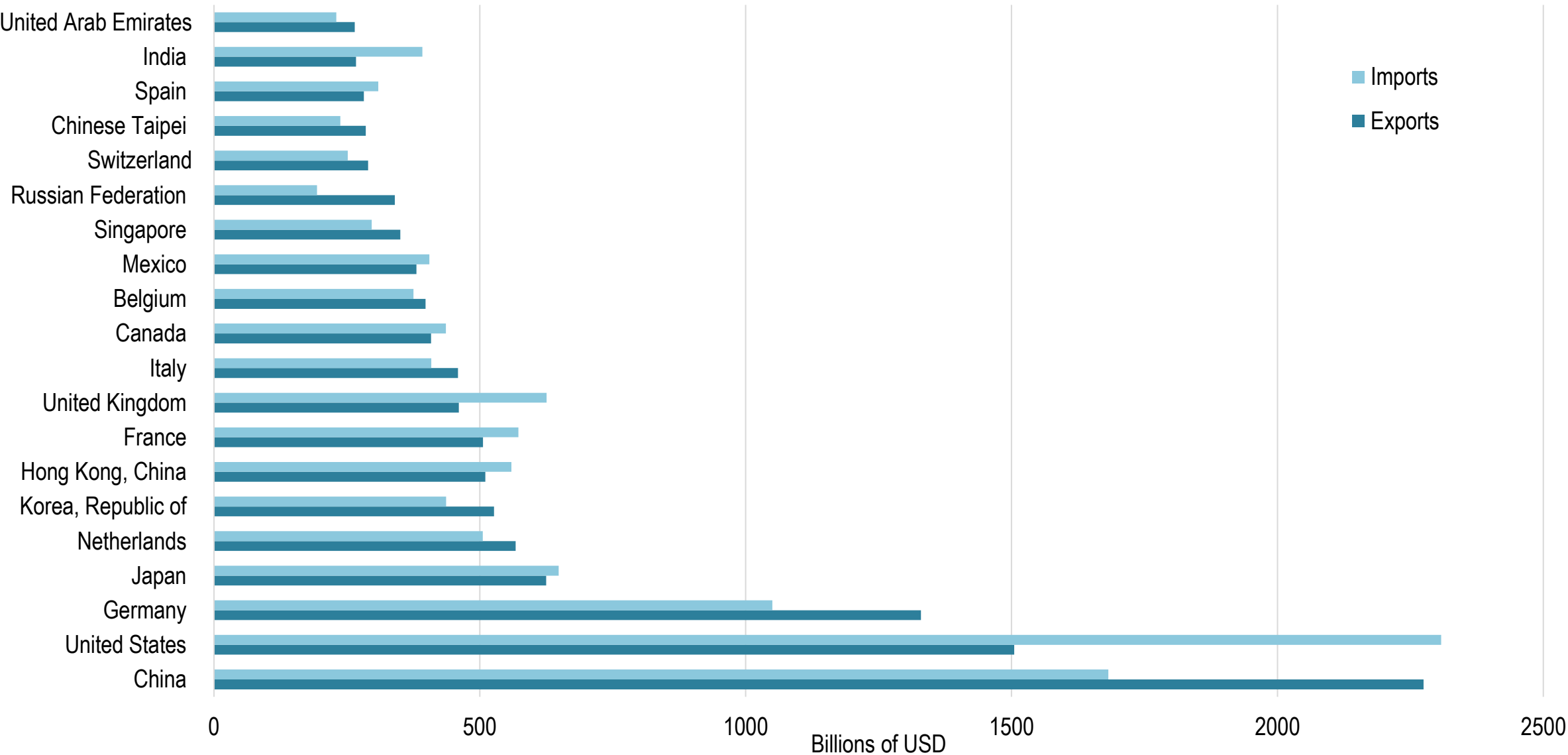
Share of Merchandise Exports by Region, 1948-2012



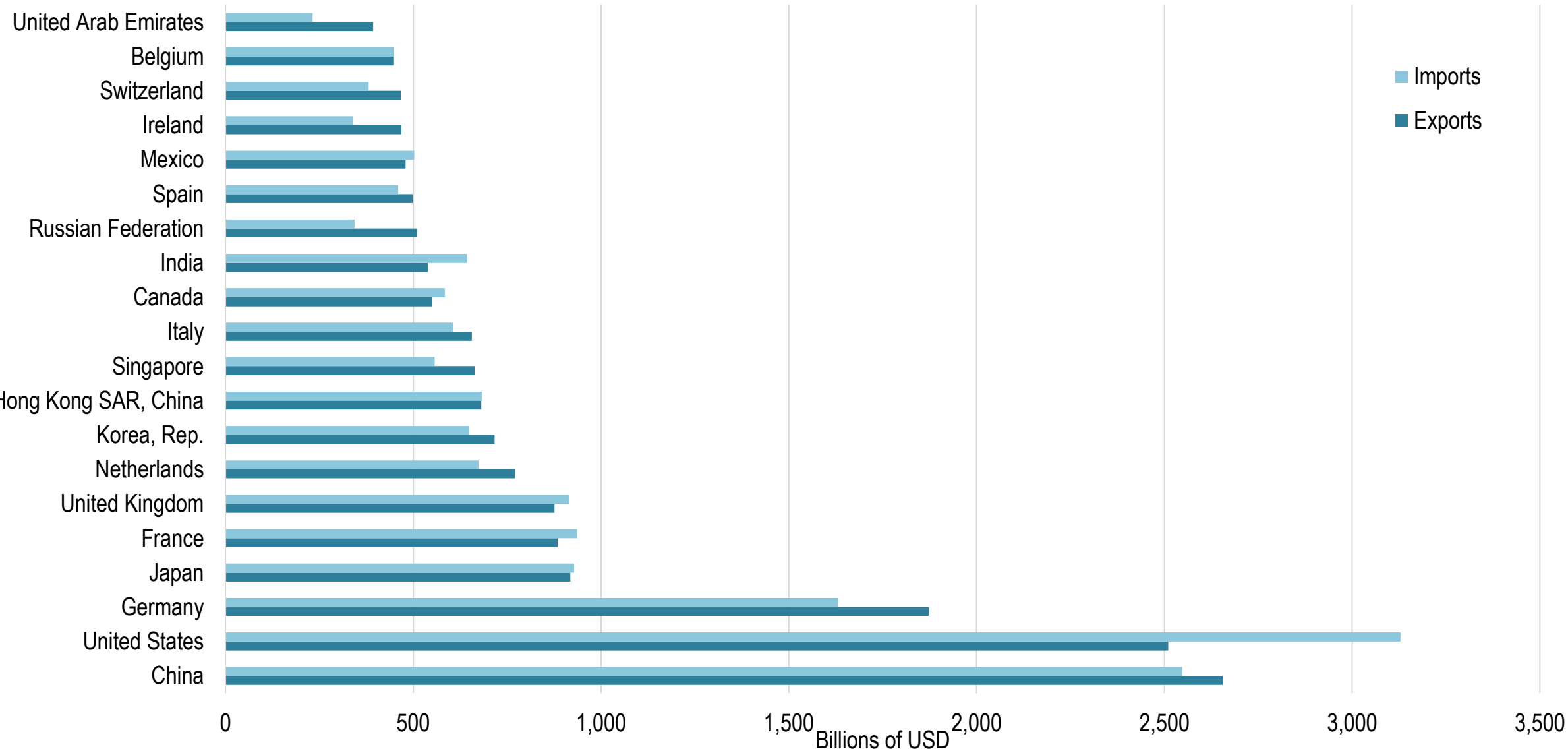
Share of Merchandise Exports by Region, 1948-2021



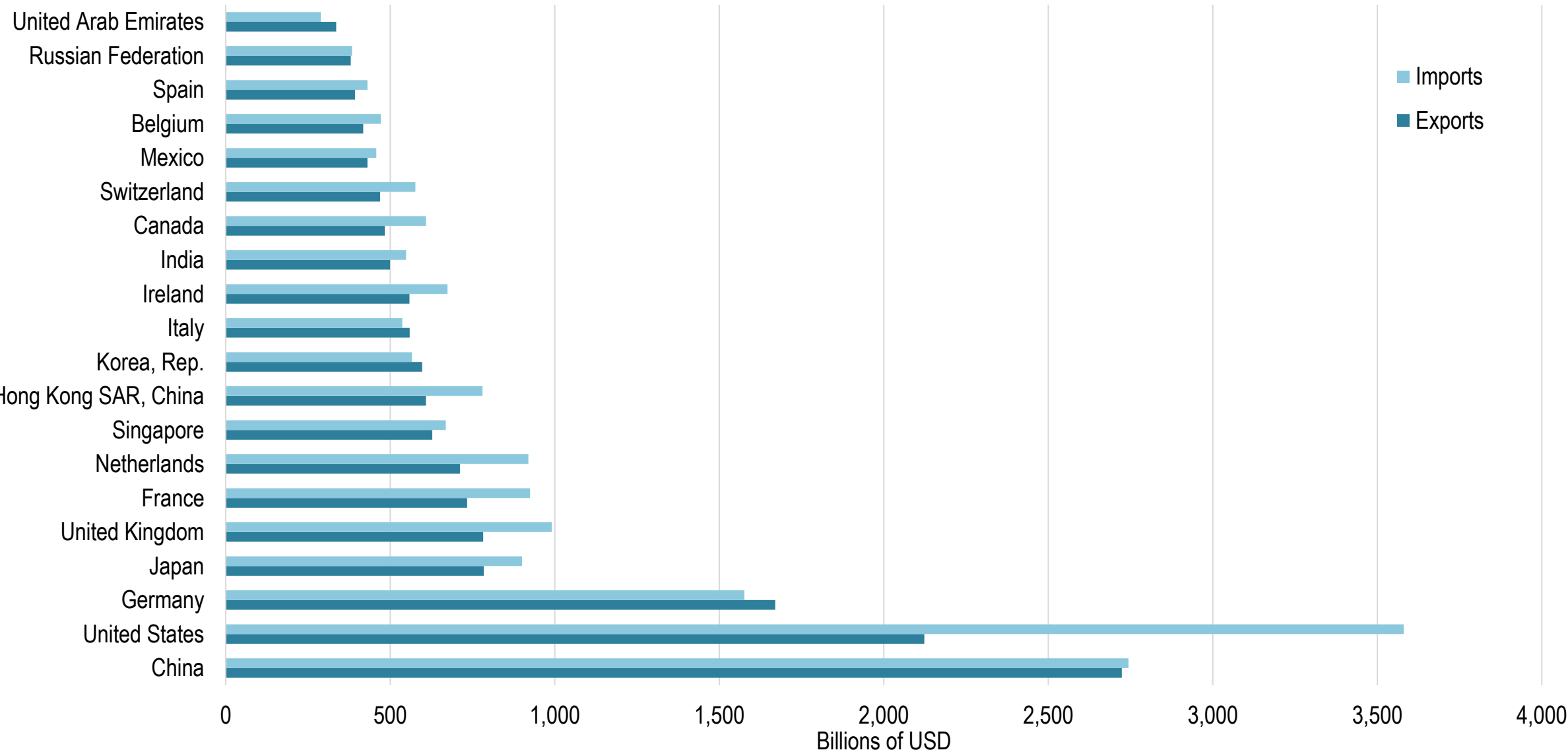
World's 20 Largest Exporters and Importers, 2015



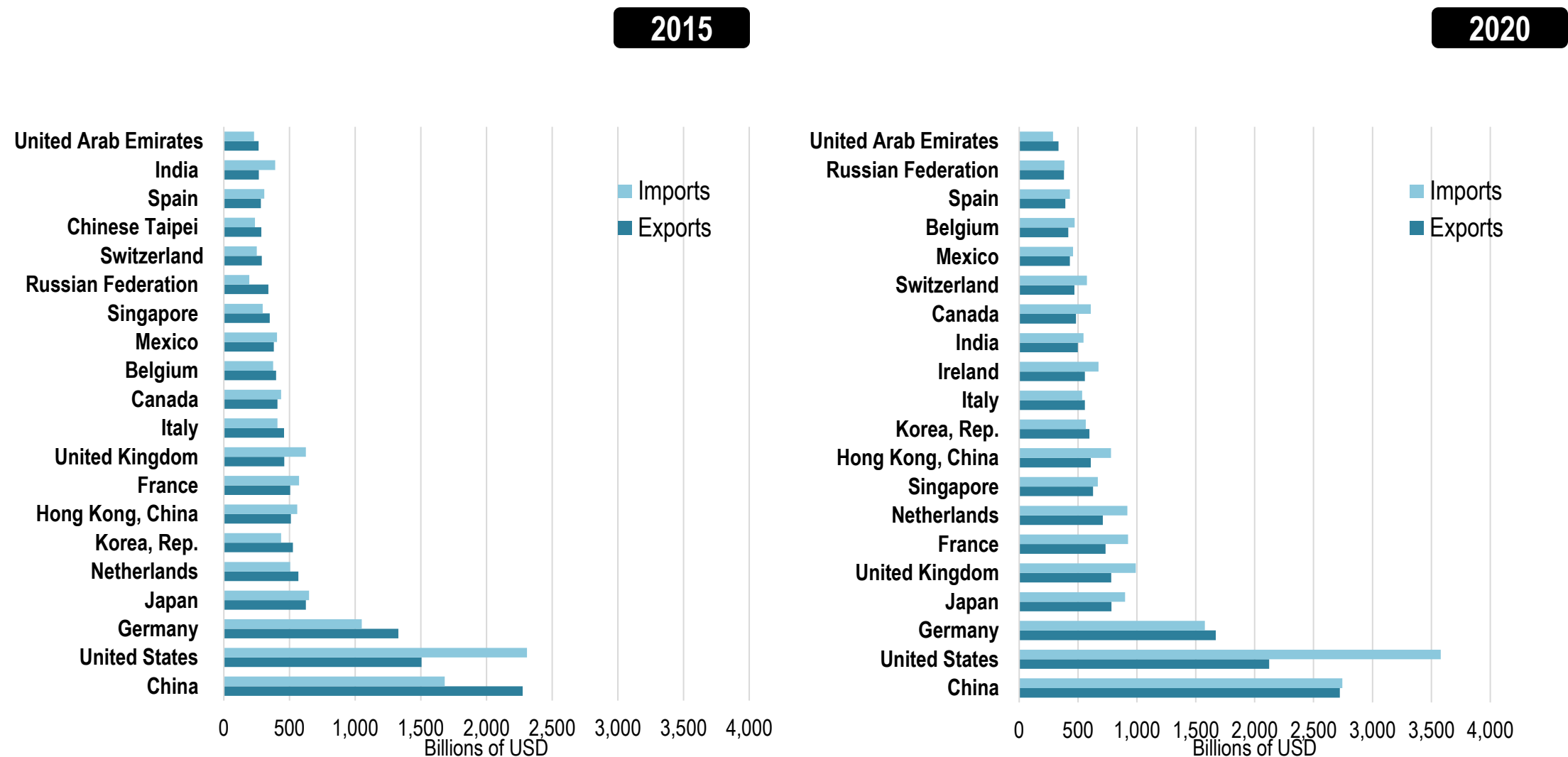
World's 20 Largest Exporters and Importers of Goods and Services, 2018



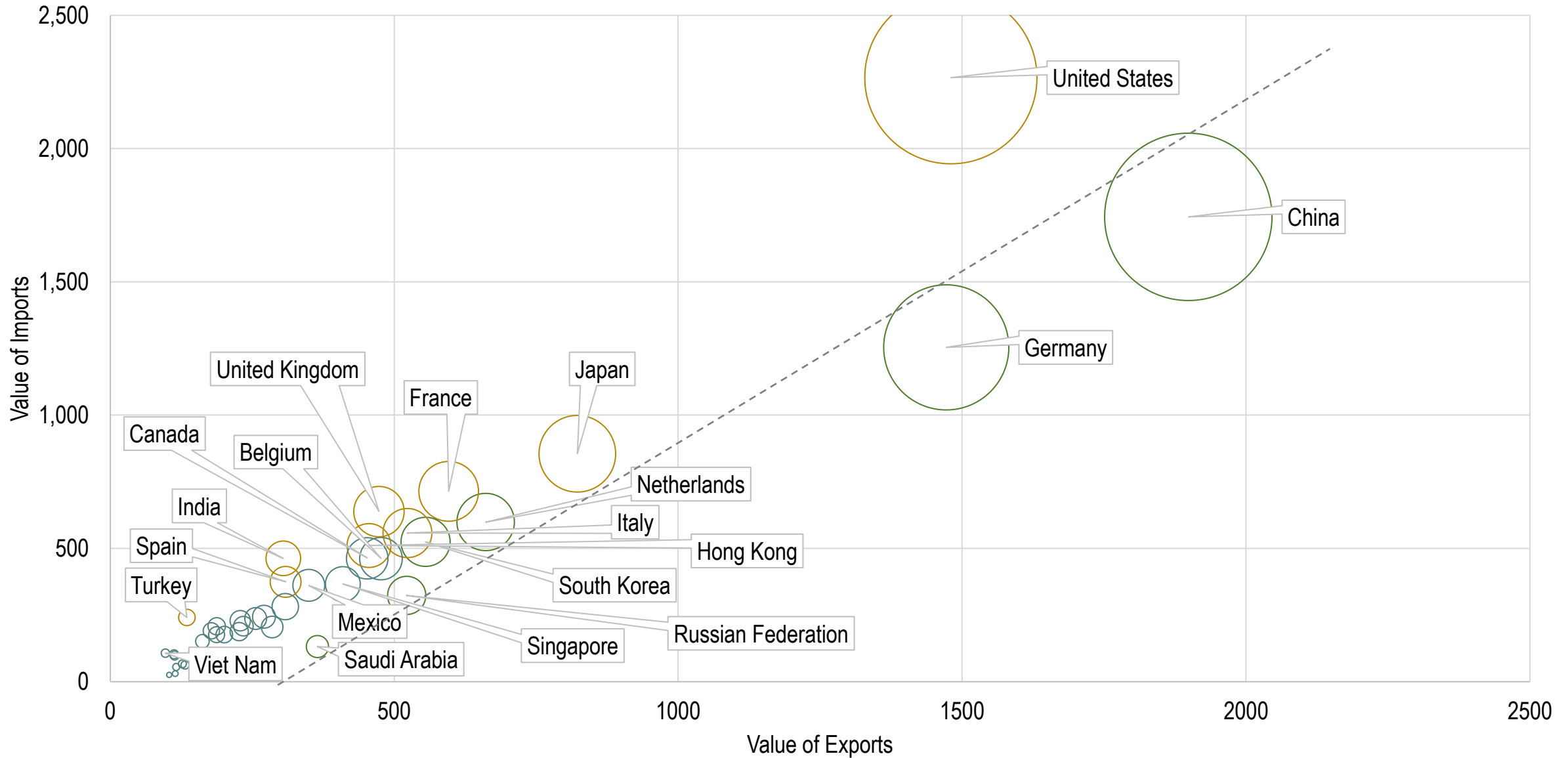
World's 20 Largest Exporters and Importers of Goods and Services, 2020



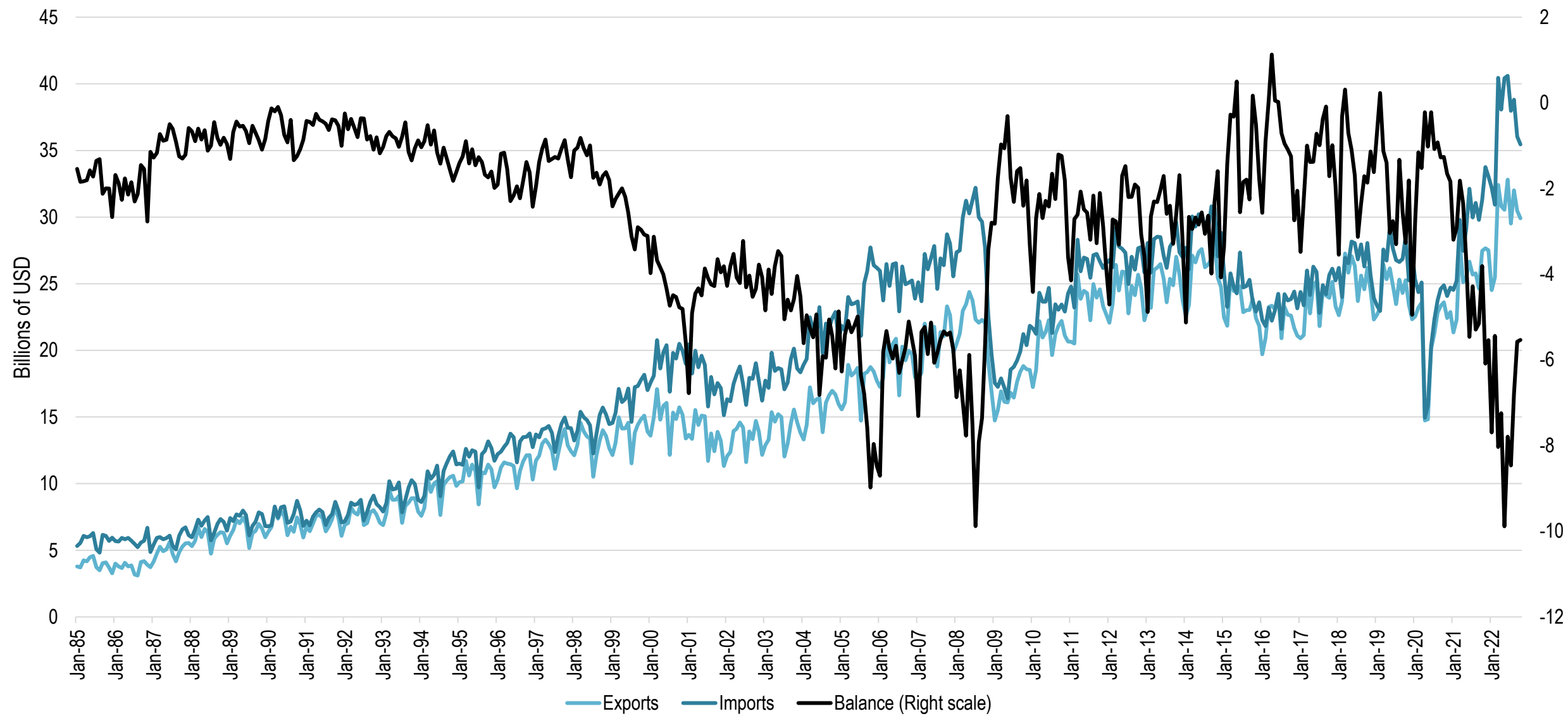
World's 20 Largest Exporters and Importers of Goods and Services, 2015-2020



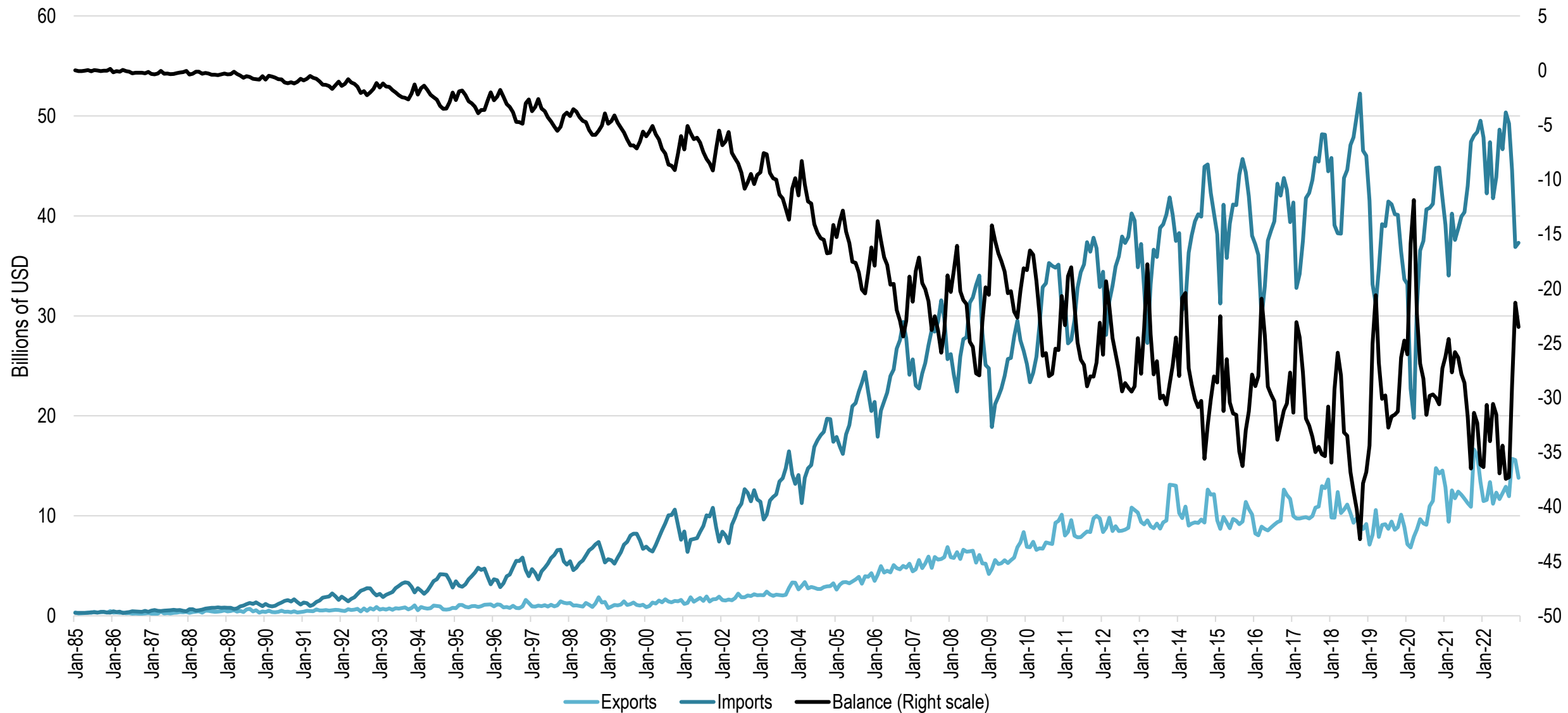
World's Largest Exporters and Importers, 2011



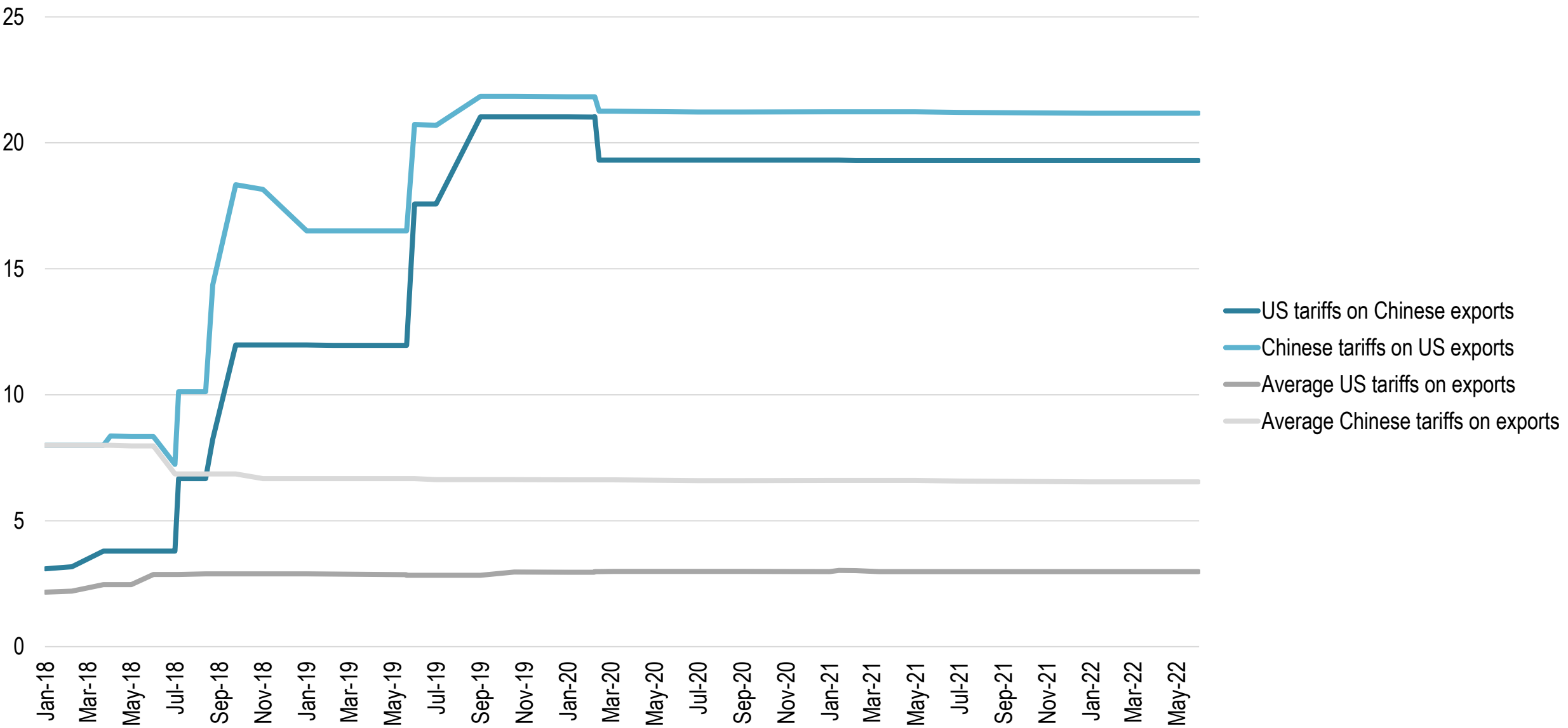
Monthly Trade between Canada and the United States (1985-2022)



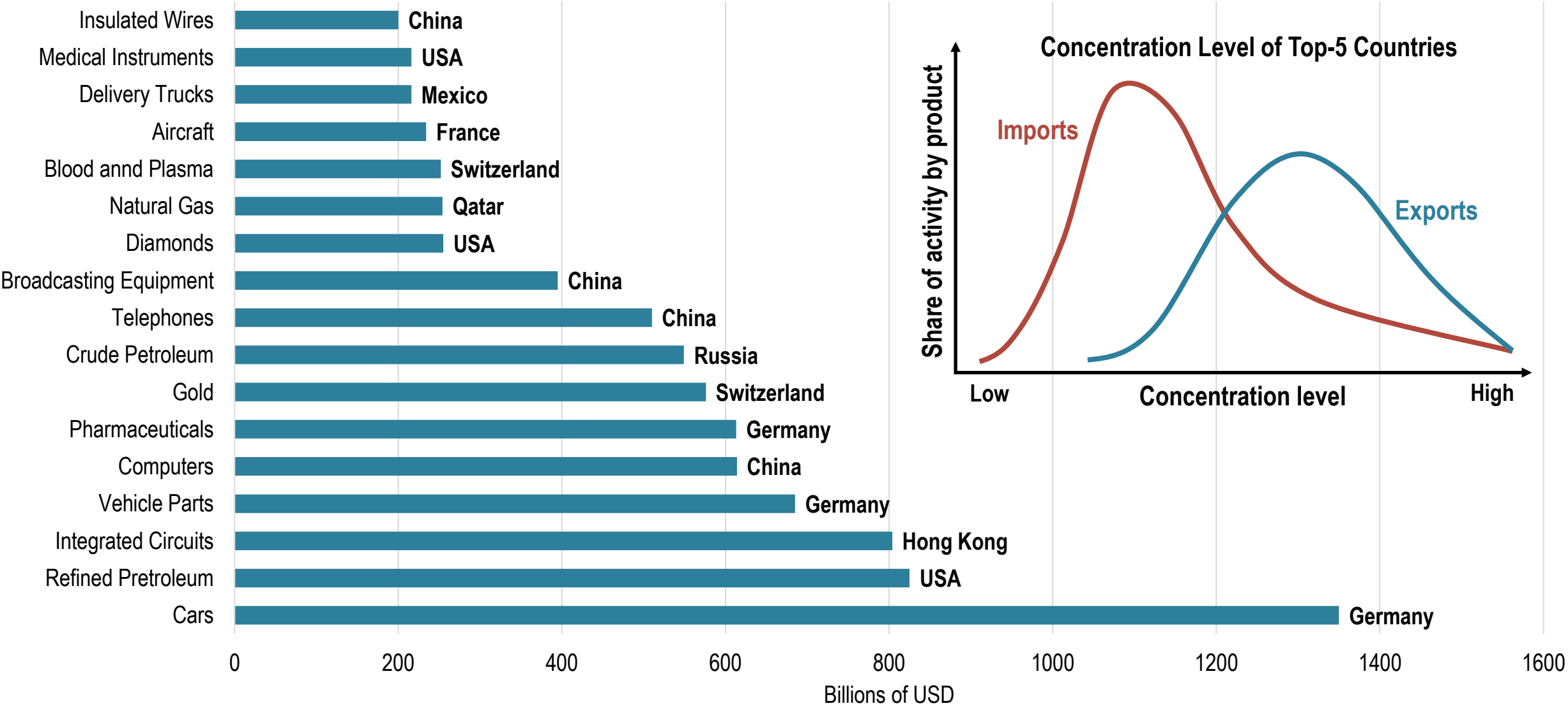
Monthly Trade between China and the United States (1985-2022)



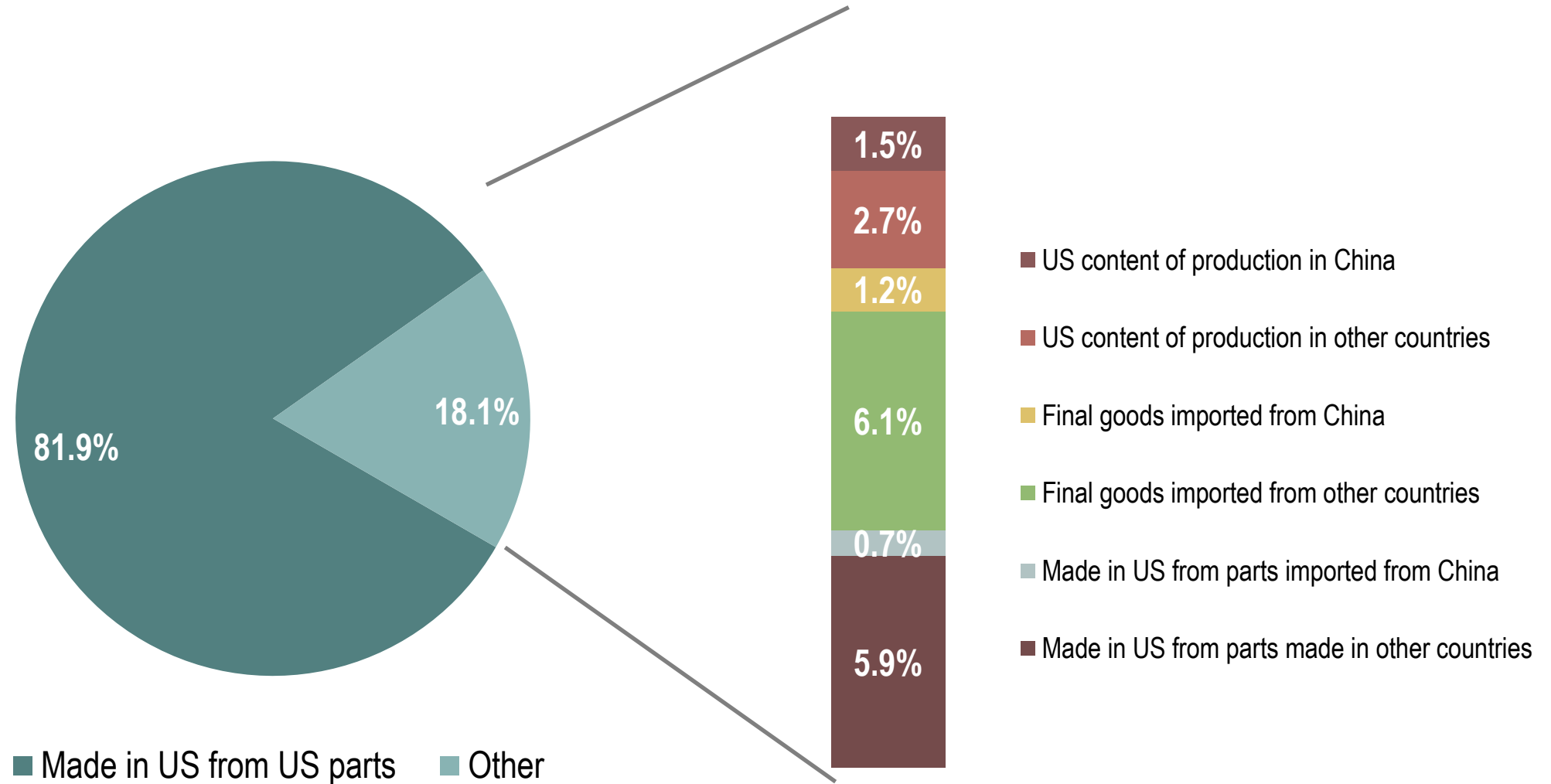
US-China Tariffs, 2018-2022



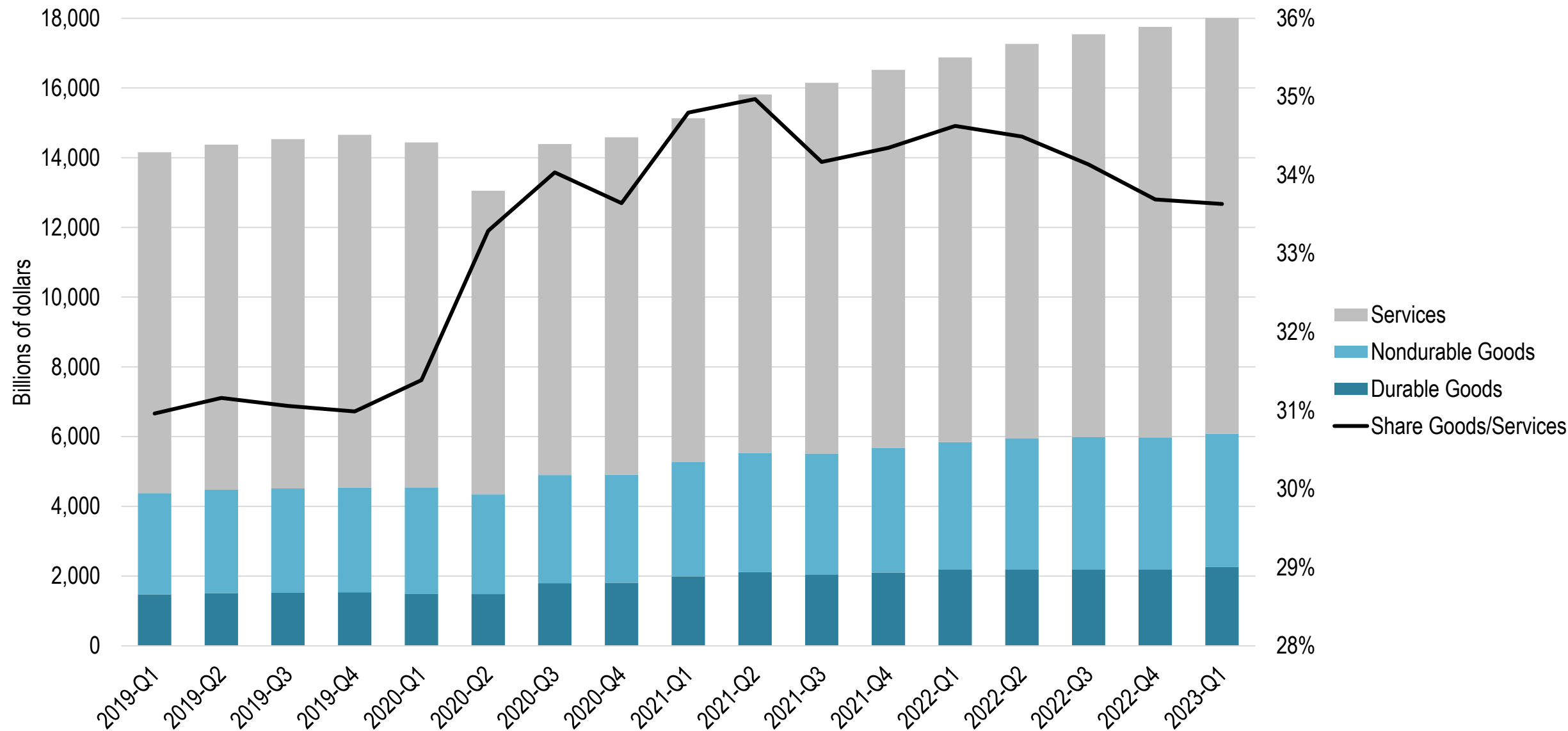
World's Most Traded Goods, Lead Exporter and Concentration, 2016



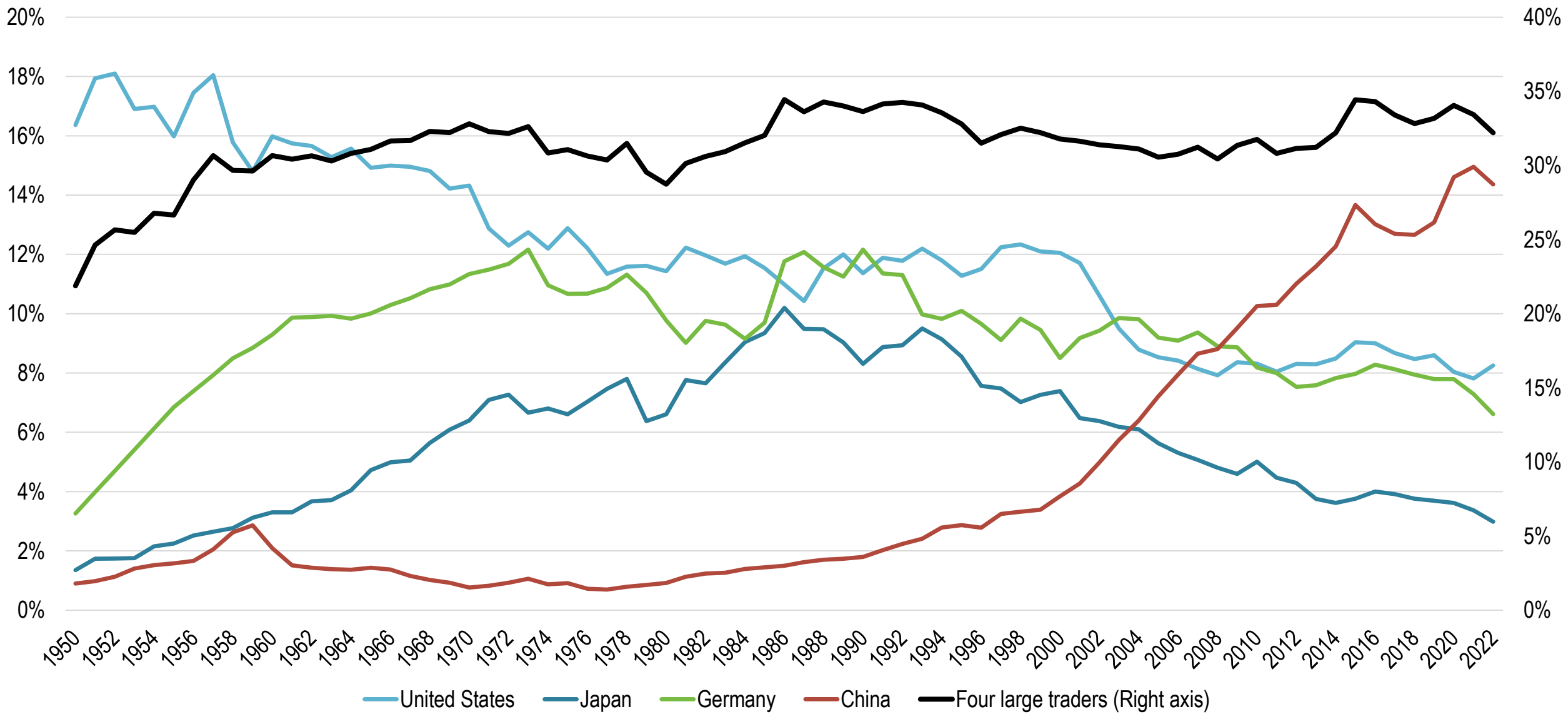
Personal Consumption Expenditures, United States 2010



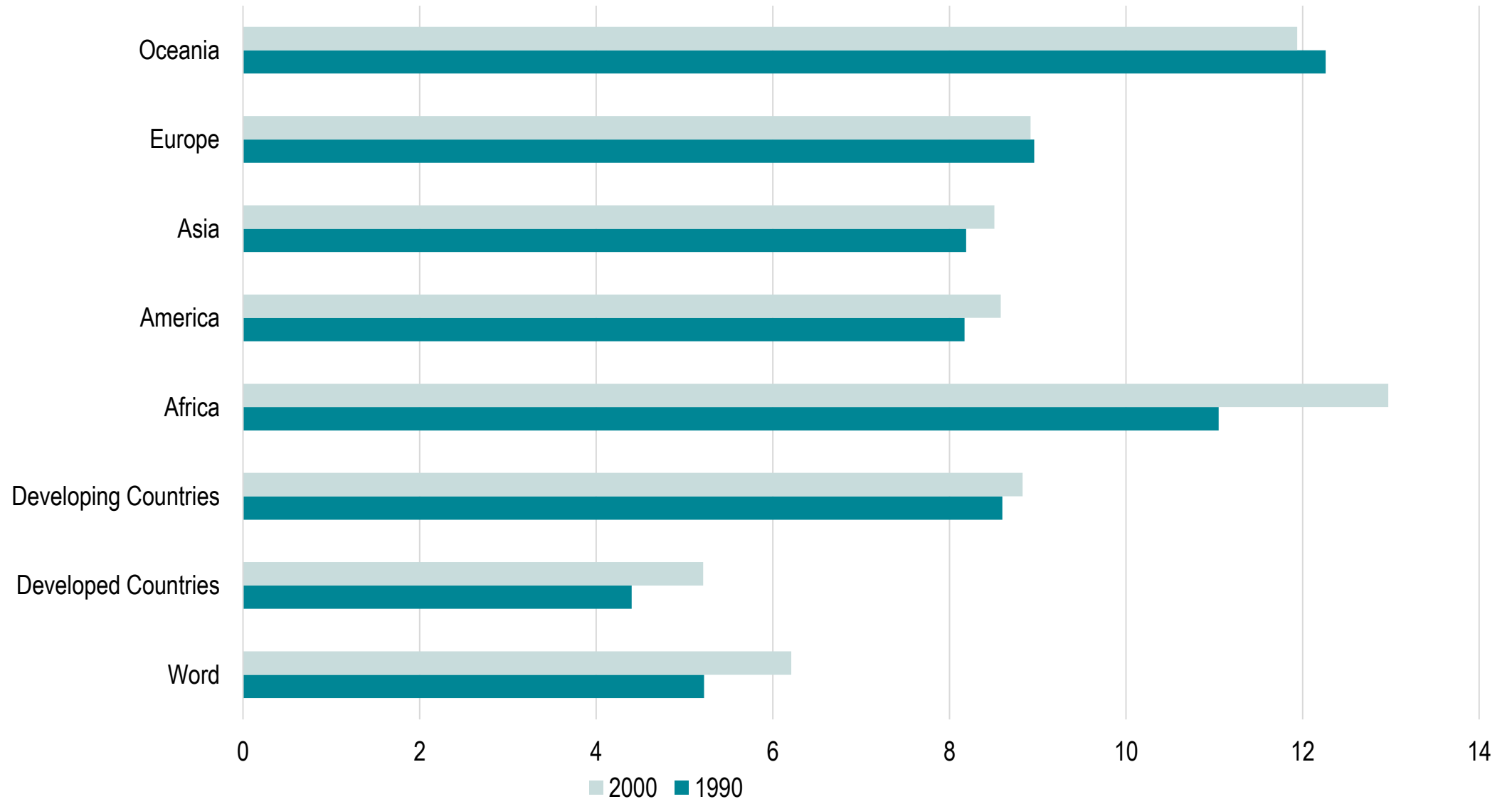
Personal Consumption Expenditures by Major Type of Product, United States



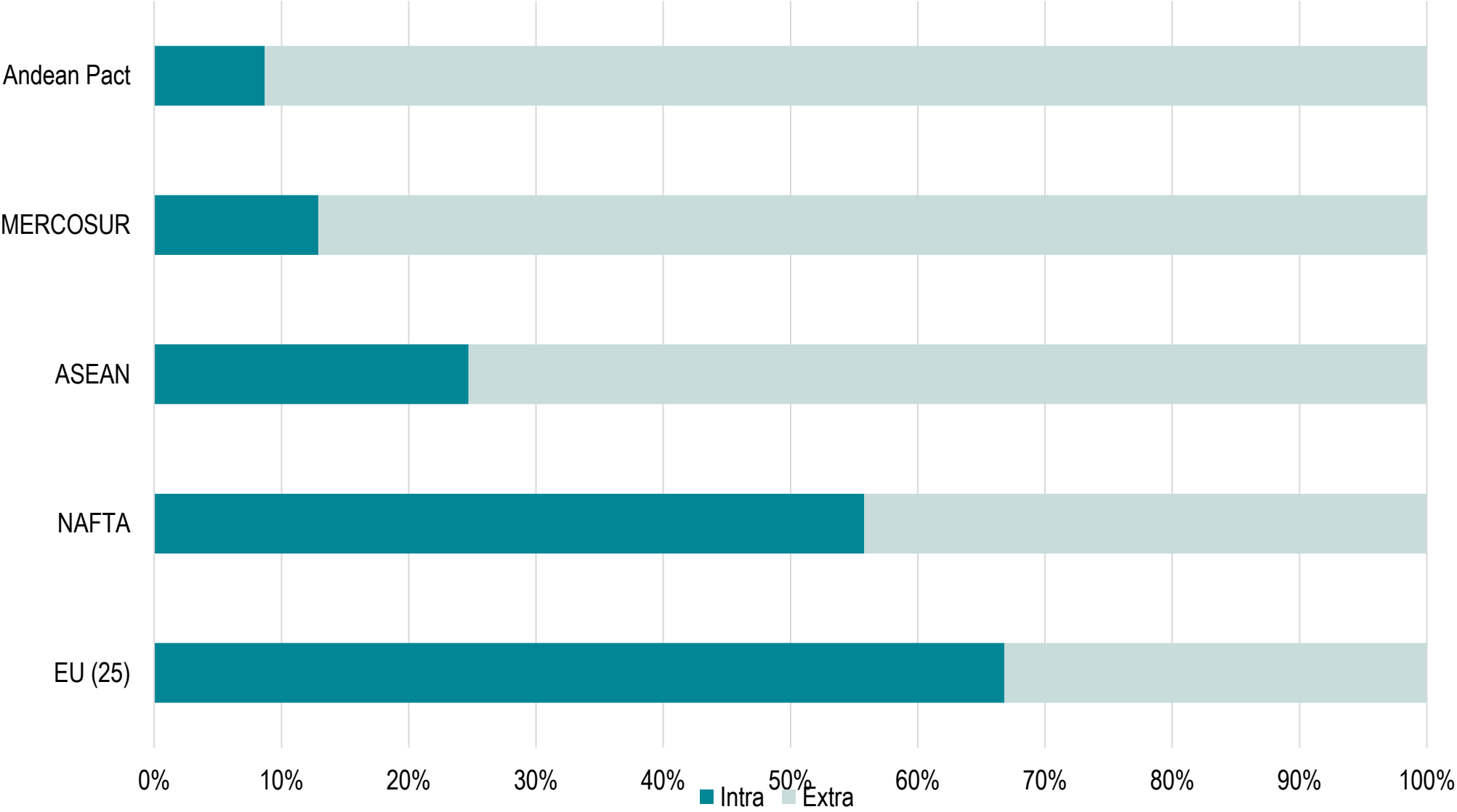
Share of World Goods Exports, Leading Exporters, 1950-2022



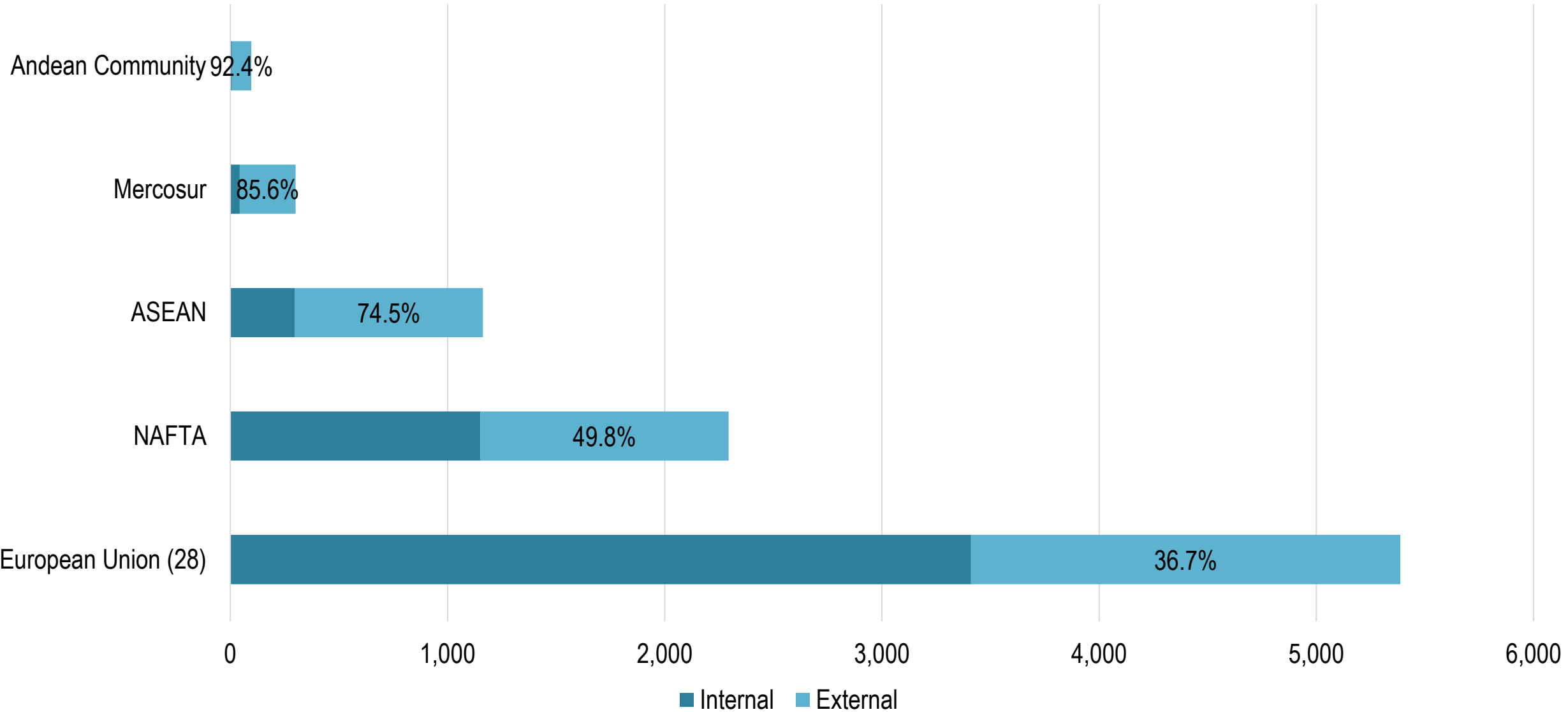
Total Freight Costs for Imports in World Trade (% of Total Costs)




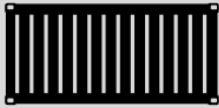
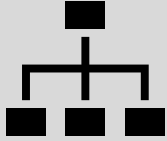

Merchandise Exports by Trade Agreement, 2005

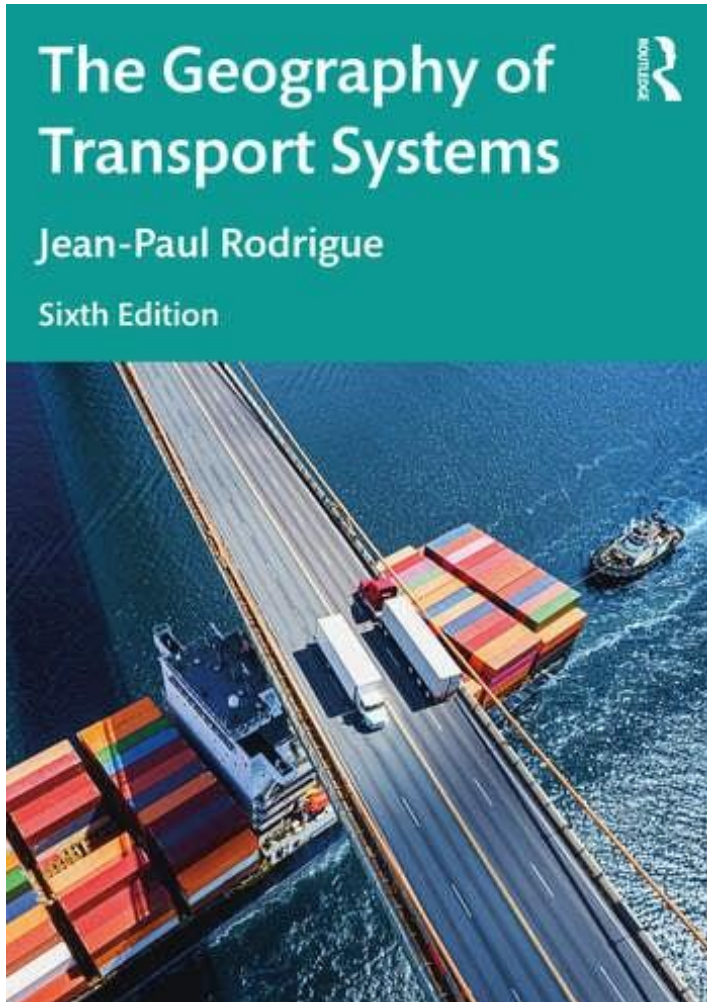


Merchandise Exports by Trade Agreement, 2015 (in billions USD)



Trends Shaping International Trade

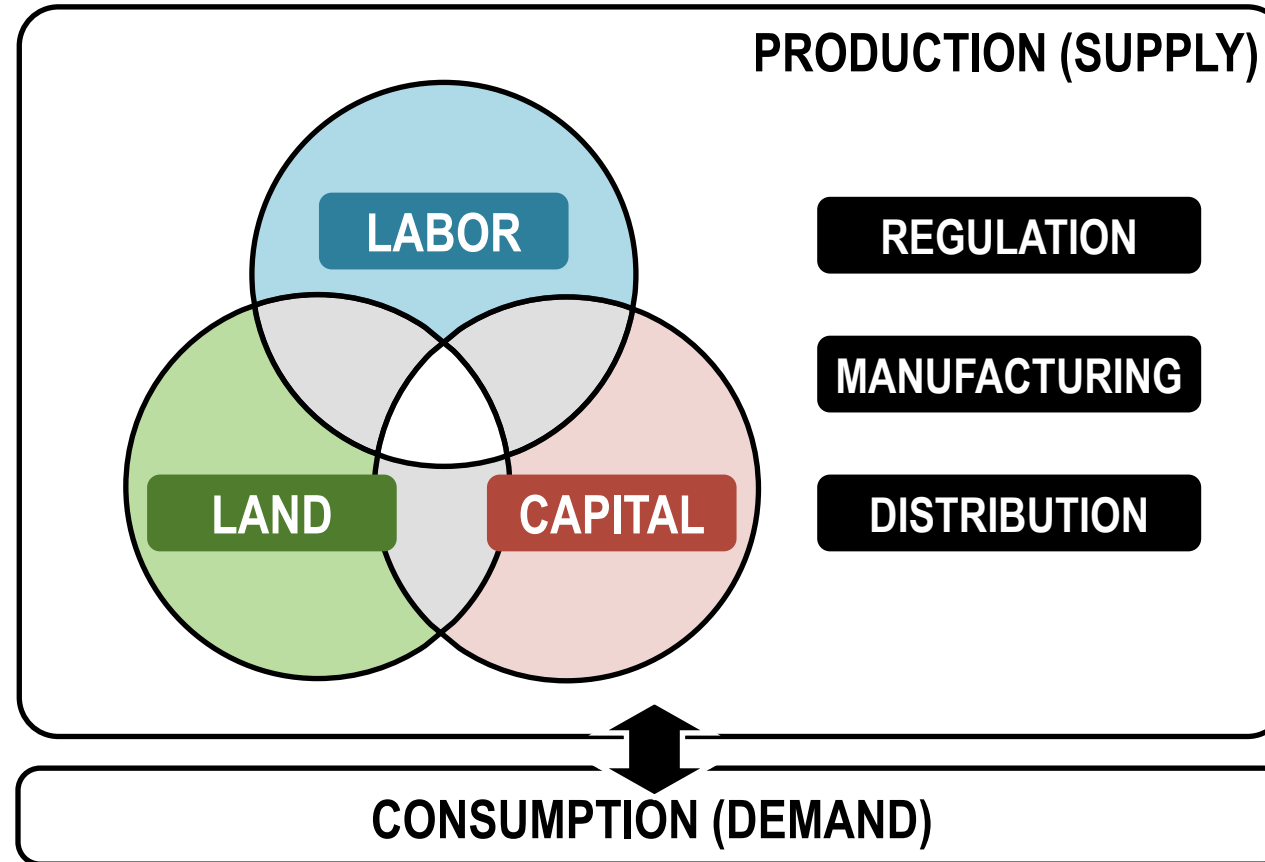
Volume	Support	Actors	Geography
 Peak growth	 Containerization	 Multinational Corporations	 Export-Oriented Economies
<p>1980-2020:</p> <ul style="list-style-type: none">• Population: 1.7 times.• GDP: 7.2 times.• Exports (value): 8.9 times.• TEU: 20 times.	<ul style="list-style-type: none">• Growing proportion of global trade.• Intermodal transport chains.	<ul style="list-style-type: none">• Transnational production networks.• Outsourcing and offshoring.	<ul style="list-style-type: none">• Focus on exports to promote economic growth.• Imbalances in trade relations. <p>© GTS</p>



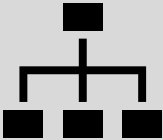
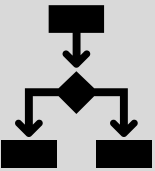
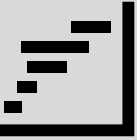
Freight Transportation and Value Chains

Chapter 7.3

Elements of an Economic System



The Corporation as a Decision, Management and Planning Unit

	Management Unit	Decision Unit	Planning Unit
			
Nature	Maintain operational conditions.	Decisions about the allocation of resources.	Anticipate market changes and opportunities. Allocate its factors of production.
Scope	Production, sales, marketing, payroll, distribution.	Financial, labor, raw materials, research and development.	Economic, technological, social and political change.
Timeframe	Short term (production cycles).	Short to long term (product cycles).	Medium to long term (business cycles).

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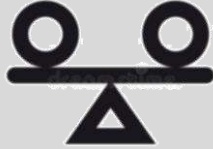
Competitive Advantages of Multinational Corporations

Lower Production Costs



- Core goal of a corporation.
- Exploitation of comparative advantages.
- Finding lower costs inputs (land, capital, labor).

Price Stability



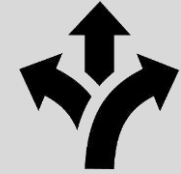
- Low costs rationale take account of price changes in raw materials and parts.
- Risky to relocate (long-term investment) to take advantage of conditions that can change in the short term.

Product Quality



- Performance, service and maintenance.
- A quantitatively competitive product has limited advantages if not qualitatively competitive.



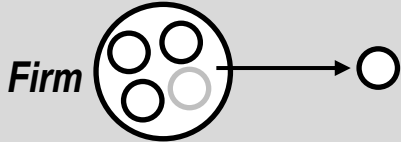
Logistics Flexibility



- Adapting to changes in the demand confers an advantage.
- Ability to withstand disruptions (resilience).

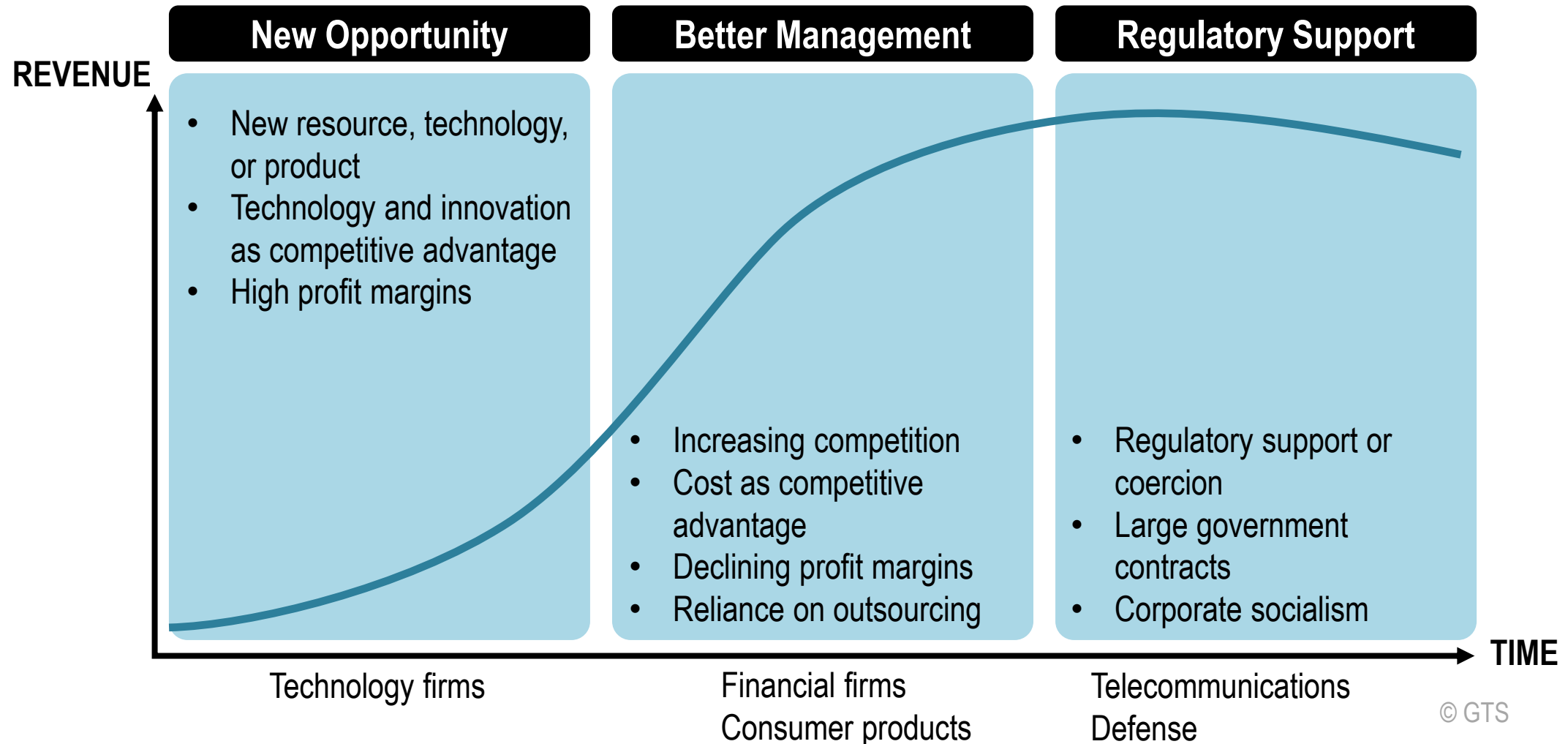
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The Corporation and its Expansion

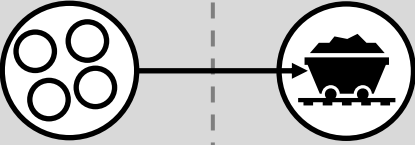
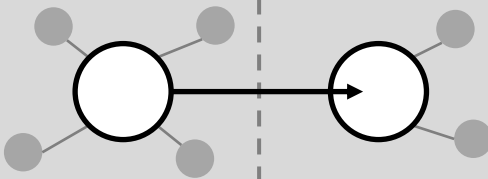
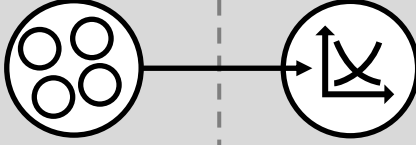
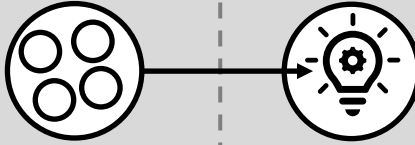
	Vertical Integration	Horizontal Integration	Outsourcing
			
Nature	Expand backward (suppliers) or forward (customers) along the supply chain.	Acquiring or merging with competitors.	Some activities performed by another corporation.
Goals	Lower costs. Enhance and protect product quality. Improve supply chain efficiency.	Economies of scale. Product differentiation. Business model replication. Oligopoly.	Reduce costs. Focus on core competencies. Increase output.
Issues	Higher cost structure of suppliers. More difficult to adapt to changes.	Different business cultures. Anti-monopolistic responses.	Dependency. Loss of competency.

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The Growth Cycle of Large Multinationals

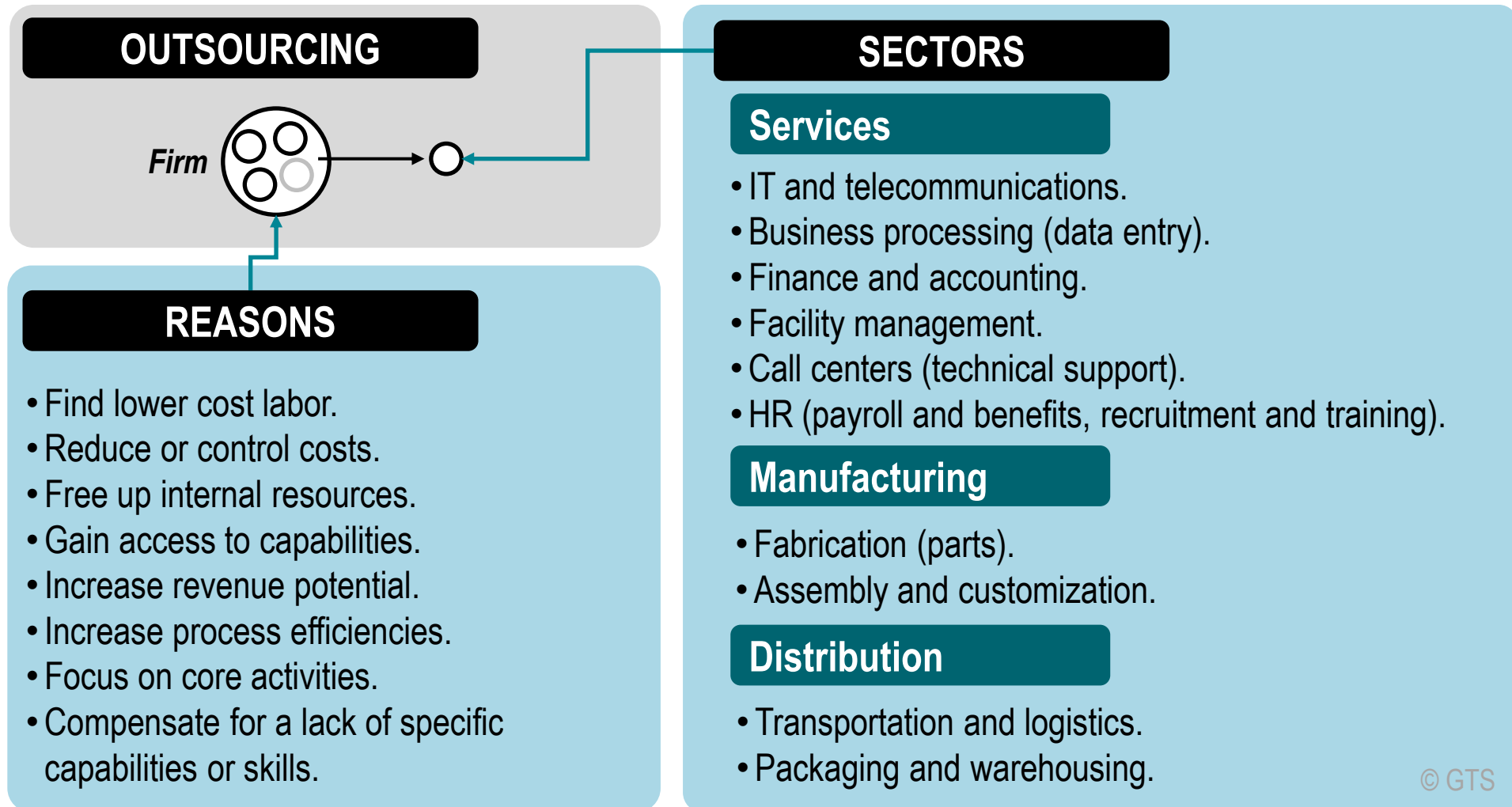


Types of Corporations by Multinational Expansion Strategy

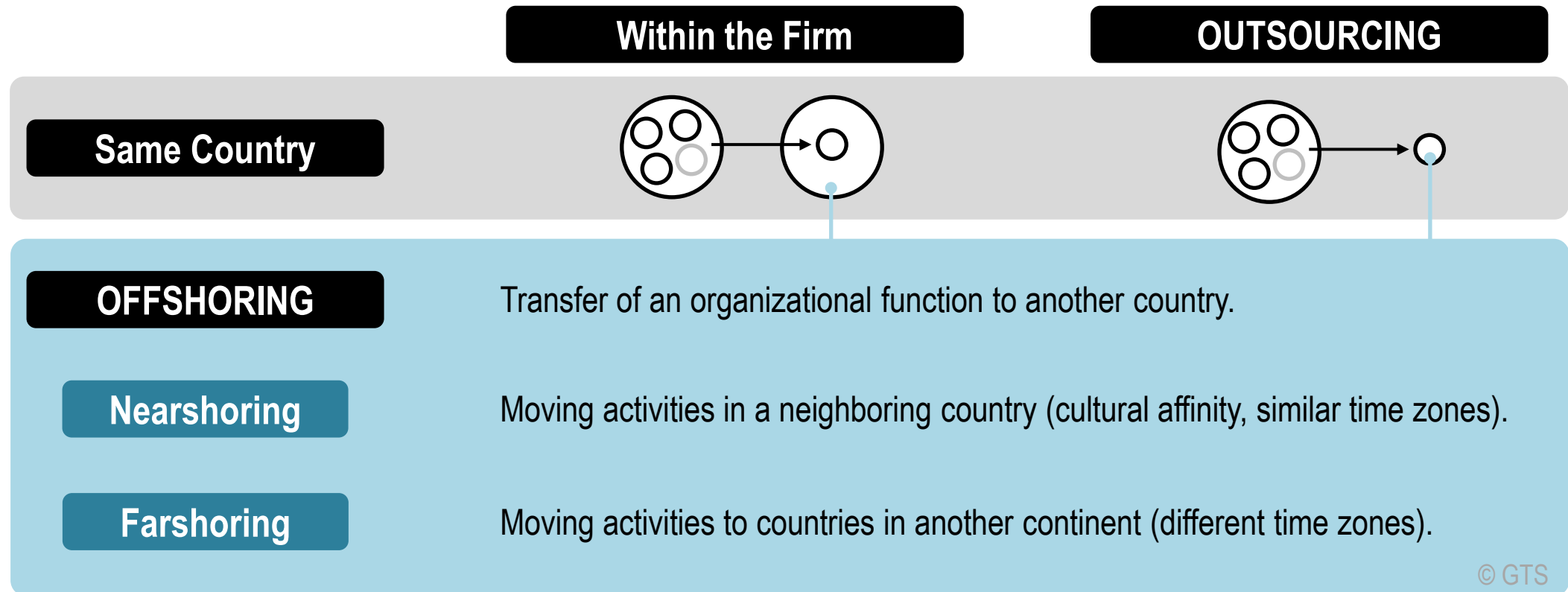
Raw Material Seekers	Market Seekers	Low Cost Seekers	Knowledge Seekers
			
<ul style="list-style-type: none">• Lower input costs• Resource acquisition• First MNCs to emerge	<ul style="list-style-type: none">• Achieve economies of scale• Expand market• Large investors	<ul style="list-style-type: none">• Look for comparative advantages• Lower production and distribution costs• Remain competitive	<ul style="list-style-type: none">• Look for qualified labor, techniques and processes• Increase innovative capabilities
Energy, mining, agricultural, forest	Retailing, wholesalers	Manufacturing	Information technologies, pharmaceuticals

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Rationale for Outsourcing









Offshoring, Nearshoring and Farshoring

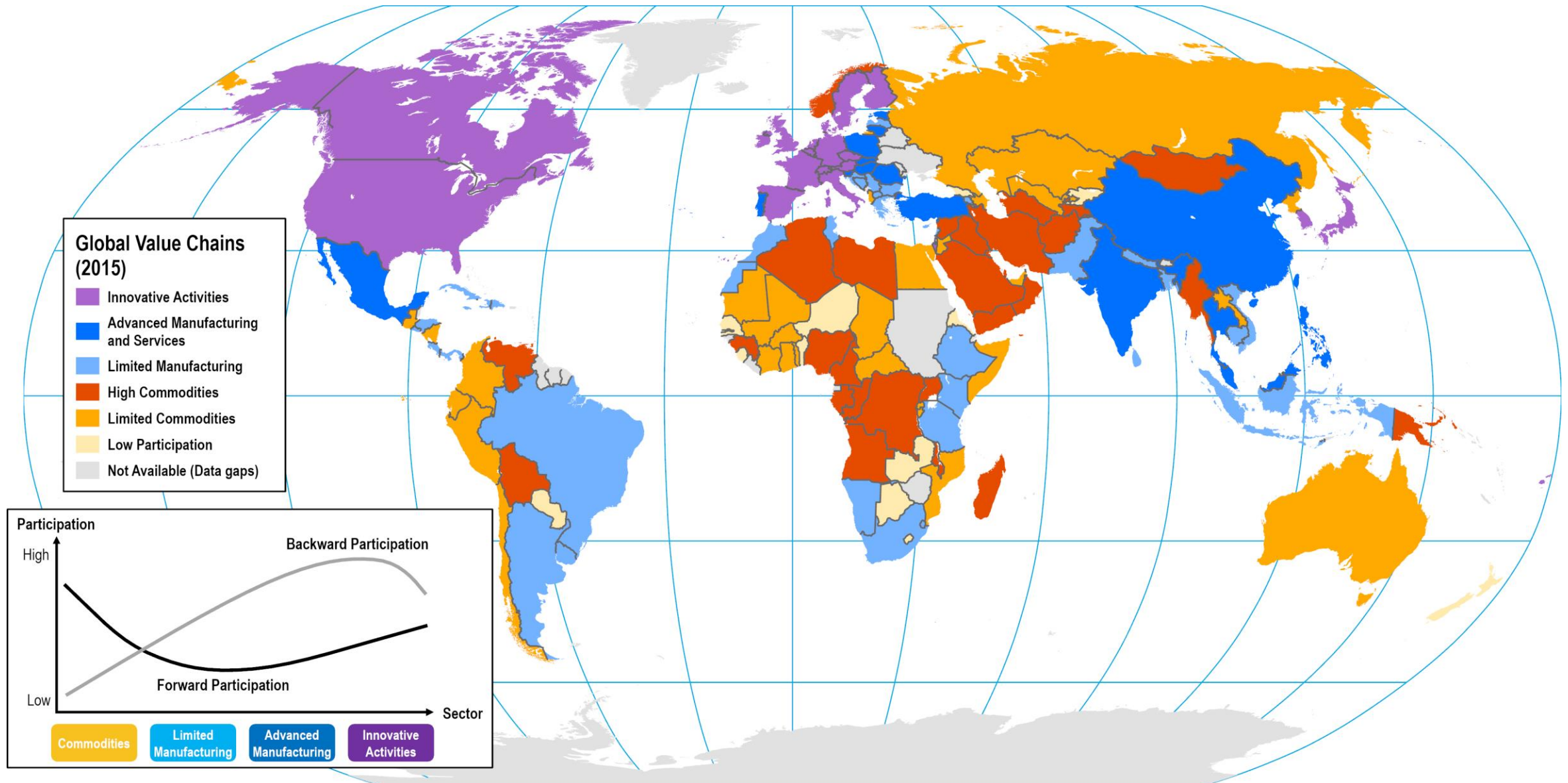


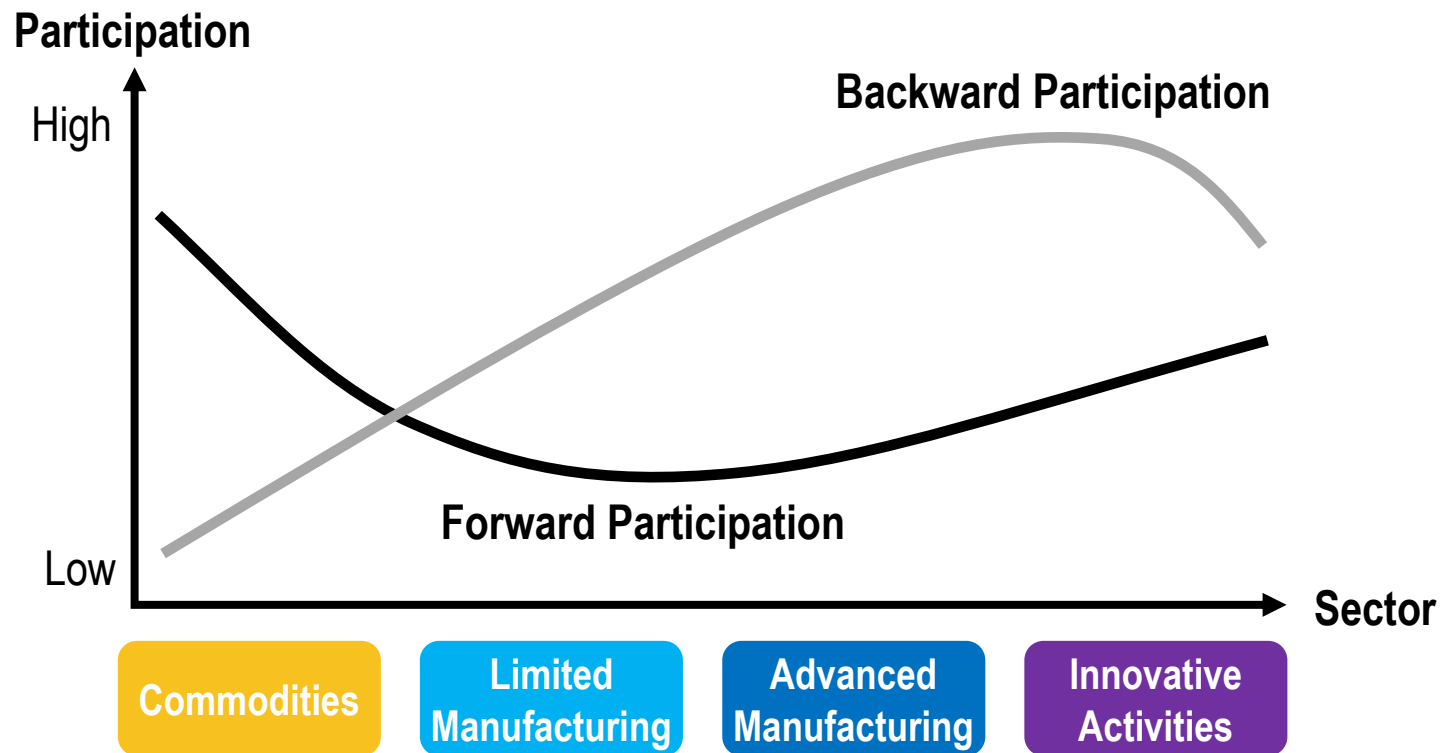
© GTS

Savings on Freight and Duties of Nearshoring Alternatives to China

	LOCATION	MODE/DAYS	LANDED PRICE	ΔChina
			For a pair of jeans	
Offshoring	Bangladesh	 30	\$10.68	-11%
	China	 30	\$12.04	0%
Nearshoring	Mexico	 2	\$10.57	-12%
Reshoring	UNITED STATES		\$14.05	+17%
Offshoring	Bangladesh	 30	\$9.94	-20%
	China	 30	\$12.46	0%
Nearshoring	Turkey	 3-6	\$12.08	-3%
Reshoring	GERMANY		\$30.36	+144%

Participation Level in Global Value Chains

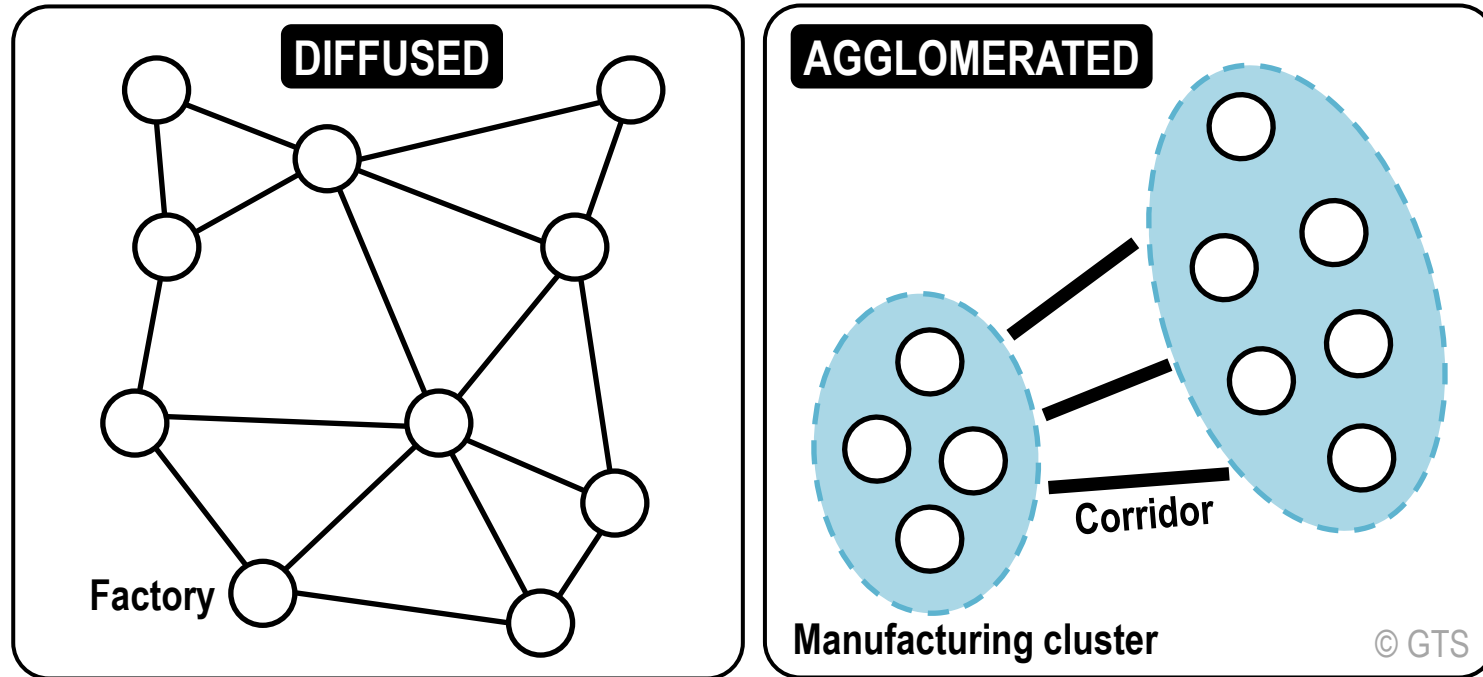




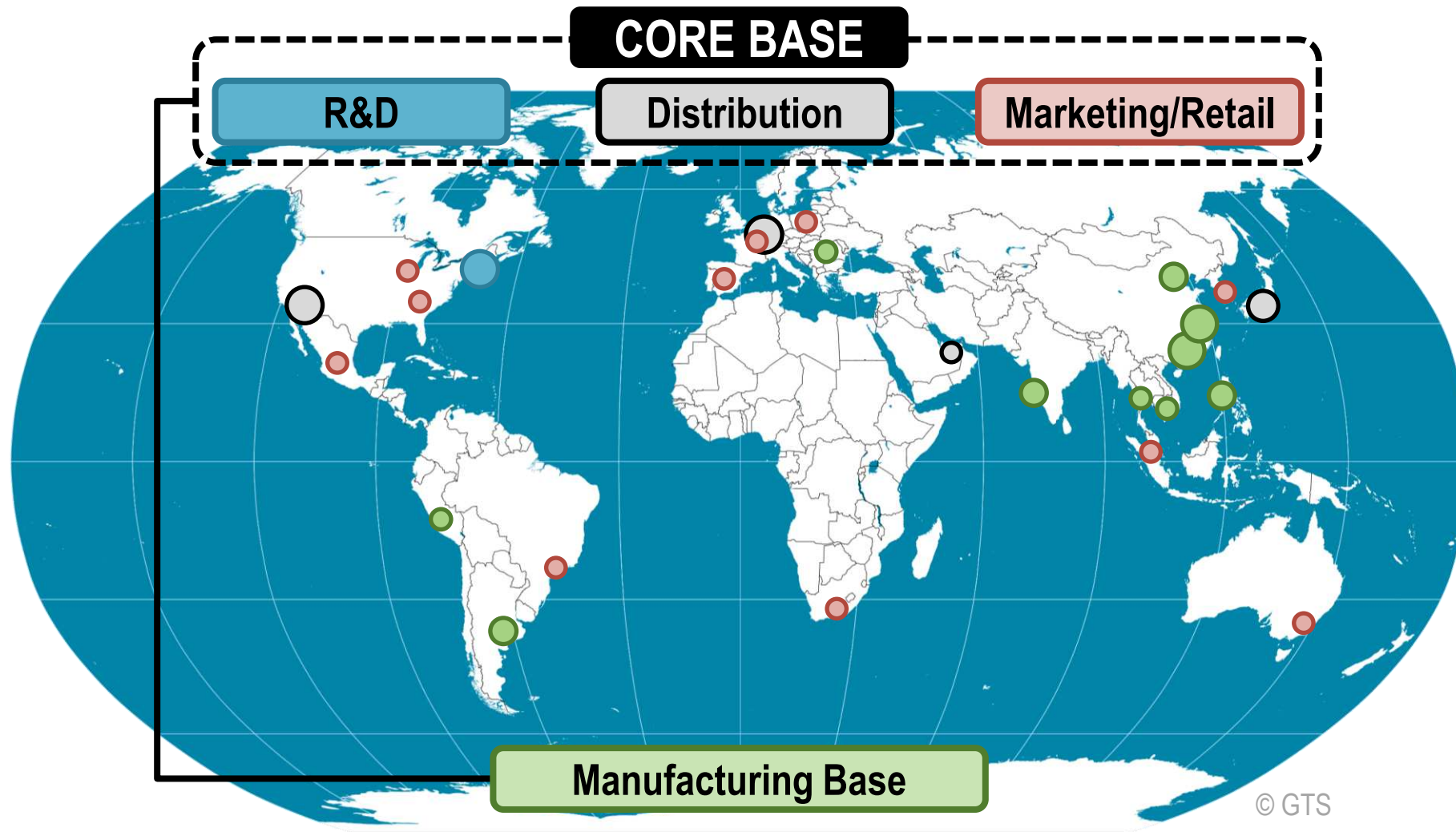
Private Firms Directly and Indirectly Related to Freight Distribution

	Function	Infrastructure
Carriers	Physical movements of goods	Modes
Terminal operators	Management and operation of terminal assets	Terminal equipment
Logistic service providers (third and fourth party)	Management of transportation physical and information assets	Stakes in transportation assets
Commodity producers	Extraction and transformation of raw materials	Storage facilities and terminal equipment
Manufacturers	Production of intermediate and final goods	Distribution centers
Retailers	Procurement and sale of final consumption goods	Distribution centers and delivery

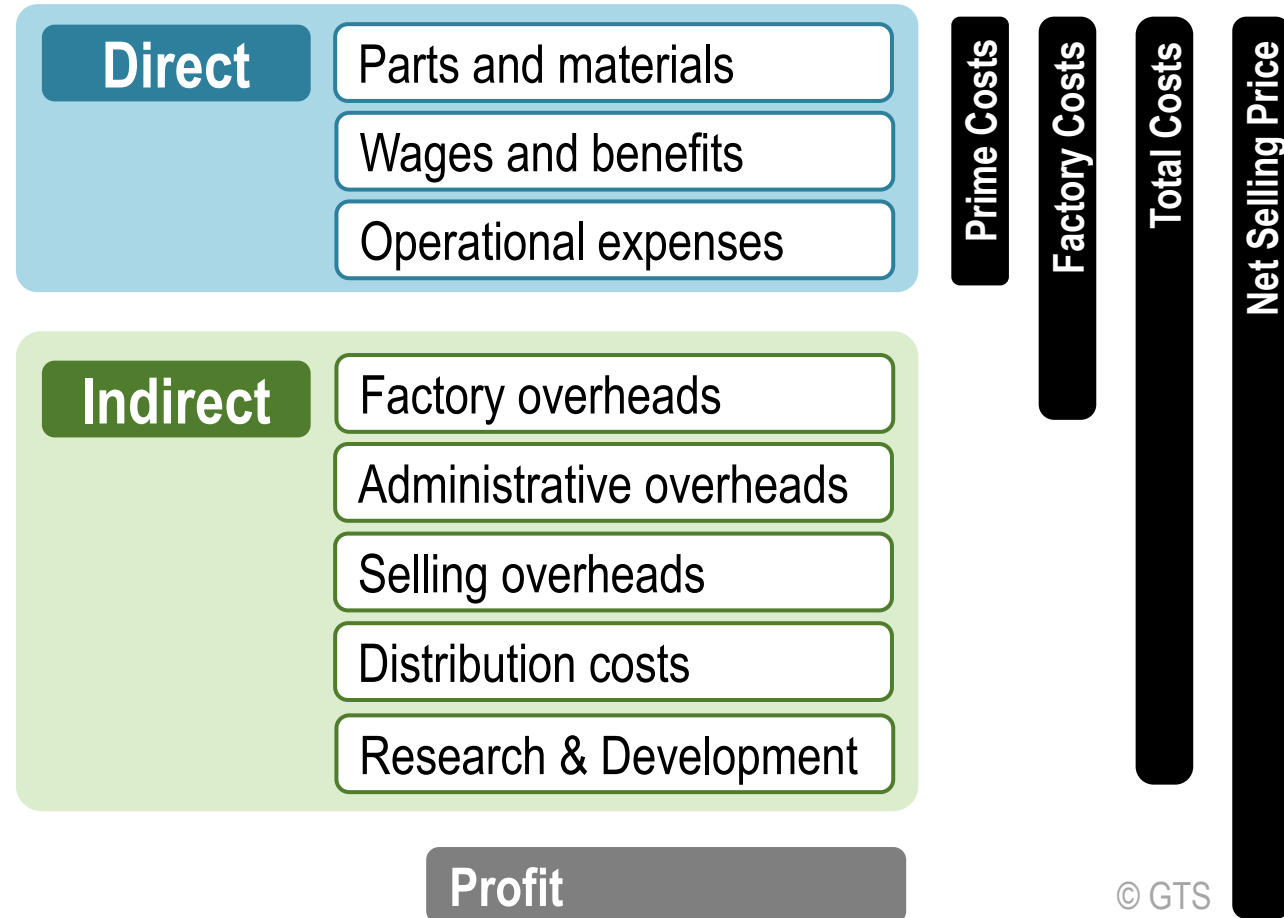
Industrial Agglomeration and Transportation



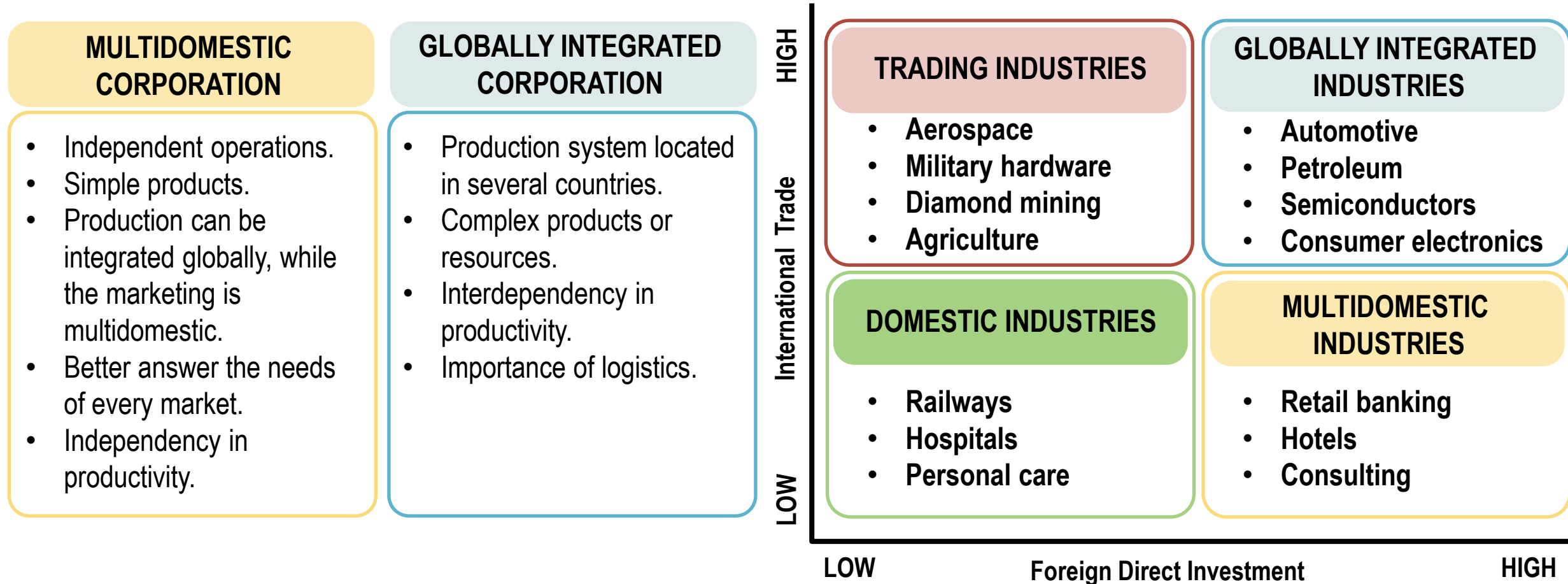
Disconnection of Global Production and Distribution



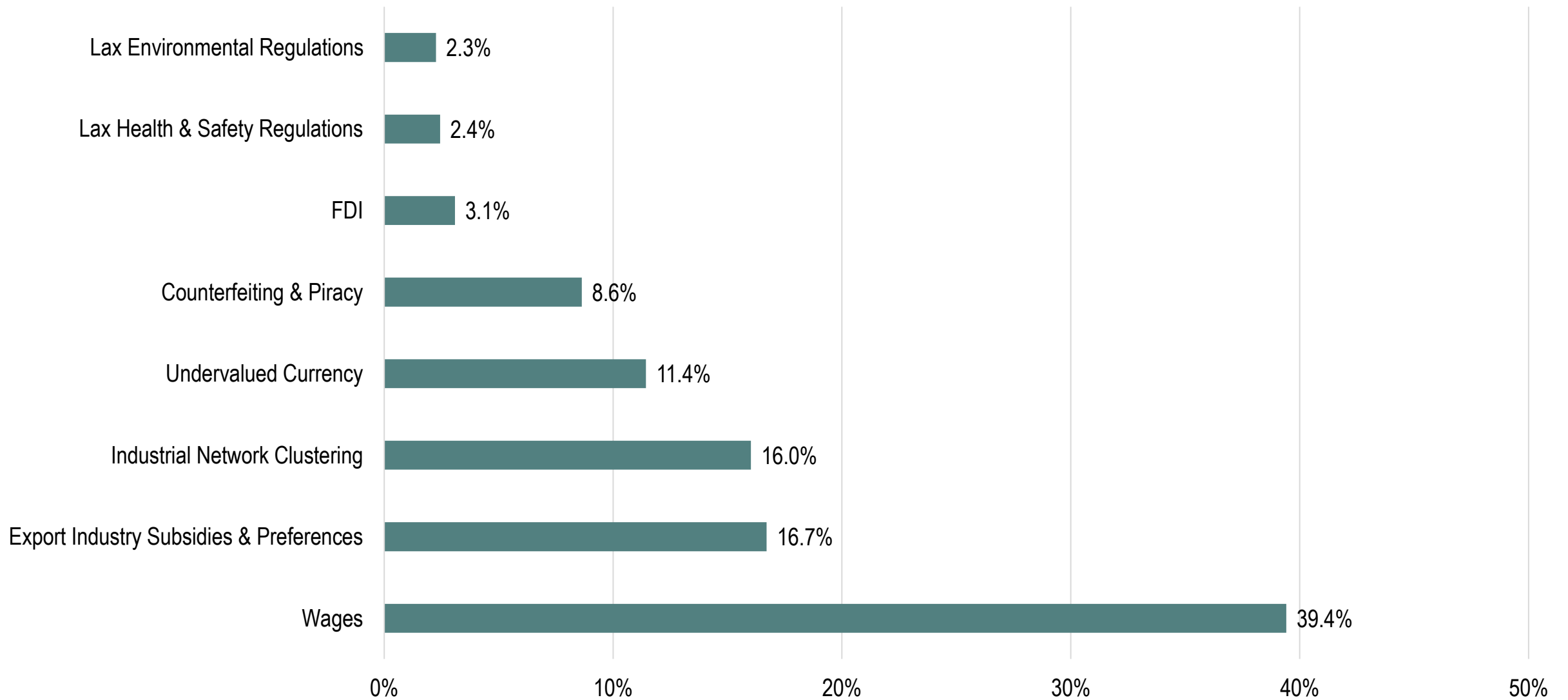
Manufacturing Cost Structure



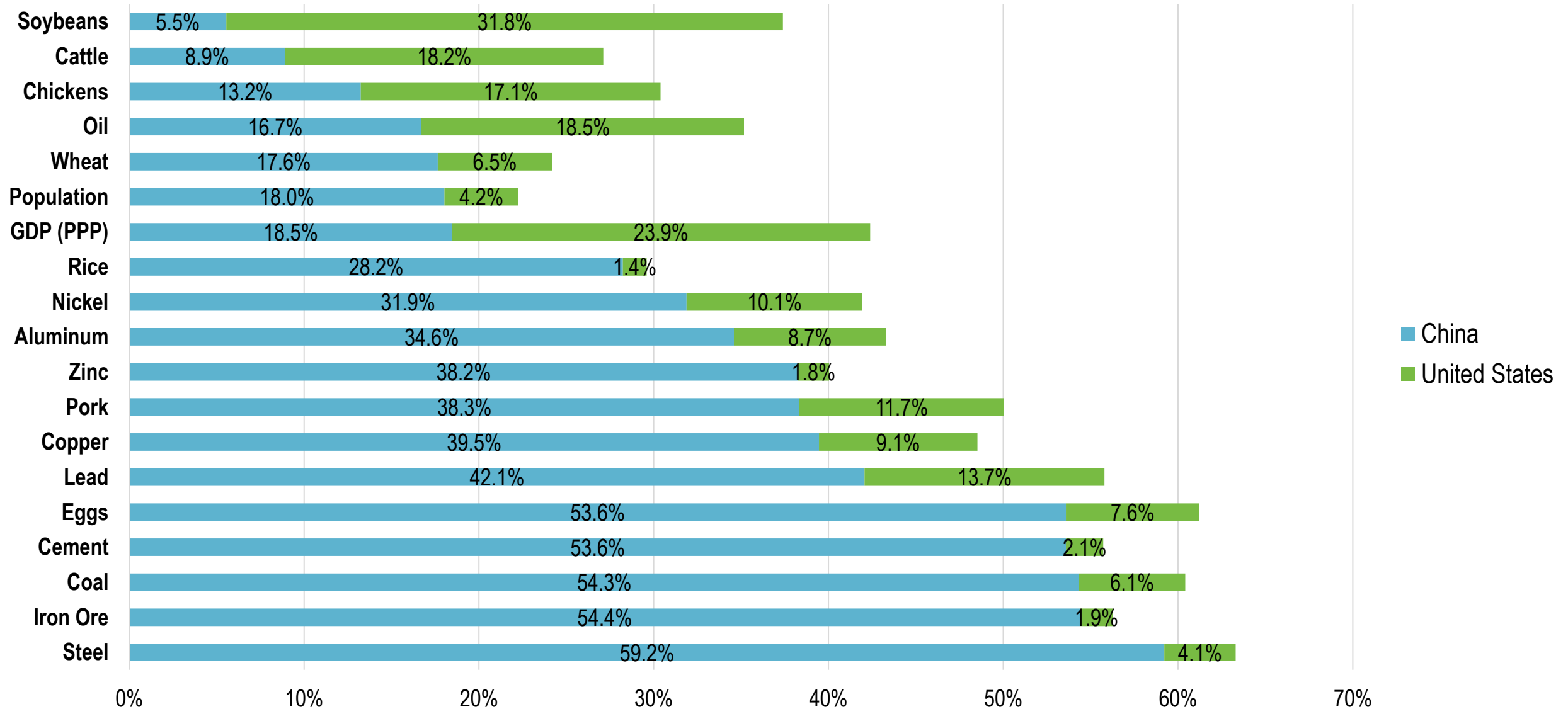
Types of Internationalization in Manufacturing



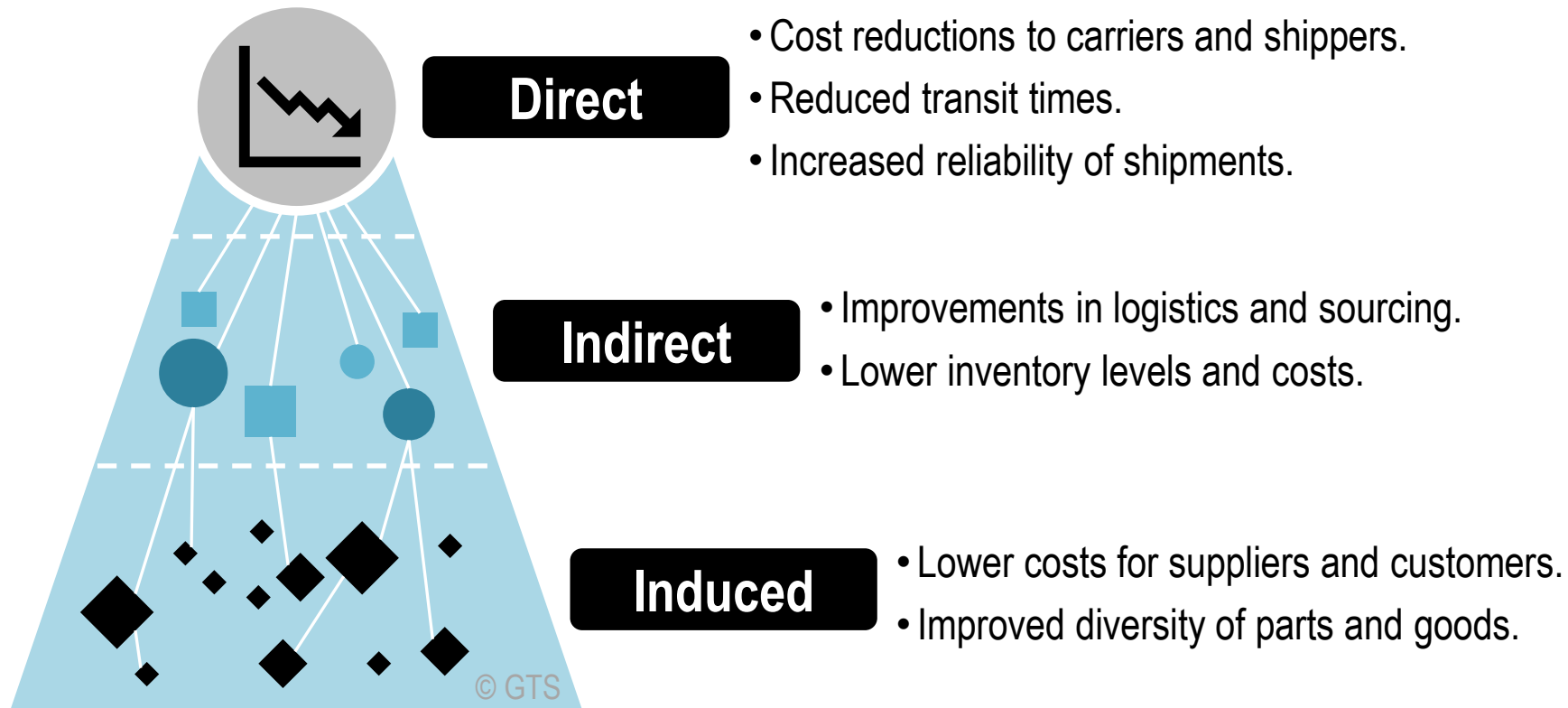
Major Components to Price Reductions by the Chinese Manufacturing Sector, 2005



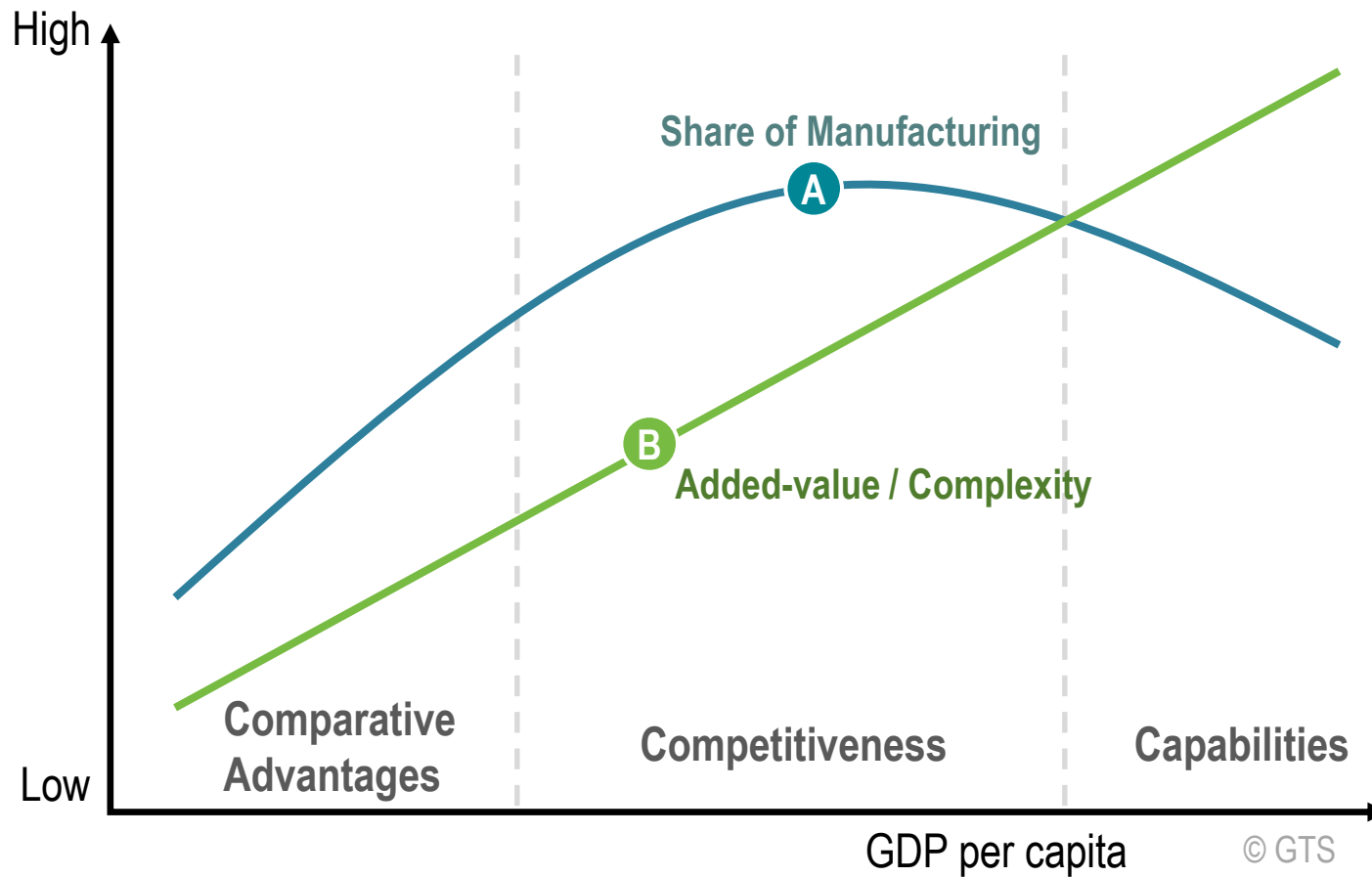
Share of the World Commodity Consumption, China and United States, c2020



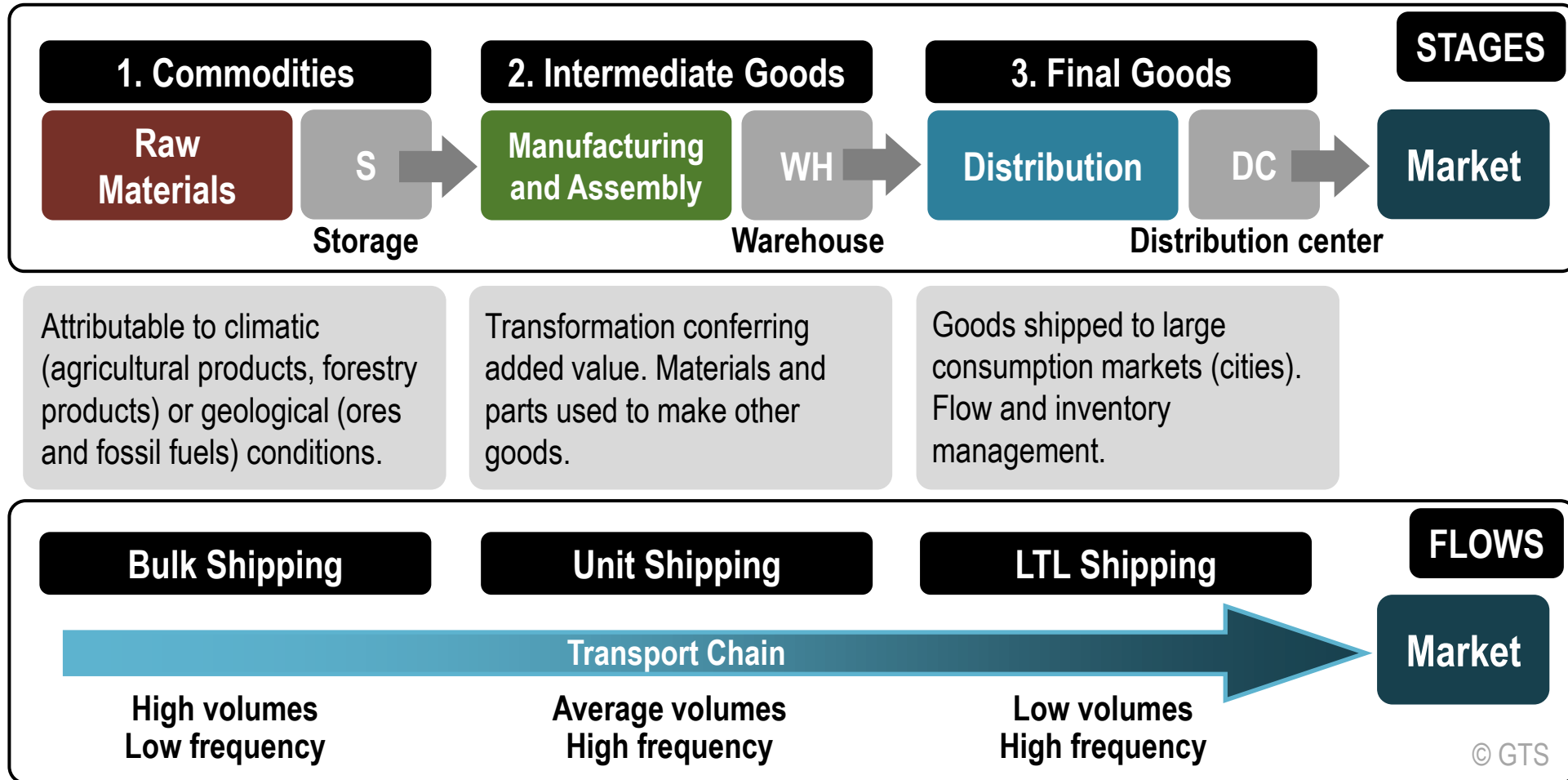
Benefits of Improved Freight Transportation on Value Chains



The Transition Towards Manufacturing Capabilities



The Value Chain (or Commodity Chain)

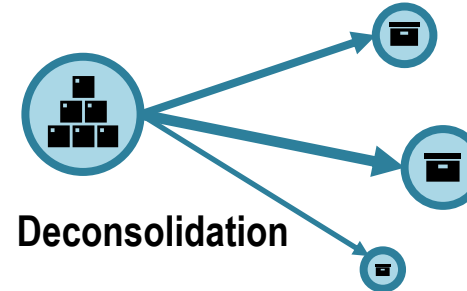


The Configuration of Value Chains

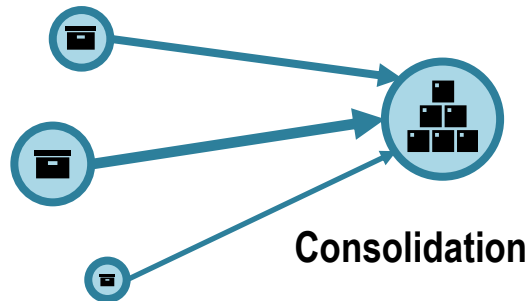
1. One-to-one



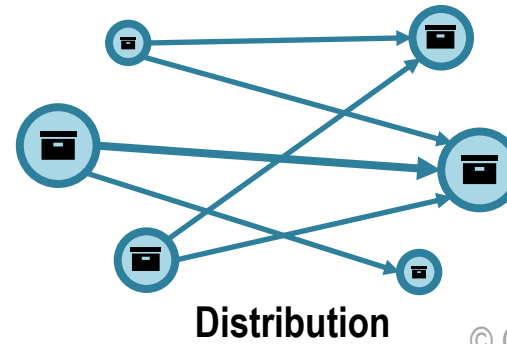
2. One-to-many



3. Many-to-one

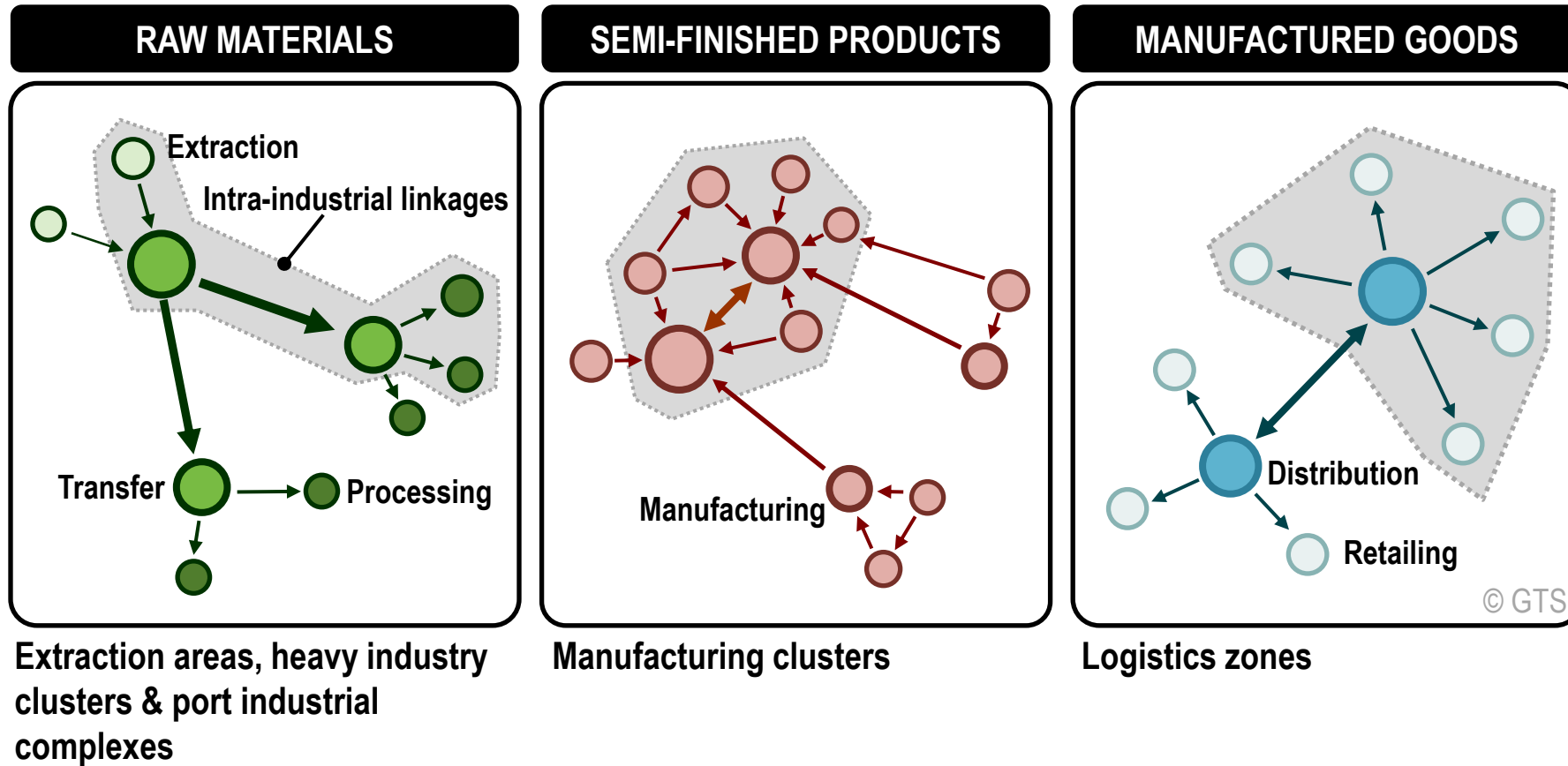


4. Many-to-many

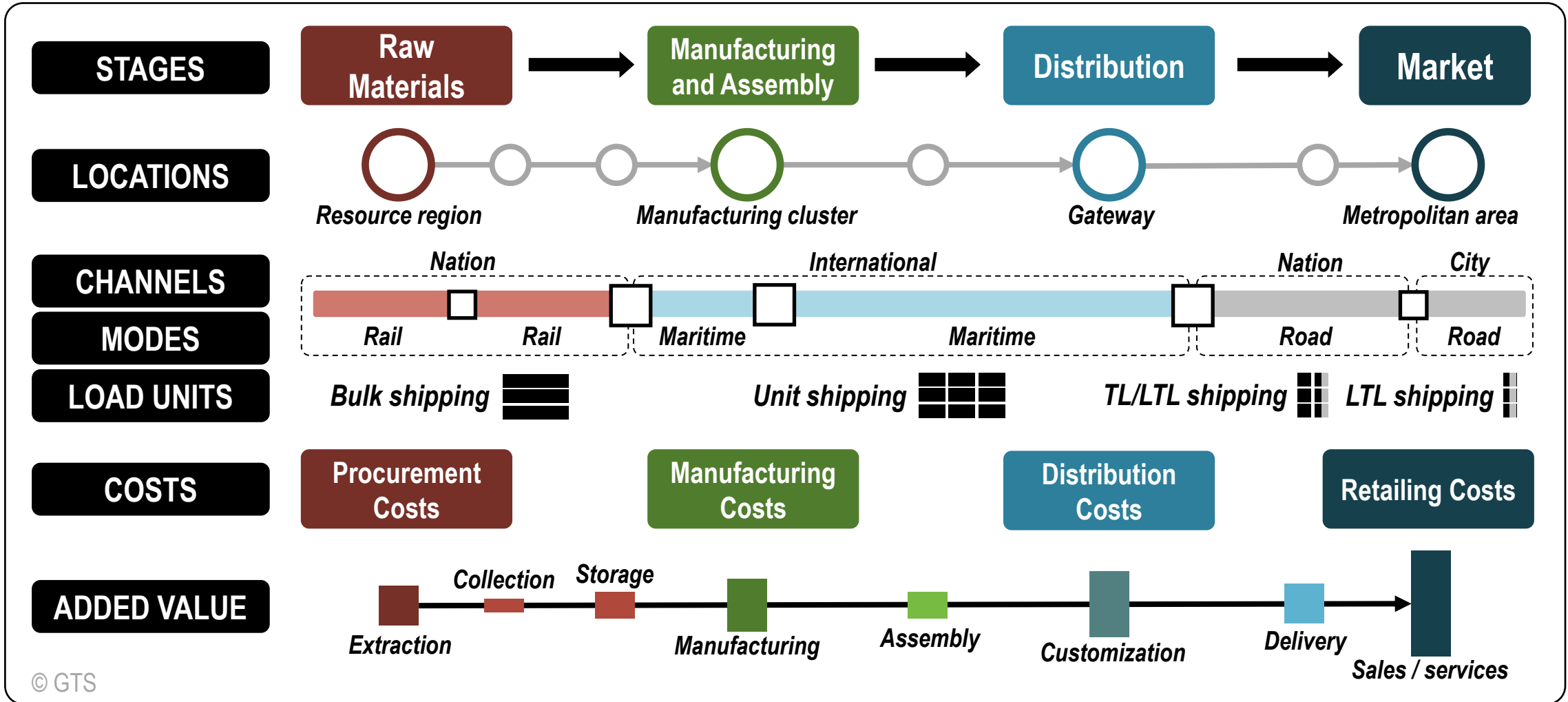


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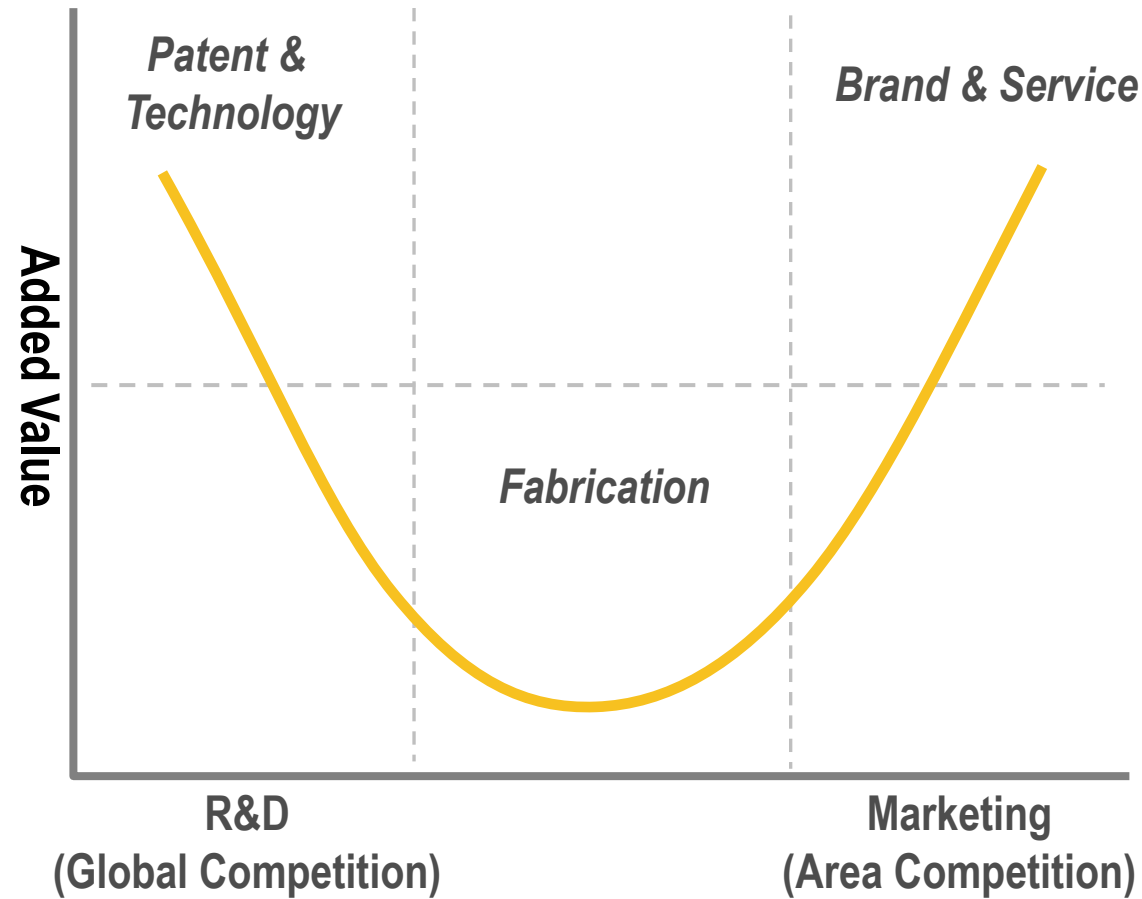
Value Chains and Freight Transport Systems



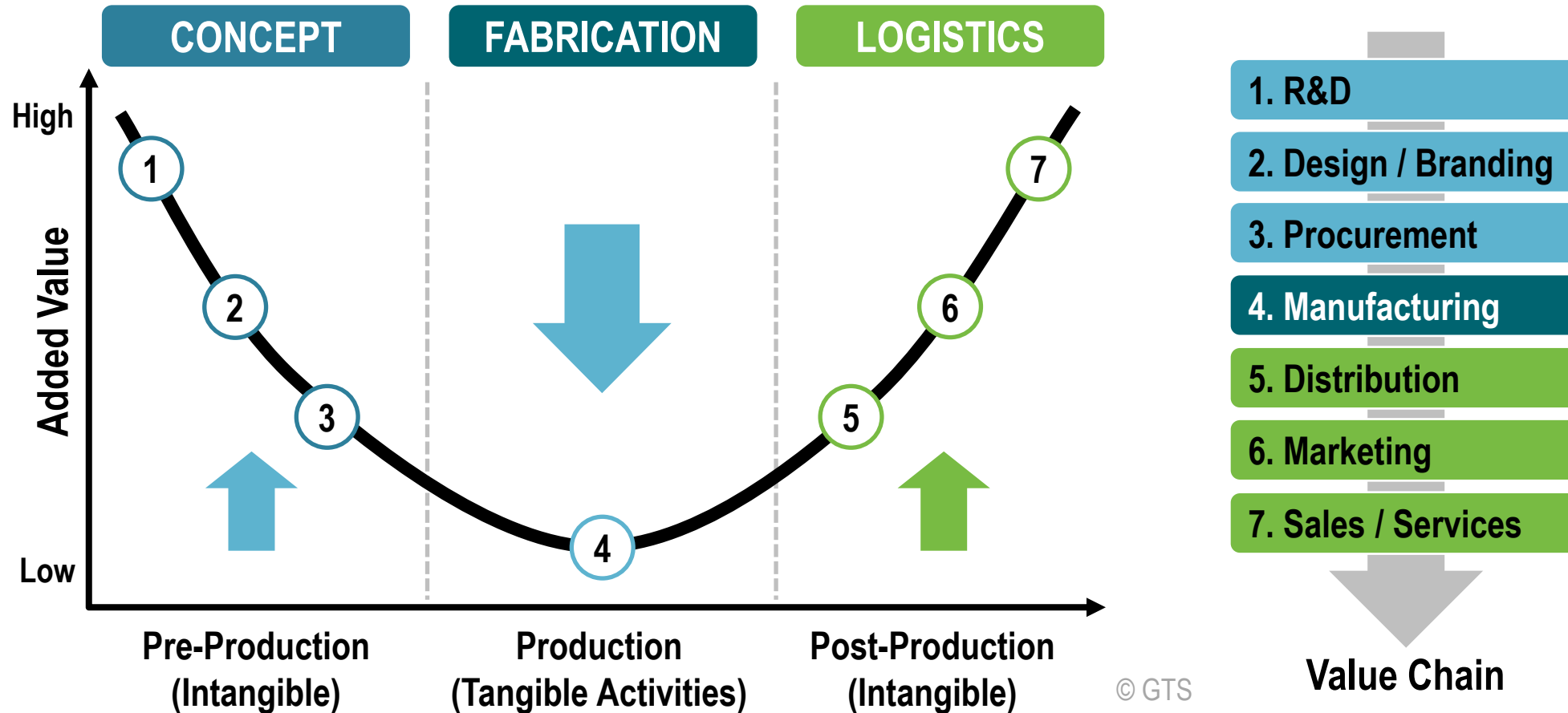
Supply Chain Analysis



Generic Smile Curve in a Value Chain



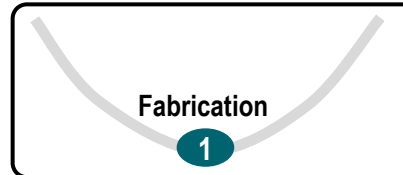
The Value Chain and its Added Value



Upgrading the Value Chain

1. Fabrication

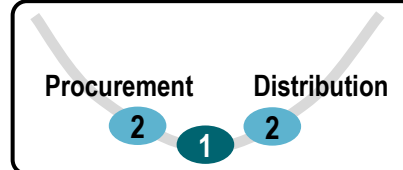
Value chain entry



- Focus on fabrication; suppliers assemble inputs, following buyers' specifications.
- Inputs may be imported due to limited availability and quality concerns over local inputs.
- Product focus may be relatively narrow.

2. Supply Chain

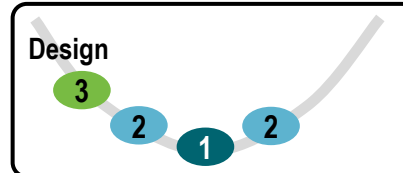
Functional upgrading



- Broader range of manufacturing-related functions, such as sourcing inputs and inbound logistics as well as fabrication.
- The supplier may also take on outbound distribution activities.

3. Product Design

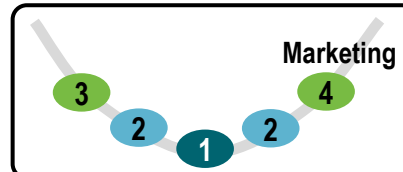
Functional upgrading



- Supplier carries out part of the pre-production processes such as design or product development.
- Design may be in collaboration with the buyer, or the buyer may attach its brand to a product designed by the supplier.

4. Product Brand

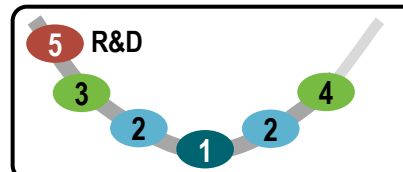
Functional upgrading



- Supplier acquires post-production capabilities and can fully develop products under its own brand names.
- Can be in collaboration with the buyer or by establishing a new market channel.

5. R&D

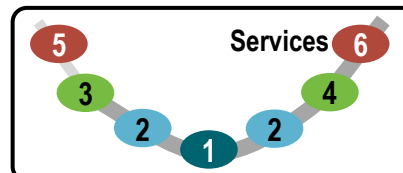
Product upgrading



- Increase unit value by producing more complex products, which requires increasing the capabilities of the firm.
- Countries must move from low-cost commodities to higher value goods that warrant higher returns as labor costs increase.

6. Advanced Services

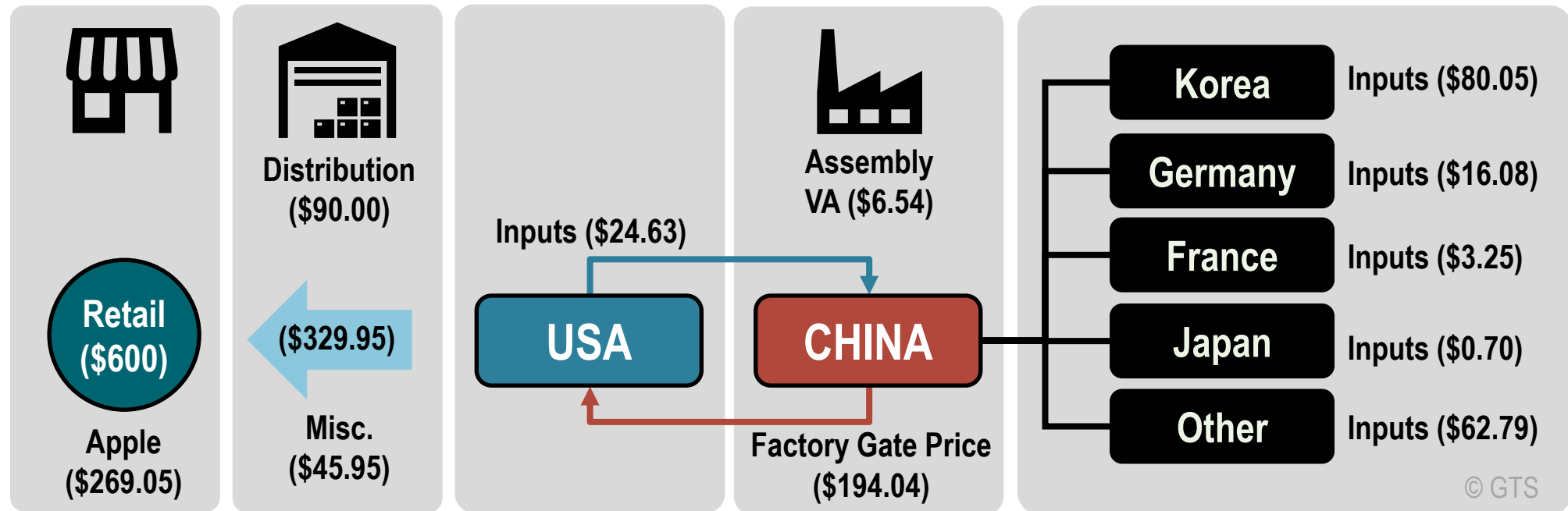
Process upgrading



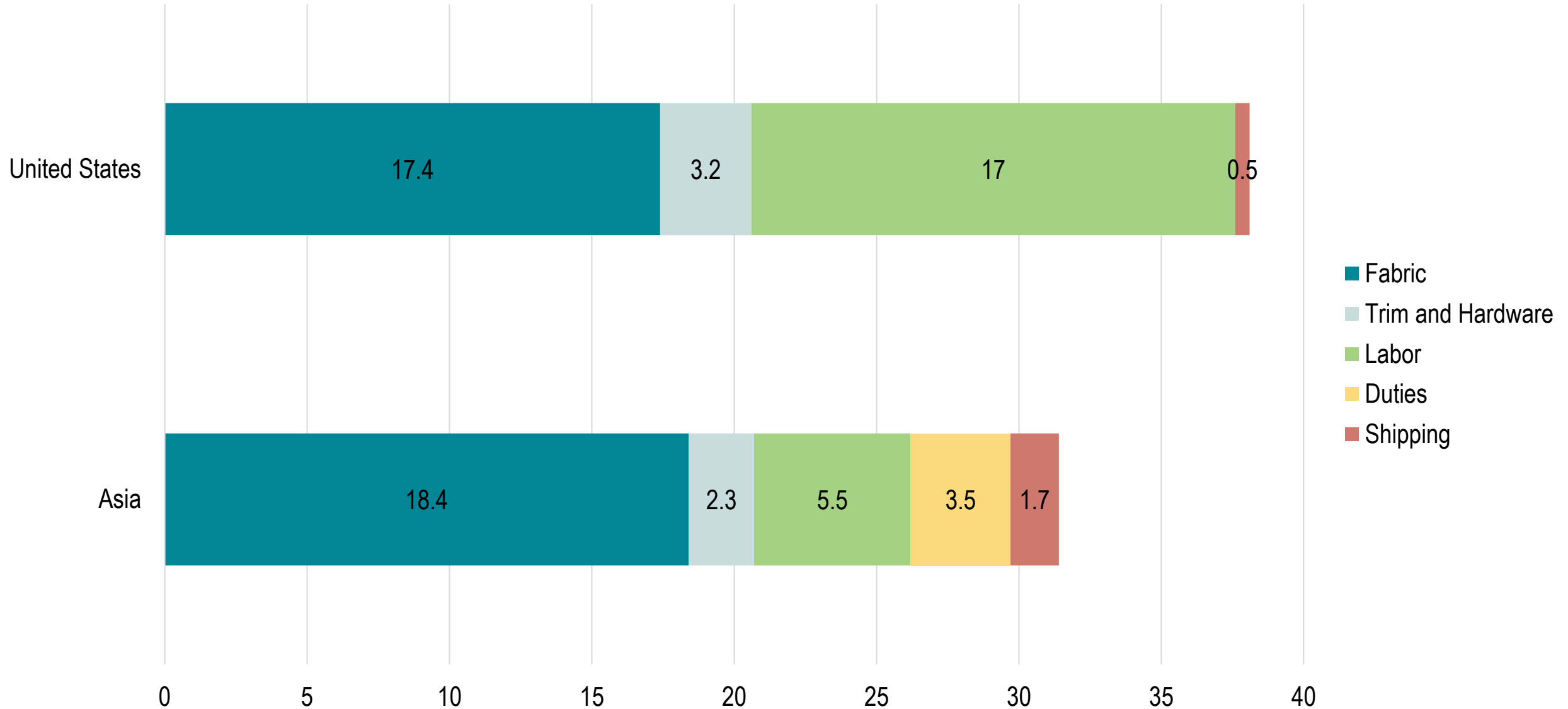
- Improving productivity through new capital investments.
- Improving IT and logistics.
- Reducing lead time and increasing the flexibility of the supply chain process.

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Value Creation and Capture, iPhone 4 (in USD)



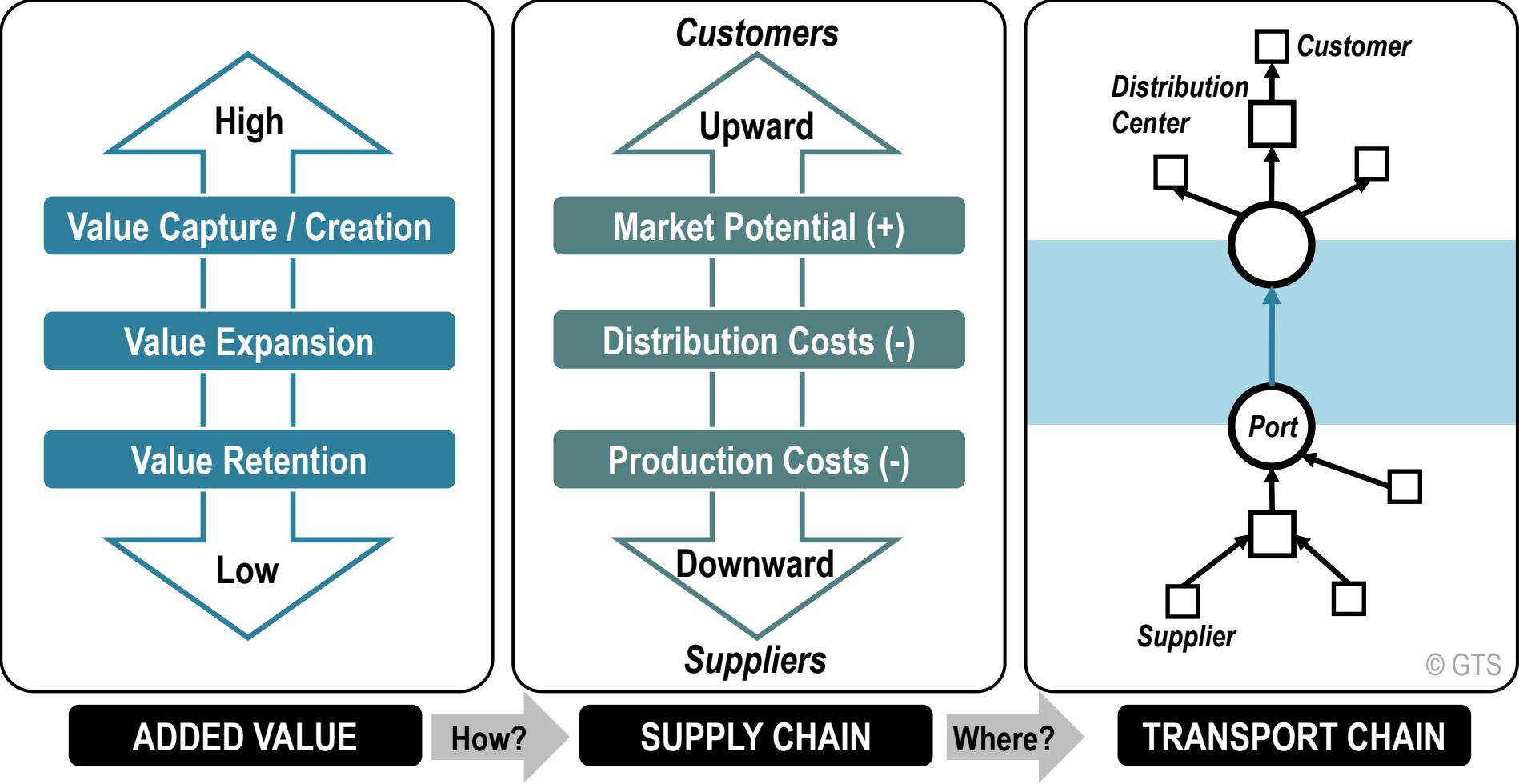
Cost to Manufacture a Cotton Vest, Asia and United States, 2013



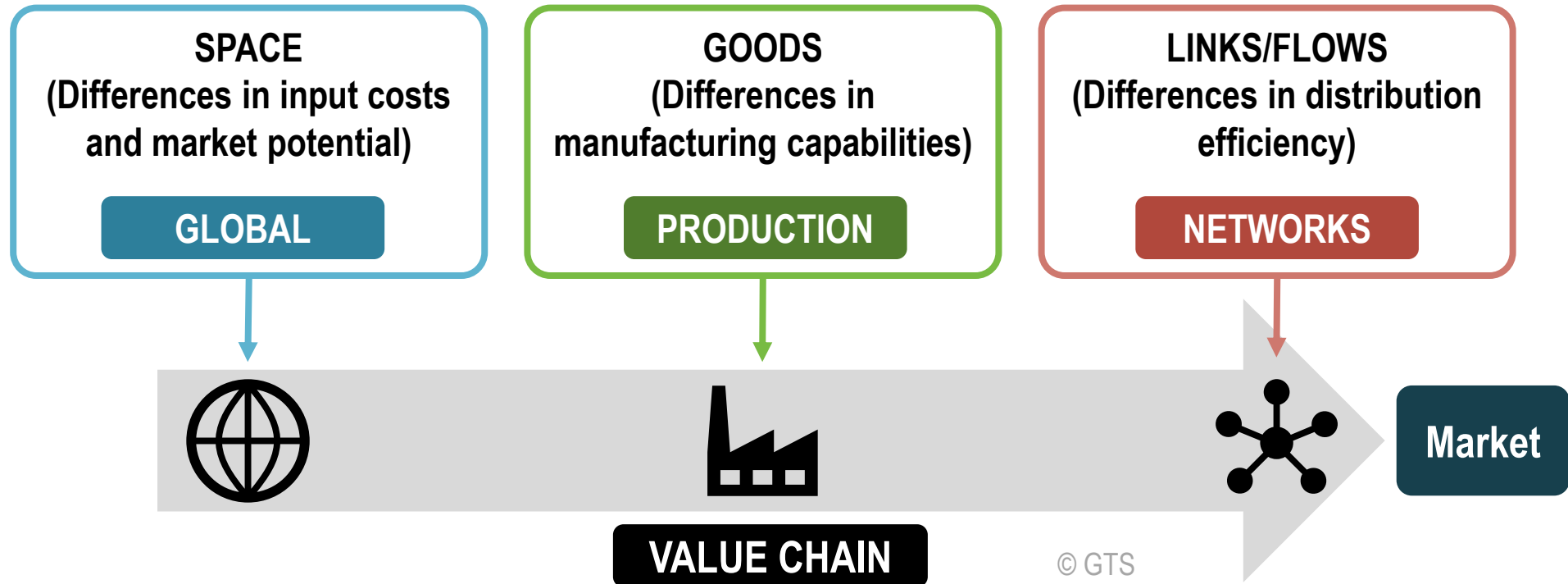
Freight Transport Costs as Share of Commodity Market Value

	1970	1980	1990	2007
Jute (Bangladesh)	12.1%	19.8%	21.2%	44.2%
Tea (Sri Lanka)	9.5%	9.9%	10.0%	13.4%
Coffee (Colombia)	4.2%	3.3%	6.8%	2.5%
Cocoa beans (Ghana)	2.4%	2.7%	6.7%	3.5%

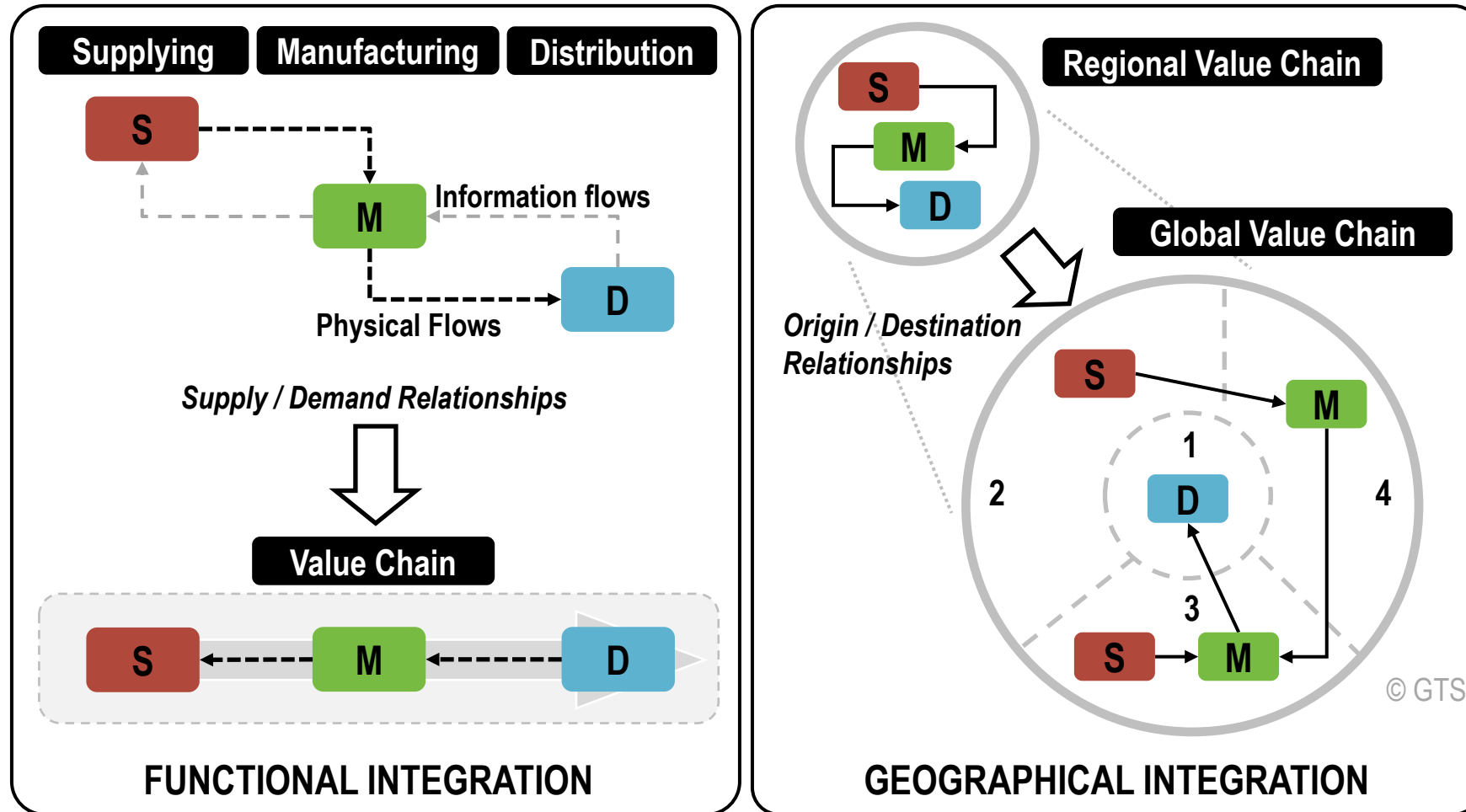
Added Value, Supply Chains and Transport Chains



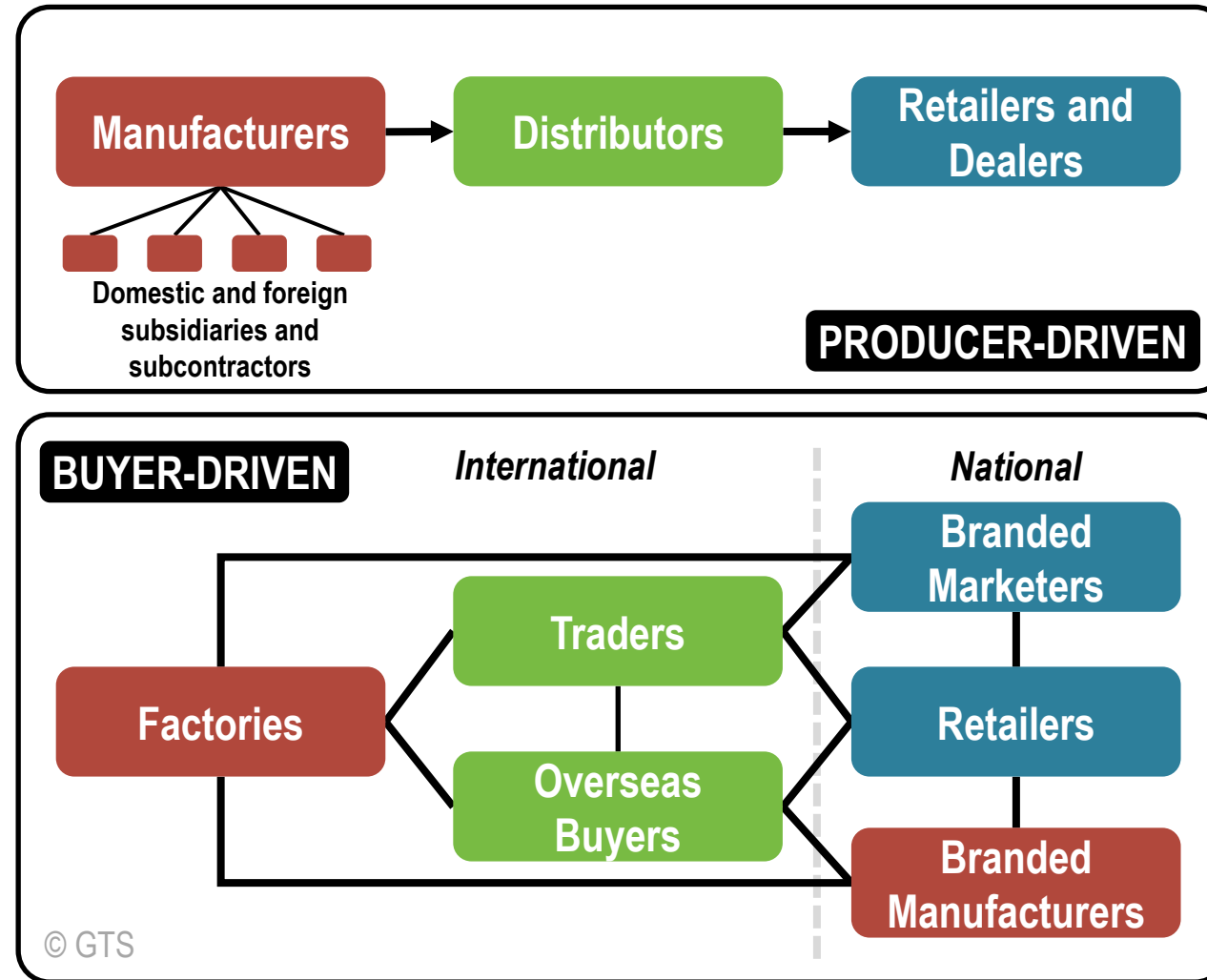
Global Production Networks



The Functional and Geographical Integration of Value Chains



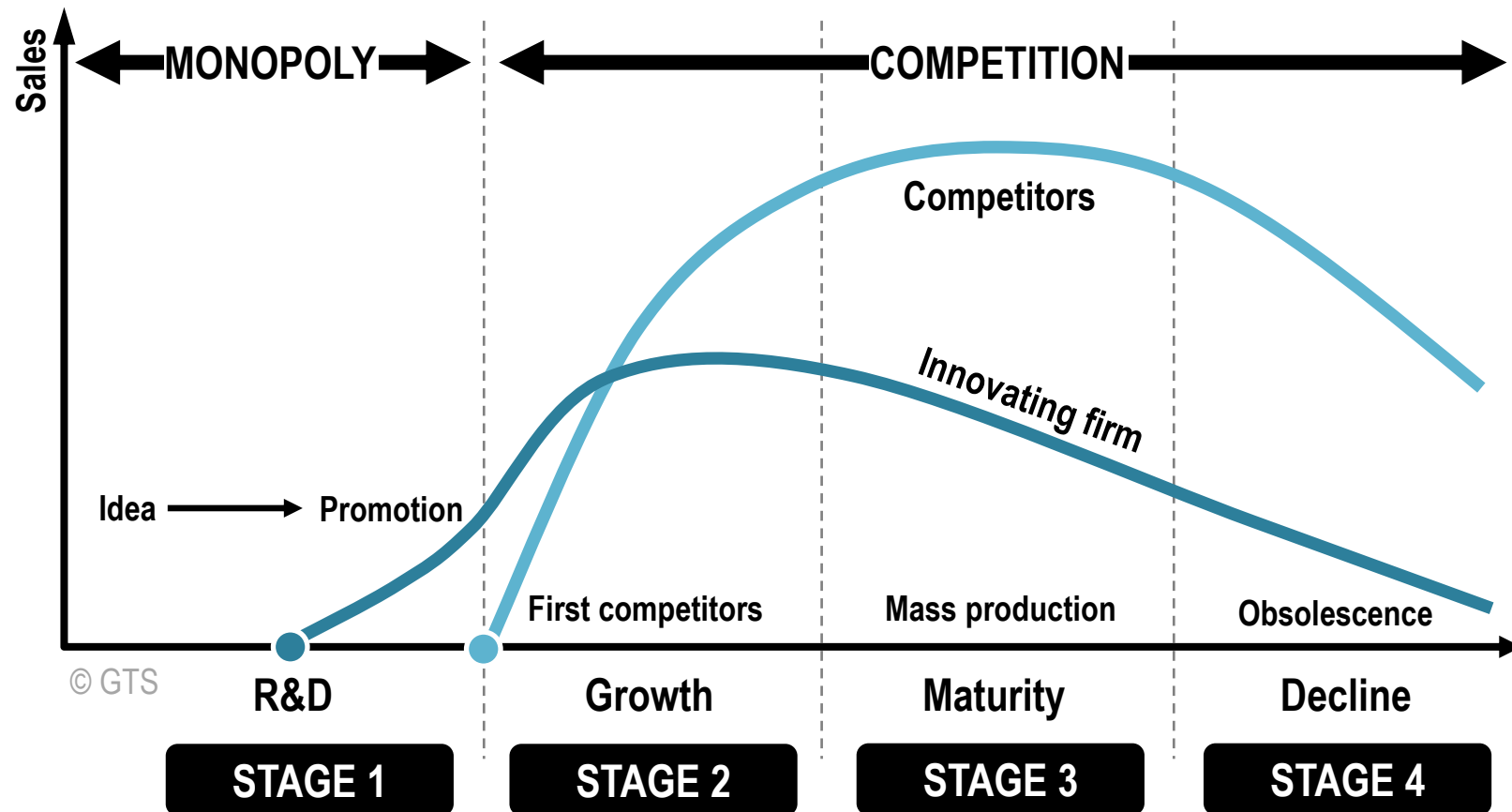
Producer and Buyer-driven Value Chains



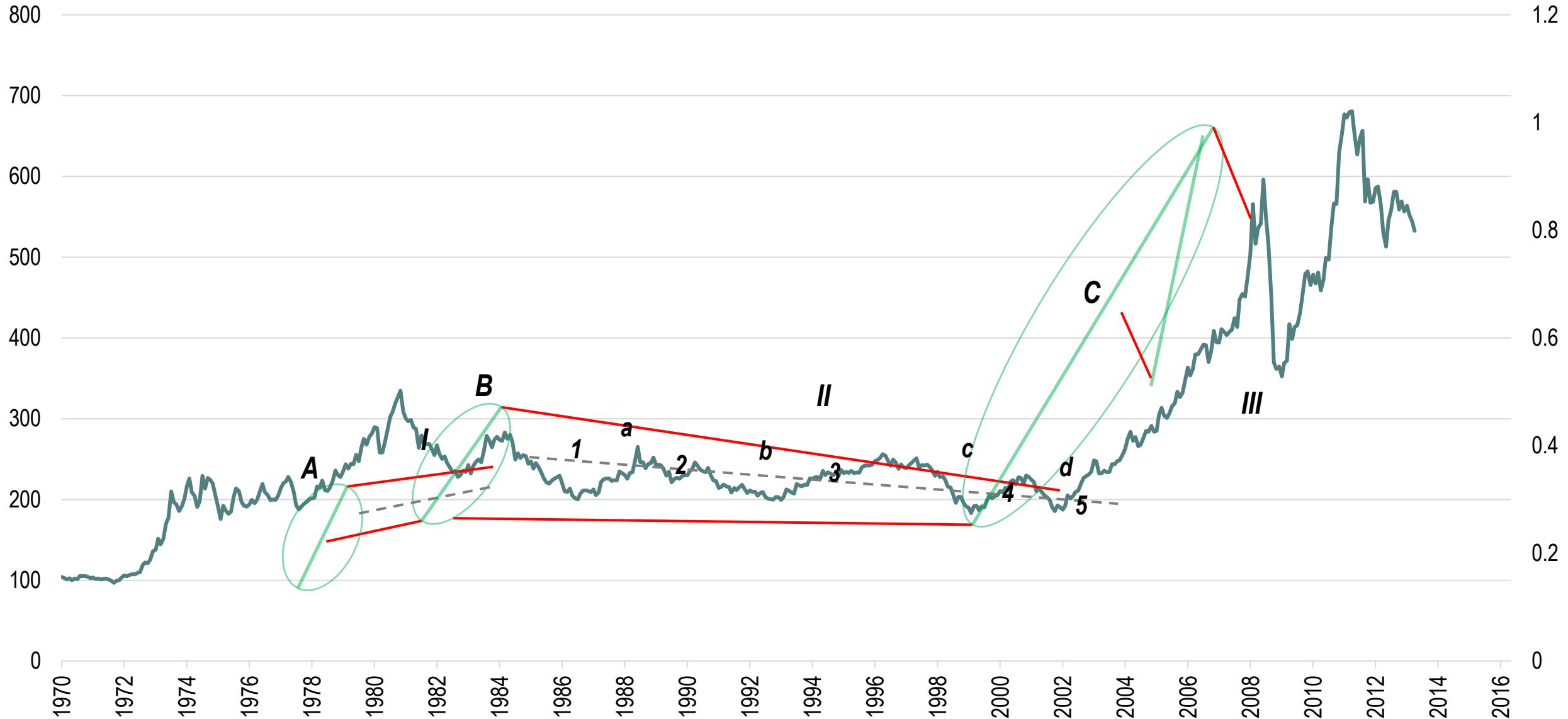
Characteristics of Producer-Driven and Buyer-Driven Global Commodity Chains

	Producer-Driven Commodity Chains	Buyer-Driven Commodity Chains
Drivers of Global Commodity Chains	Industrial capital	Commercial capital
Core Competencies	Research & Development; Production	Design; Marketing
Barriers to Entry	Economies of Scale	Economies of Scope
Economic Sectors	Consumer Durables; Intermediate Goods; Capital Goods	Consumer Nondurables
Typical Industries	Automobiles; Computers; Aircraft	Apparel; Footwear; Toys
Ownership of Manufacturing Firms	Transnational Firms	Local Firms, predominantly in developing countries
Main Network Links	Investment-based	Trade-based
Predominant Network Structure	Vertical	Horizontal

Product Life Cycle

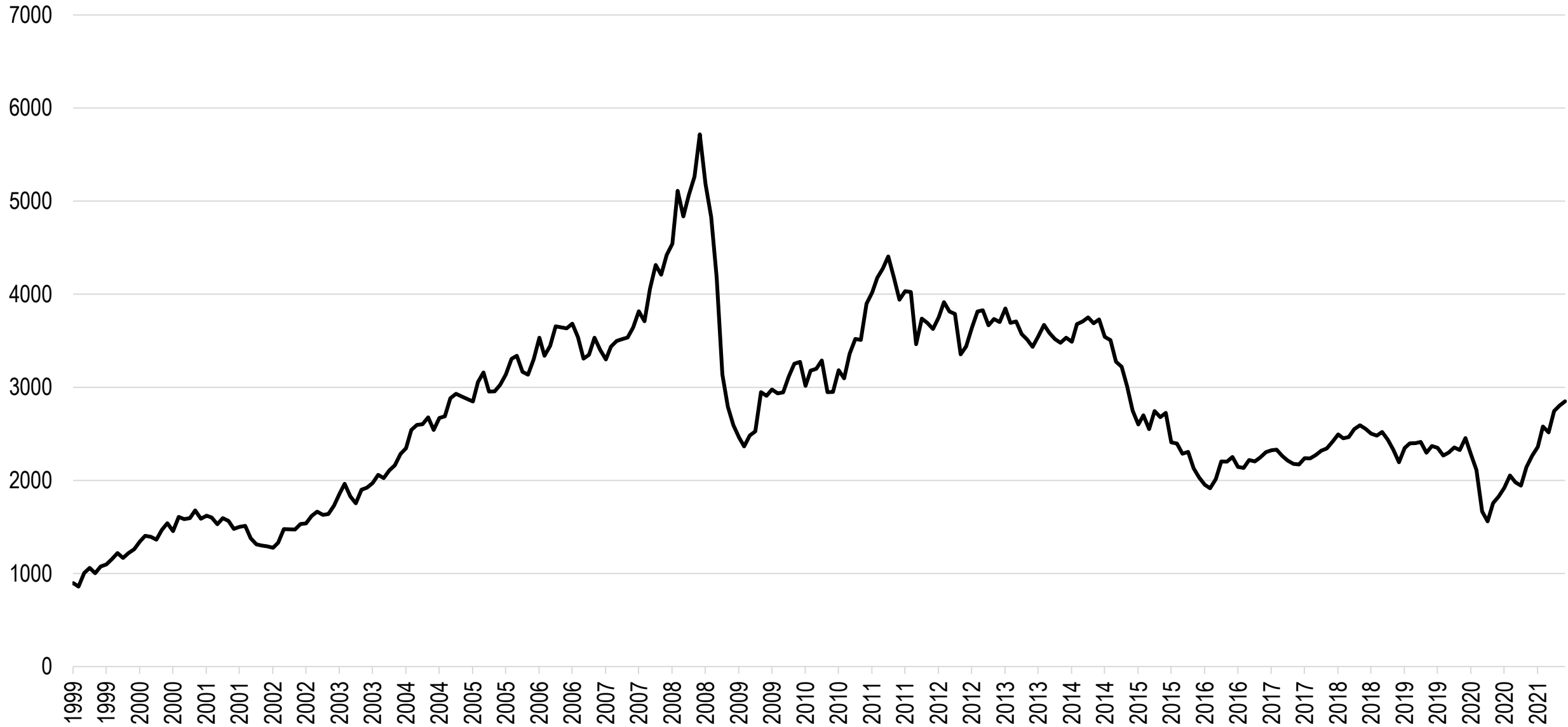


CRB Index (CCI), Monthly Close, 1970-2013

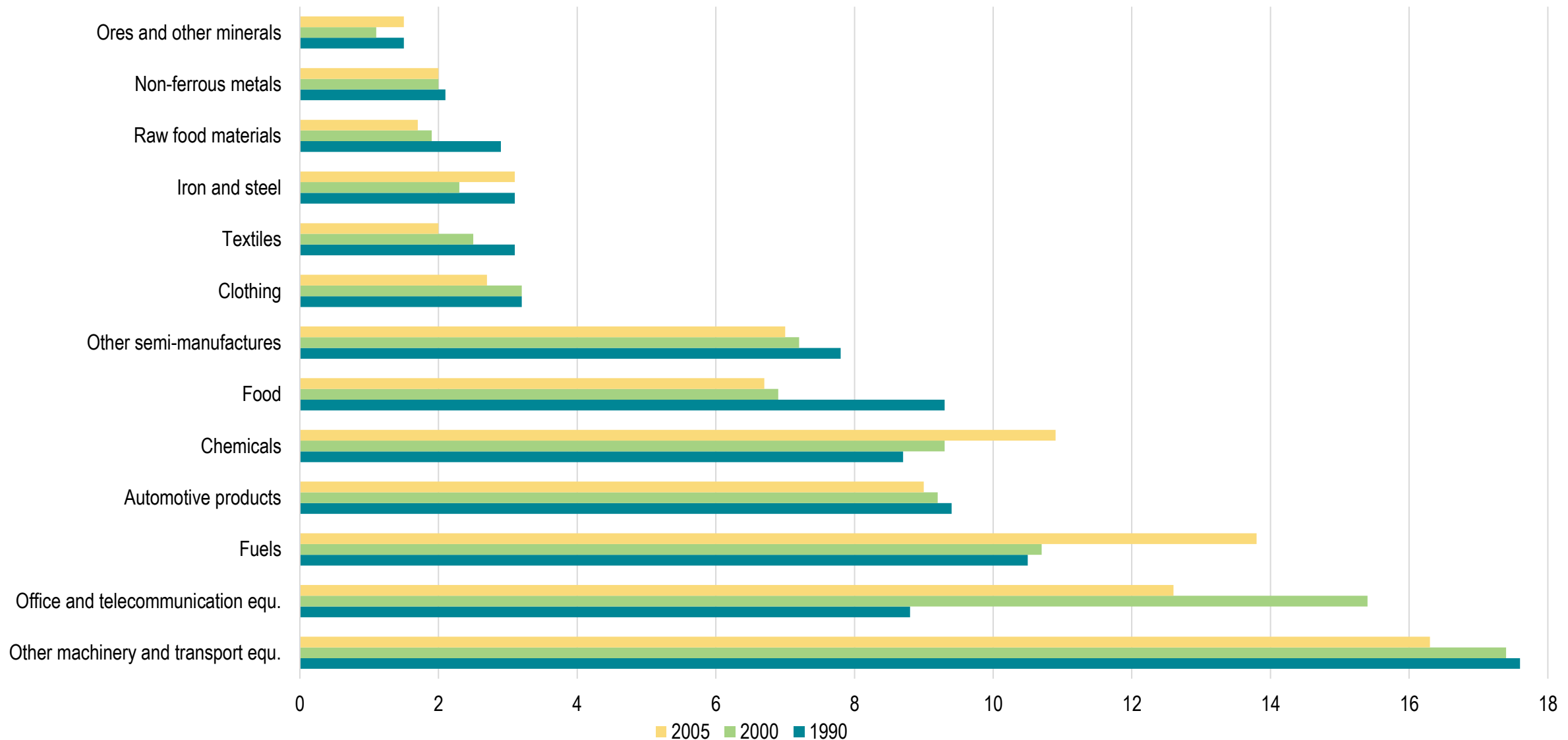


All Commodity Price Index (2016=100)

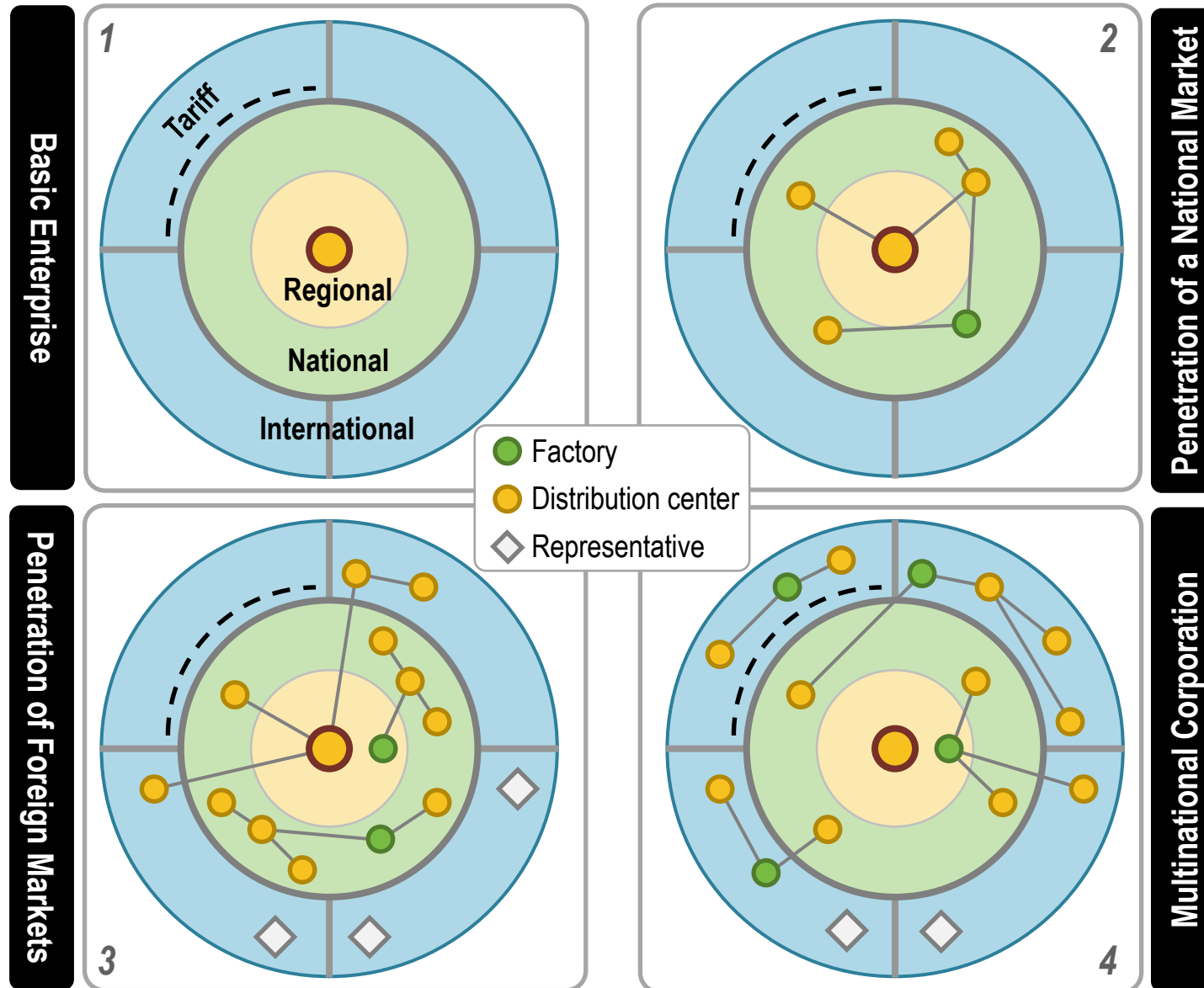
Rogers International Commodity Index 1999-2021



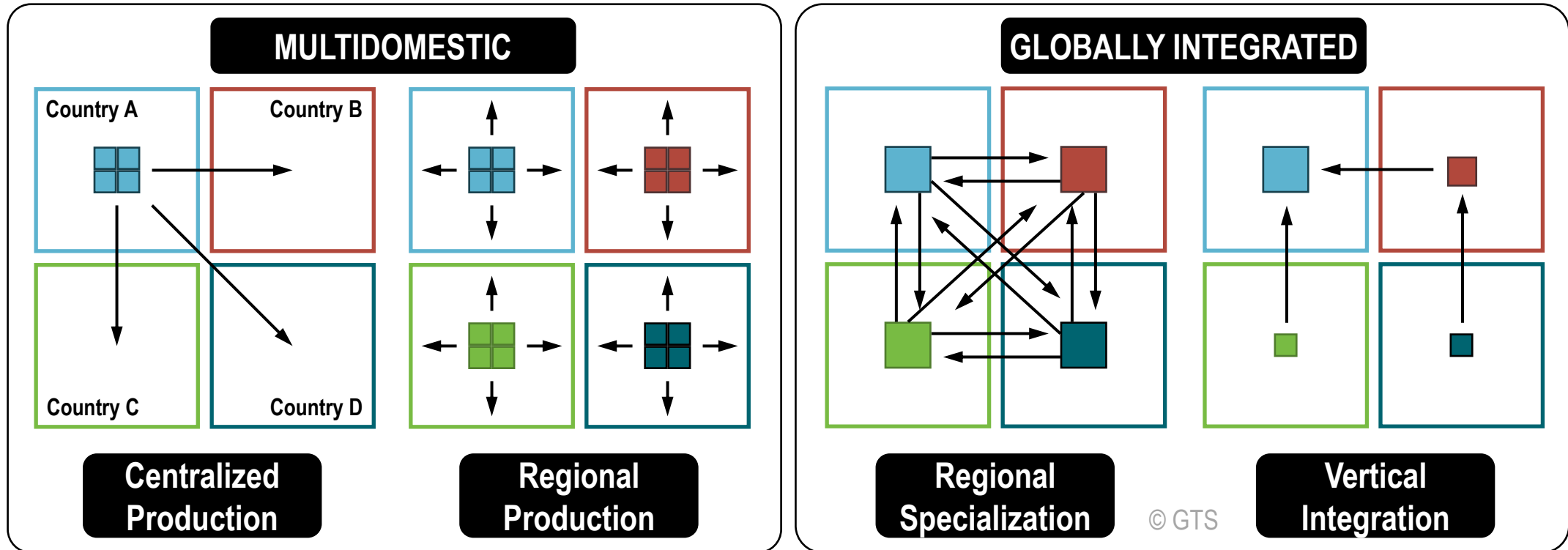
Global Merchandises Exports by Product, 1990-2005 (in % of value)



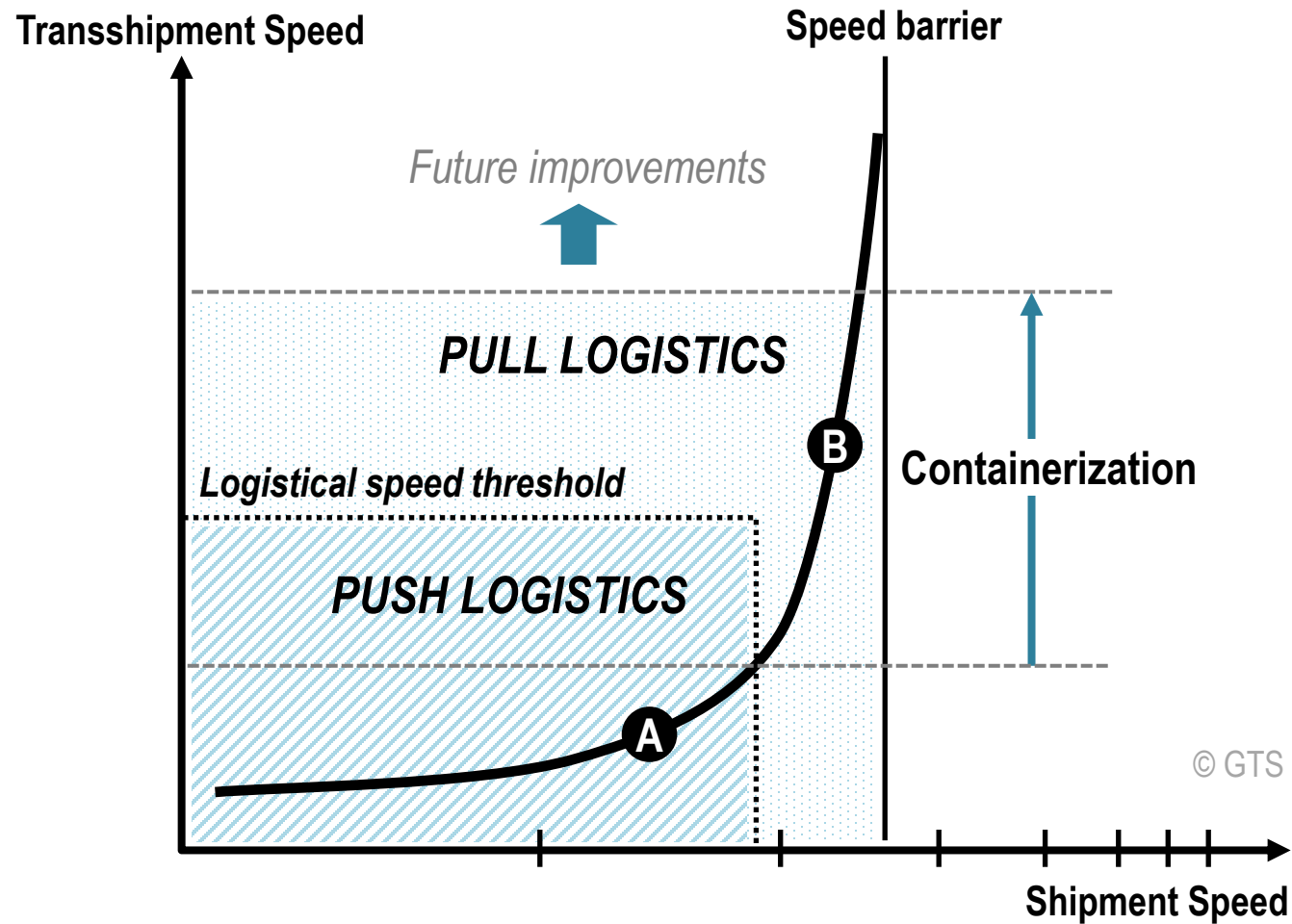
Geographical Growth of a Multinational Corporation



Global Production Networks and Location Strategies

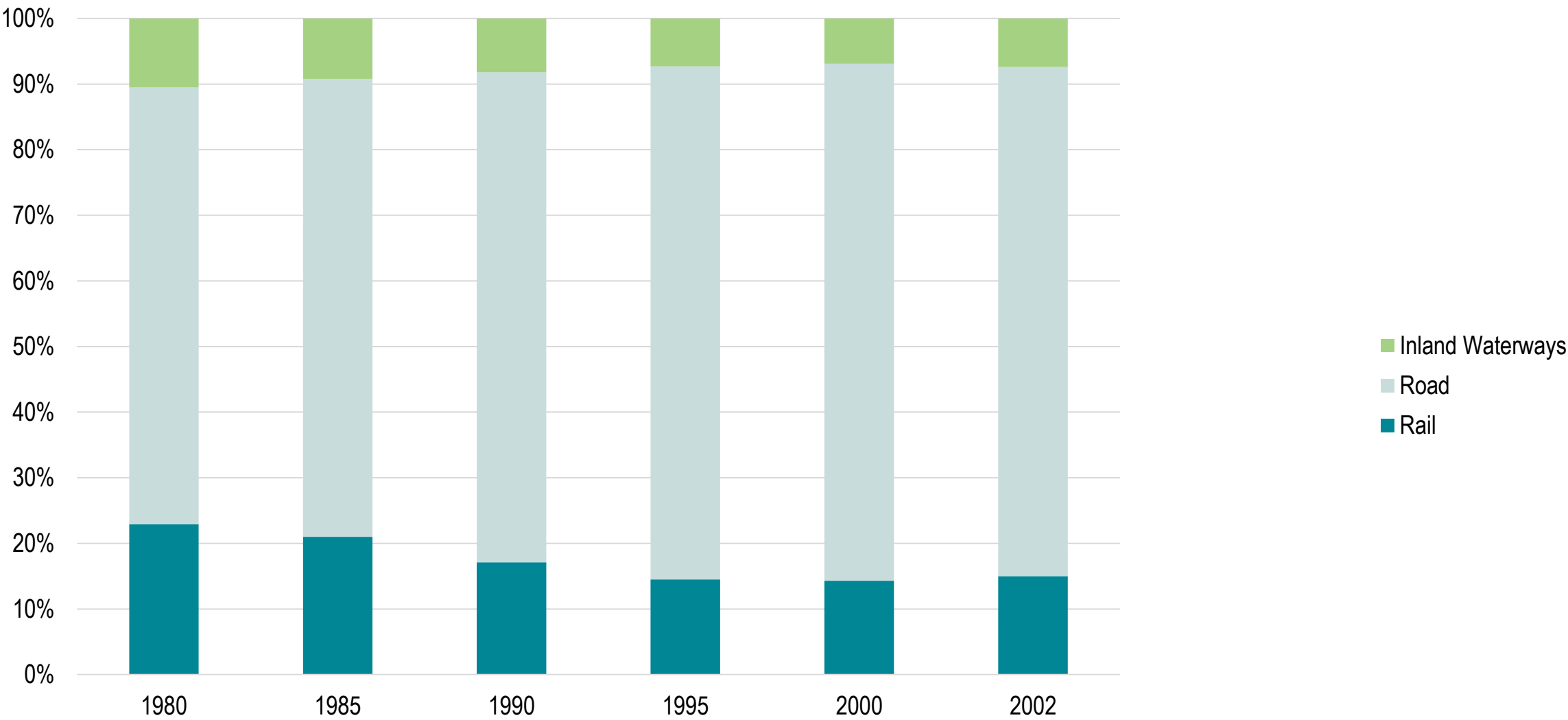


The Velocity of Freight

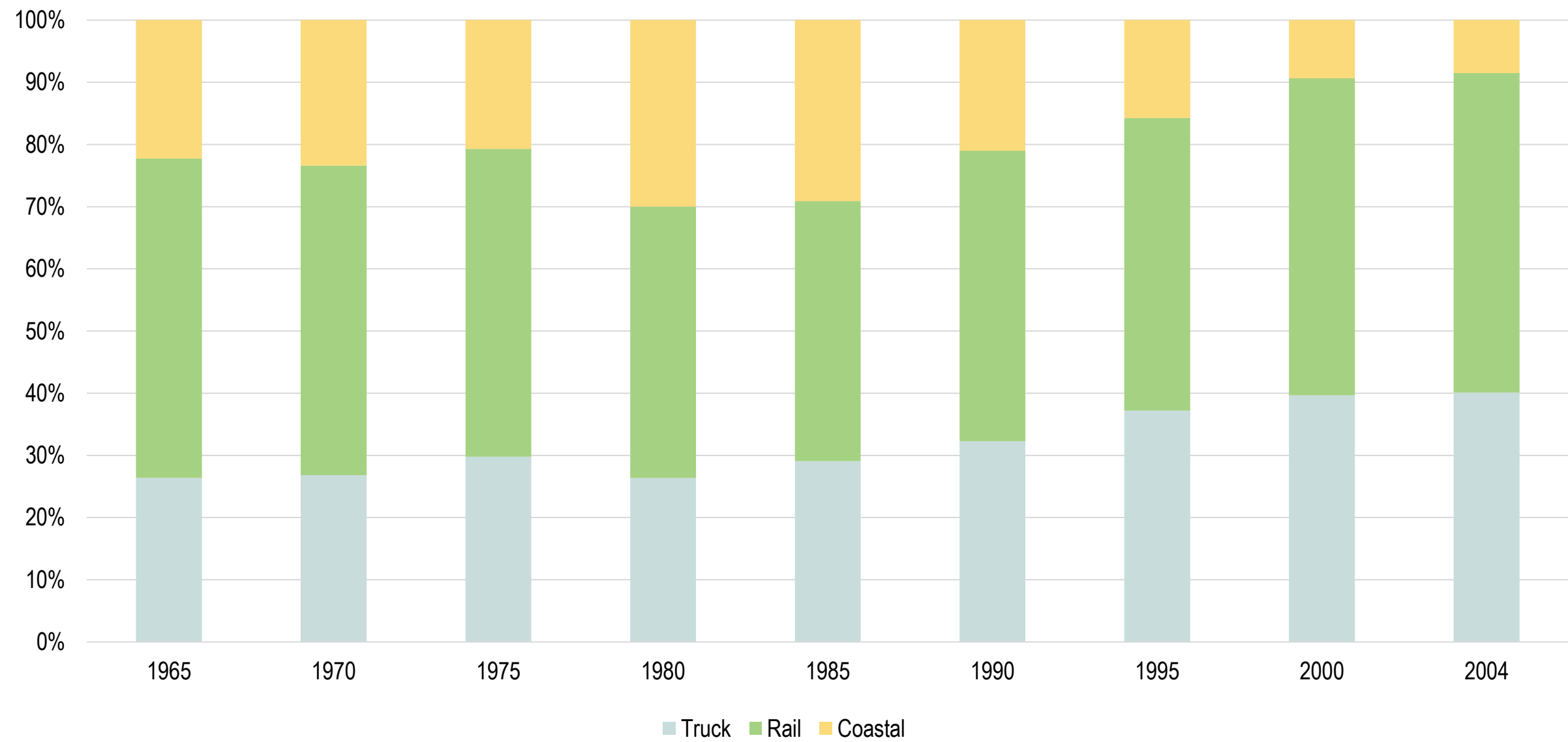


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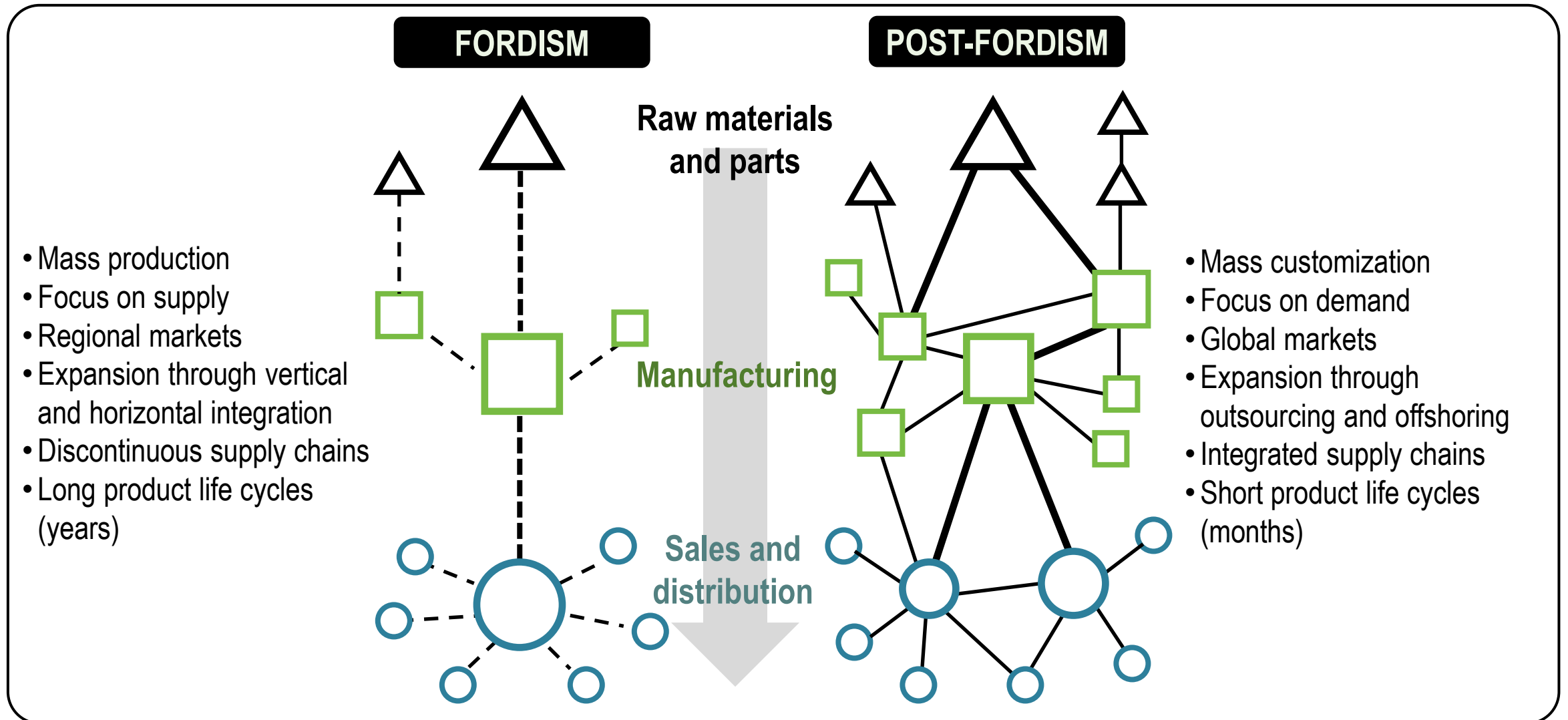
Market Share by Freight Transport Mode, Western Europe, 1980-2002 (in ton-km)



Market Share by Freight Transport Mode, United States, 1965-2005 (in ton-miles)



Fordist and Post-Fordist Production Systems



Fordist and Post-Fordist Production Structure

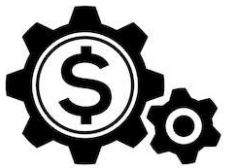
Characteristics	Fordism	Post-Fordism
Production Mode	Mass Production	Mass Customization
Organization	Structured (Pyramidal)	Networked (Flexible)
Focus	Supply	Demand
Market Reach	Regional / National	Global
Expansion	Vertical or horizontal integration	Outsourcing and offshoring
Core Resources	Physical Assets	Innovation/ Knowledge
Value Chains	Discontinuous	Integrated (continuous)
Inventories	Months	Hours
Production Cycle Time	Weeks / Months	Days
Information	Monthly / Weekly	Daily / Real-Time
Product Life Cycle	Years	Months
Quality	Affordable Best	Zero-Defect

Post-Industrial Revolution



Economic Composition

- Relative: shift from manufacturing to services.
- Absolute: growth of manufacturing.



Capital Accumulation

- Knowledge becomes a form of capital.
- High reliance on innovation.



Manufacturing

- Flexible manufacturing systems.
- Supply chain management (Just-in-time).
- Diversified trade (from resources to high-value goods).



Labor

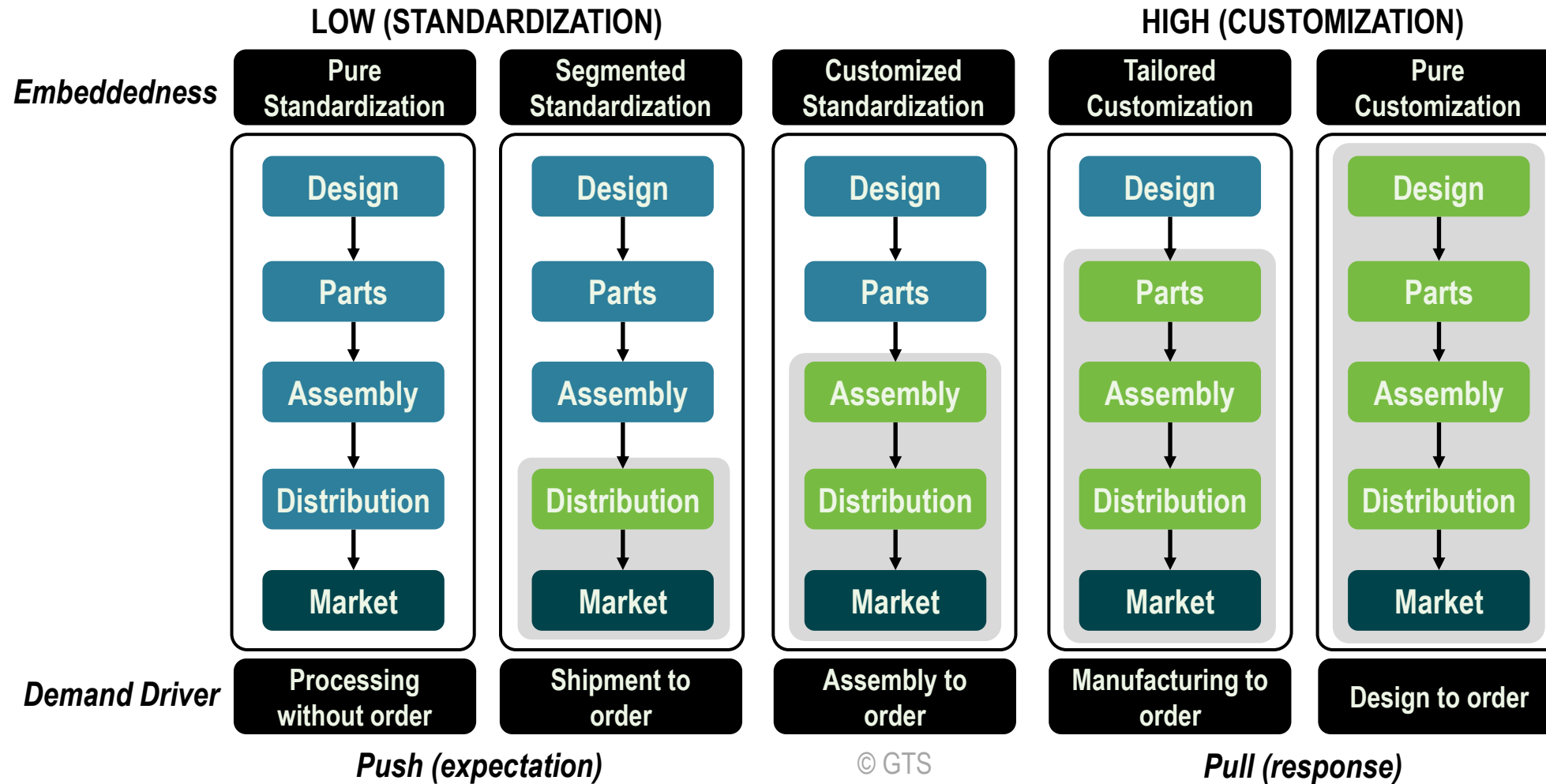
- Declining importance of “blue collar” tasks.
- Increasing importance of technical and creative tasks.



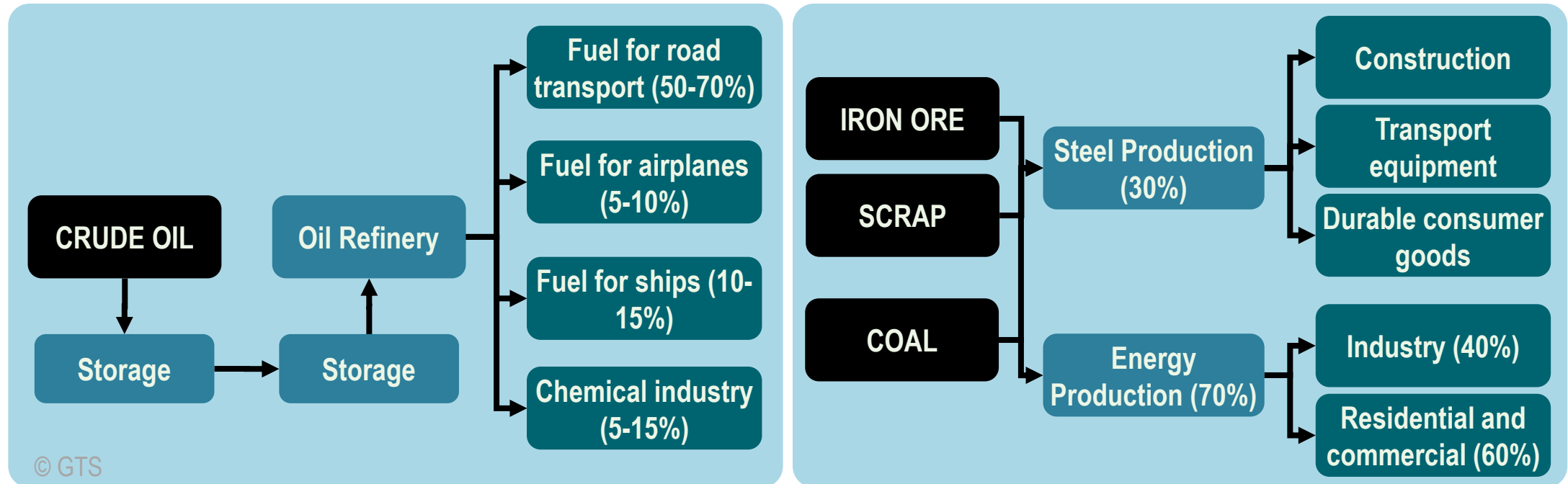
Information Technologies

- Global telecommunication networks.
- IT embedded in products and services.

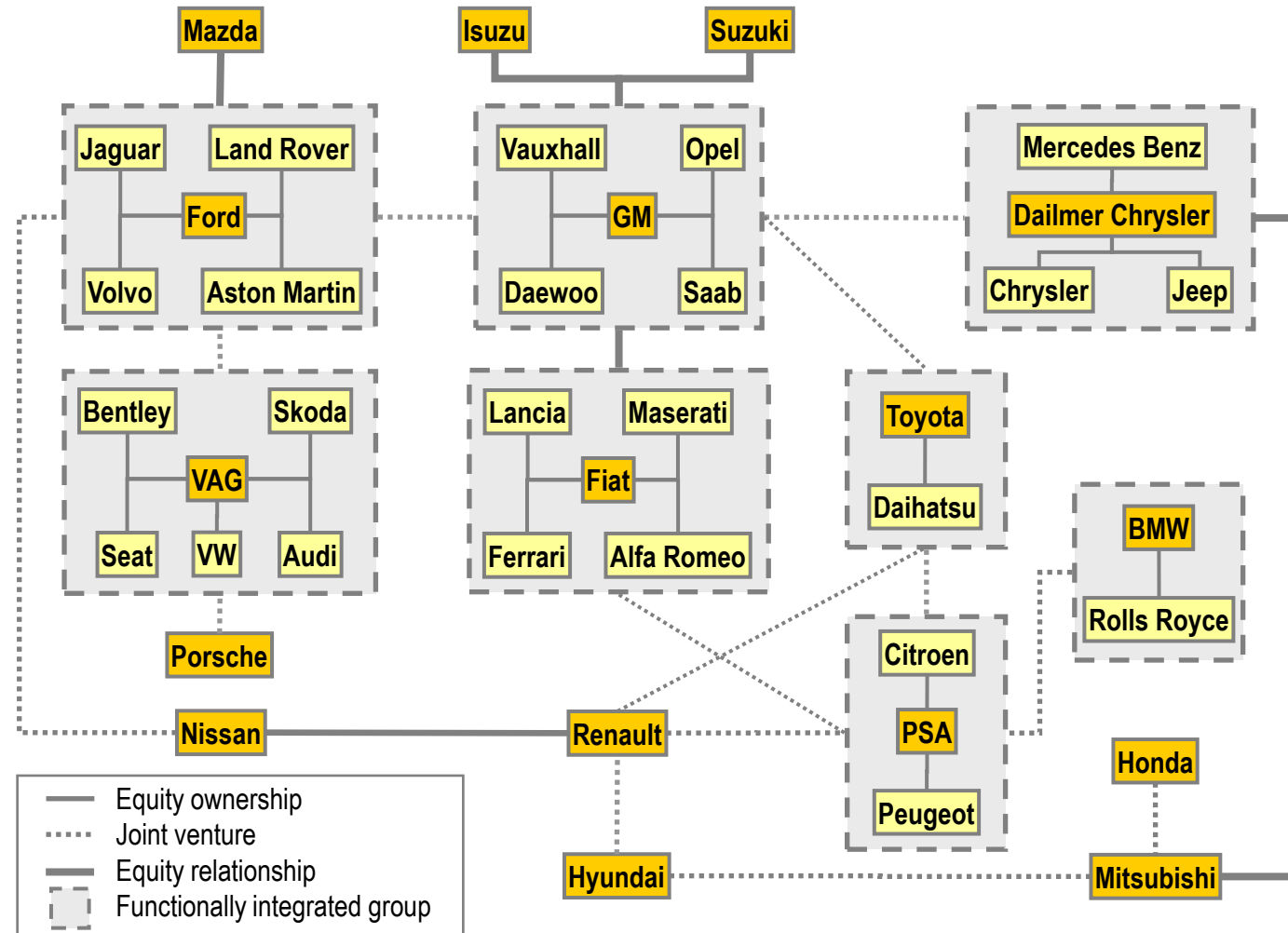
Level of Embeddedness of Value Chains



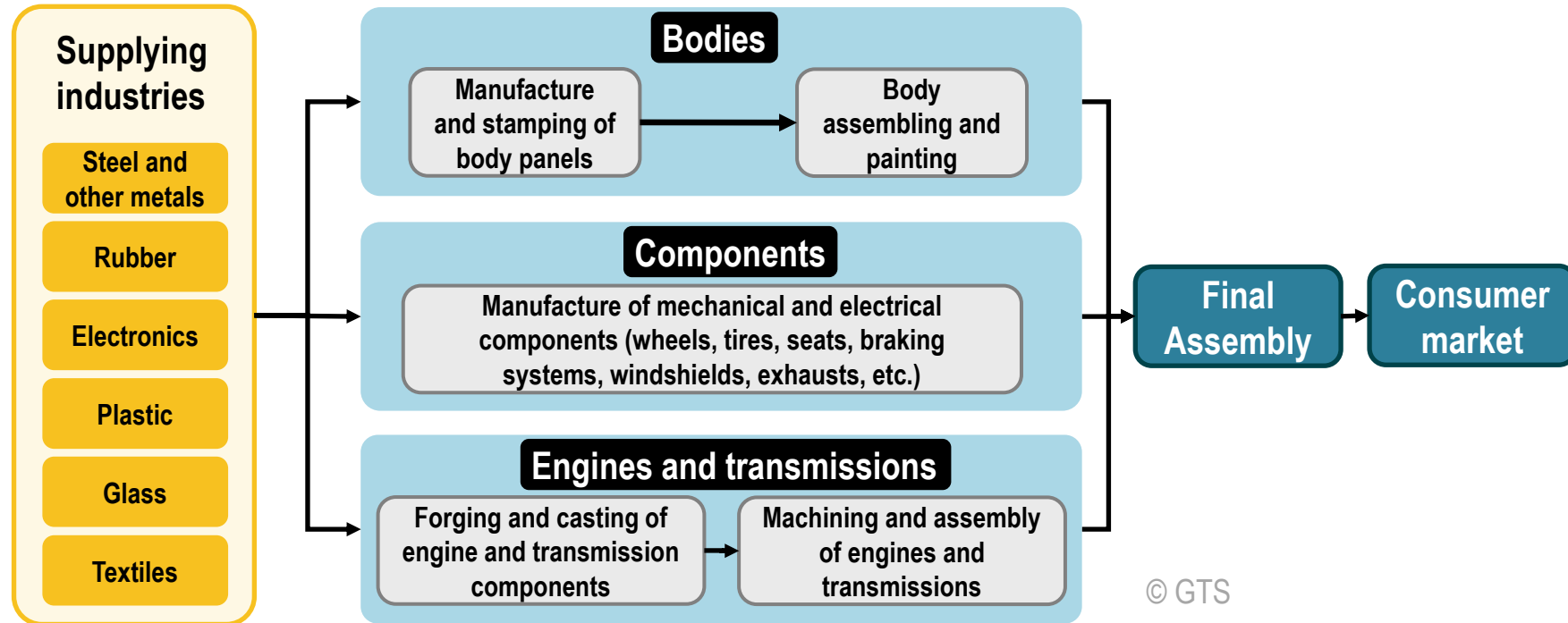
Energy and Minerals Supply Chains



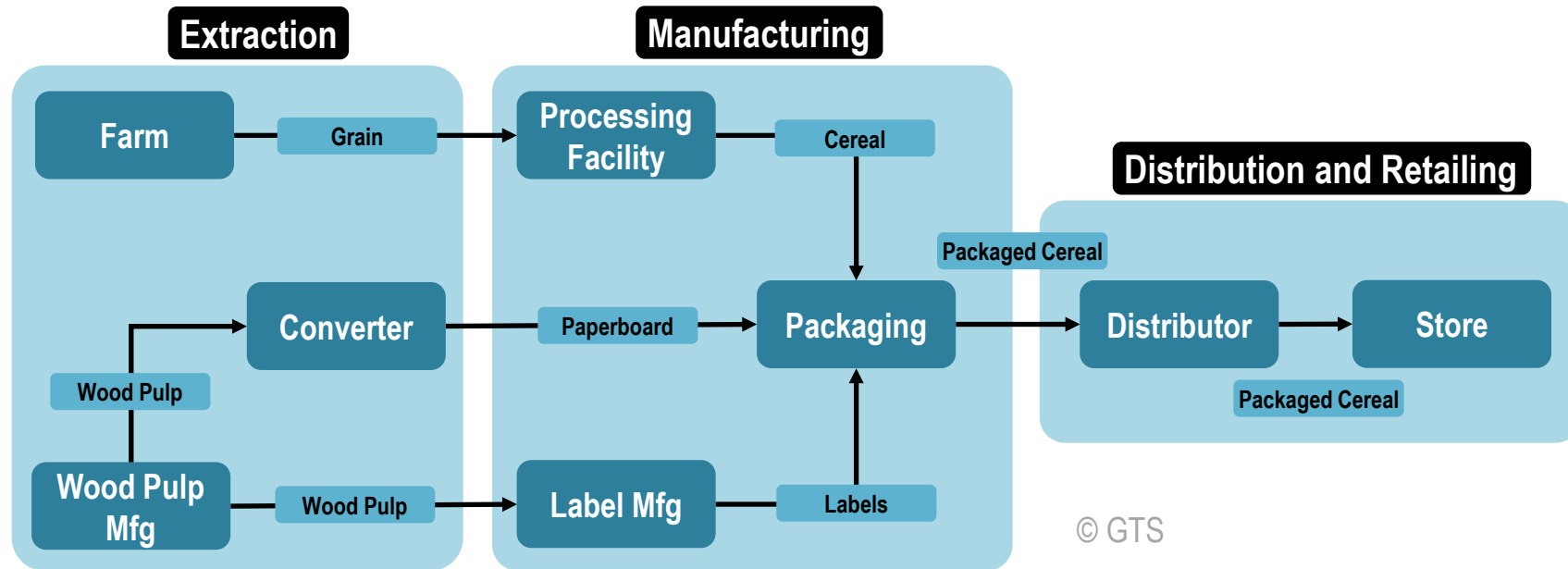
The Global Car Production Network, 2003



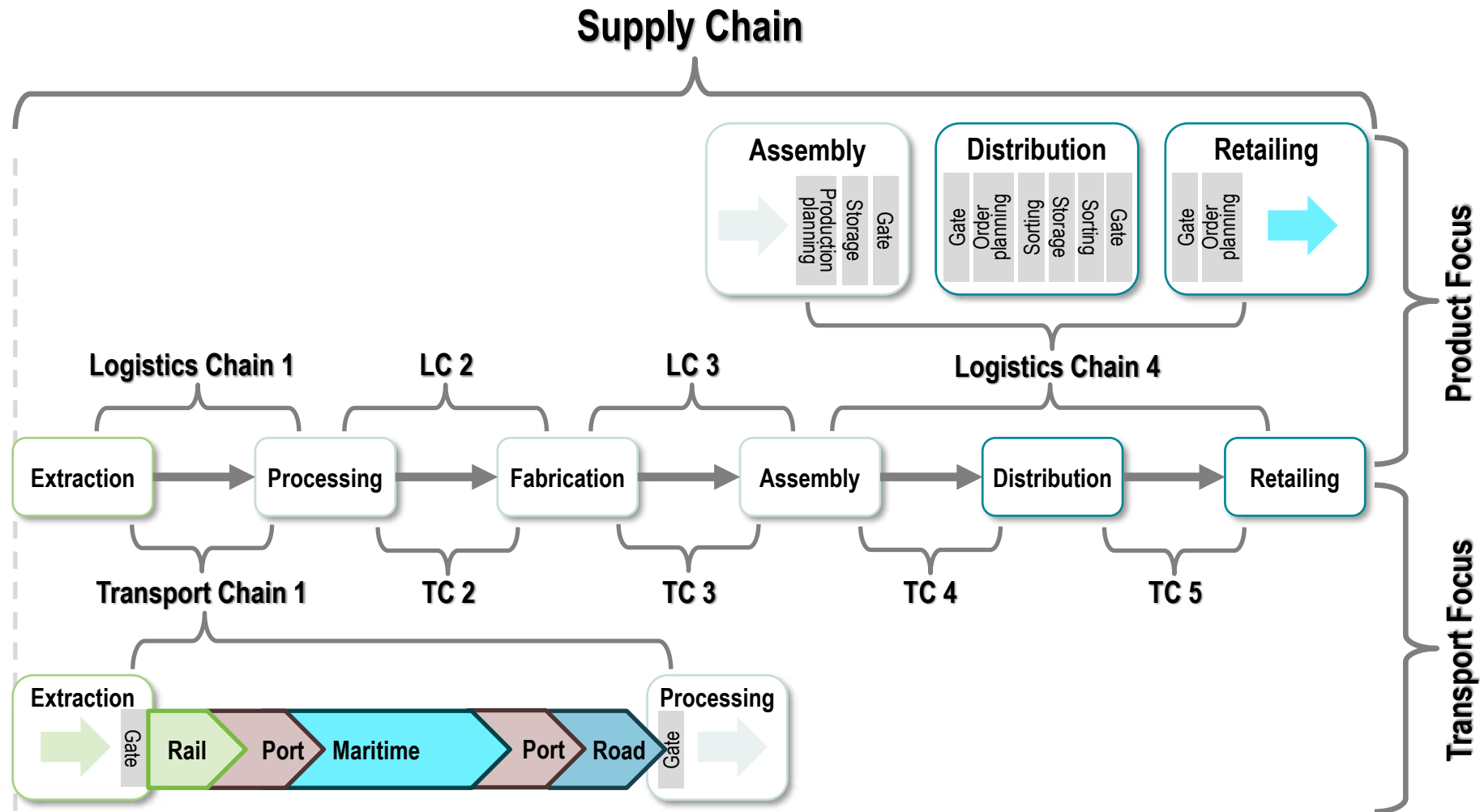
The Automobile Supply Chain



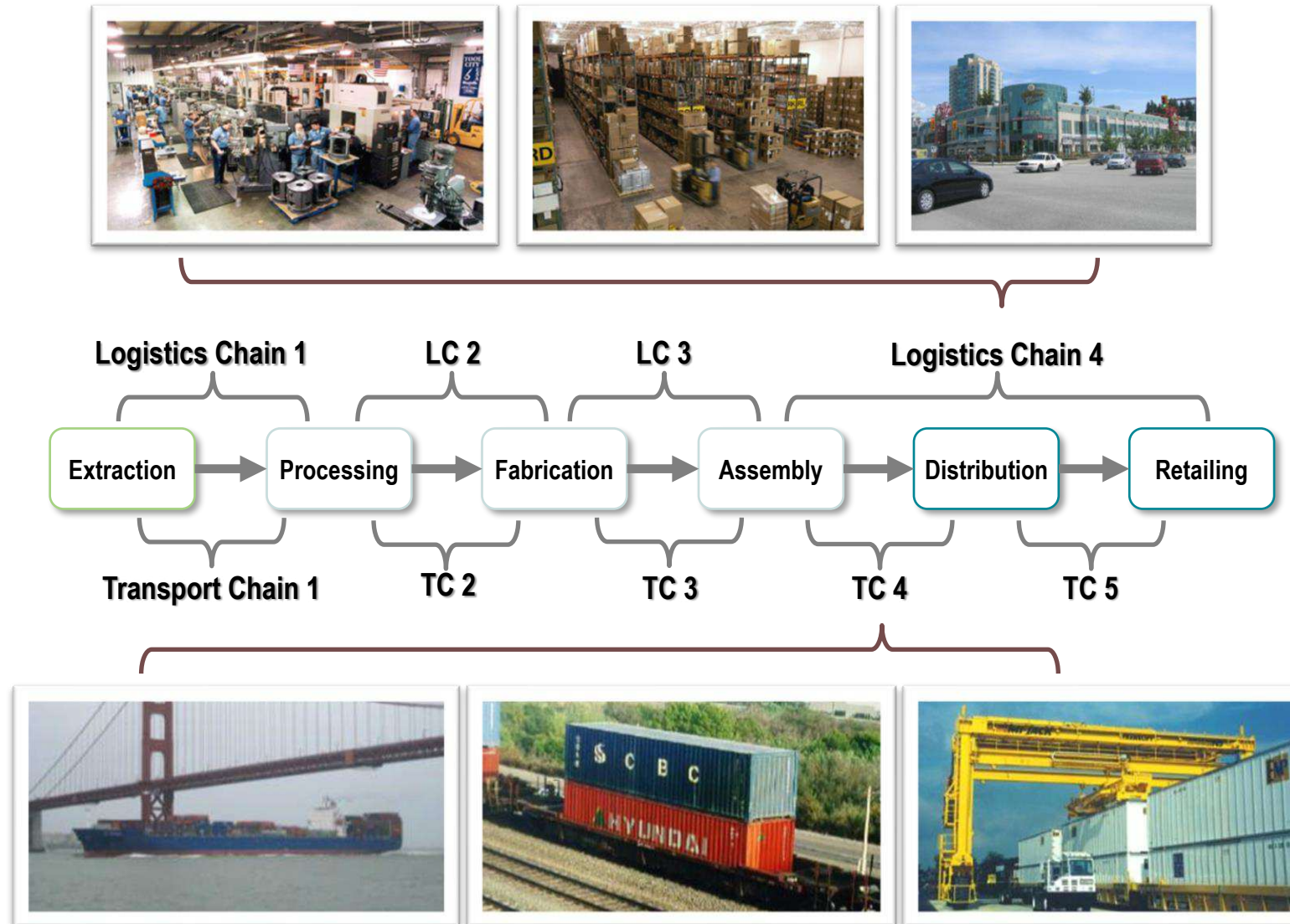
Cereals Supply Chain

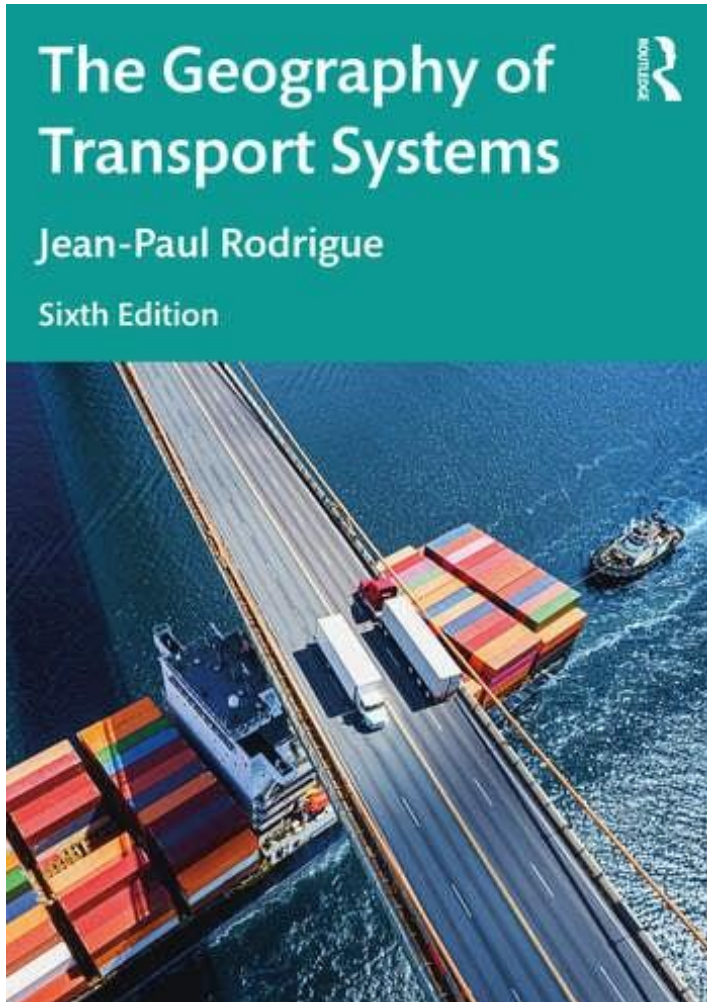


The Scope of a Supply Chain, Logistics Chains and Transport Chains



Supply Chains: Alternating First and Last Miles

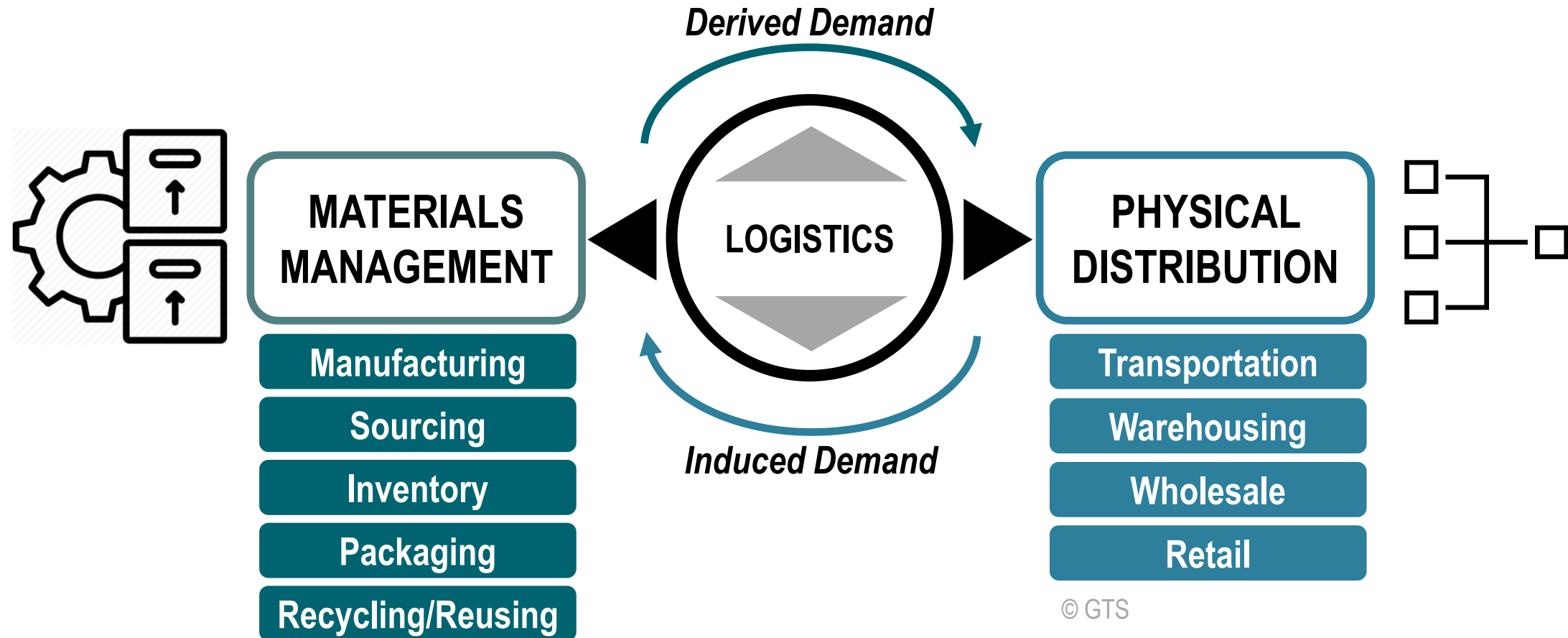




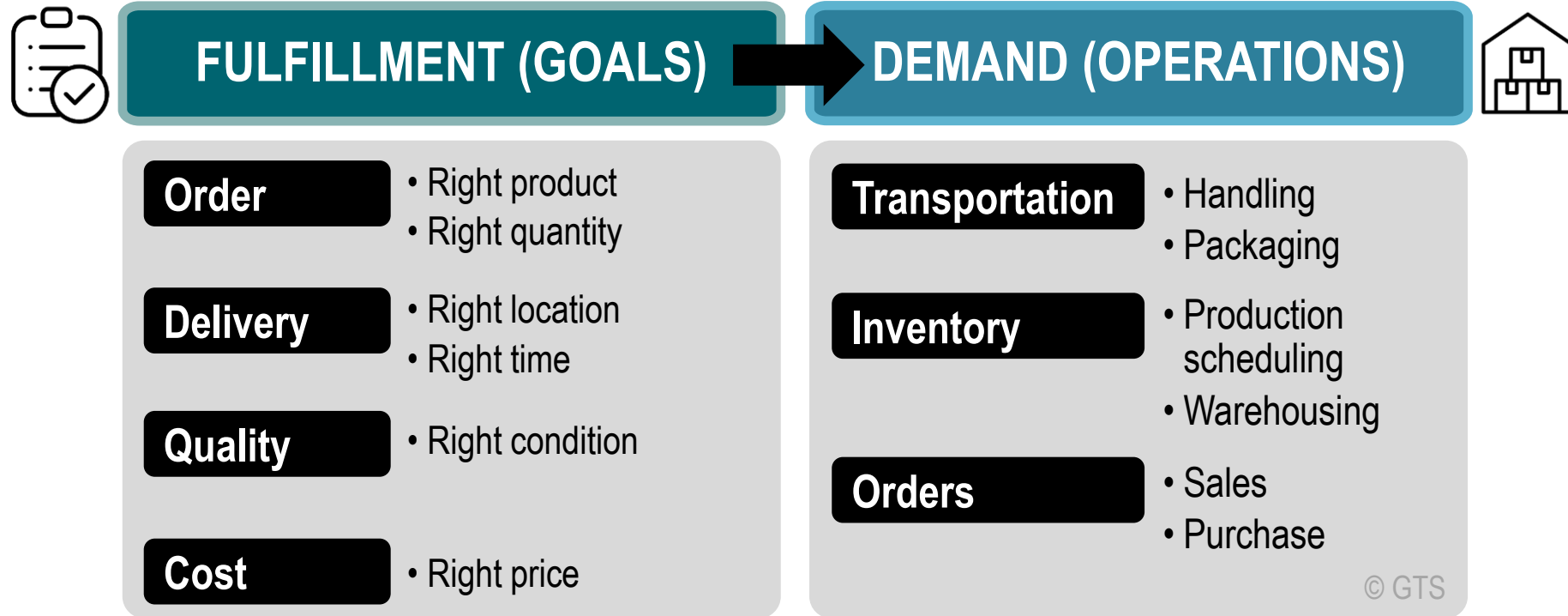
Logistics and Freight Distribution

Chapter 7.4

The Concept of Logistics



Logistics Goals and Operations



Types of Packaging

PRIMARY PACKAGING

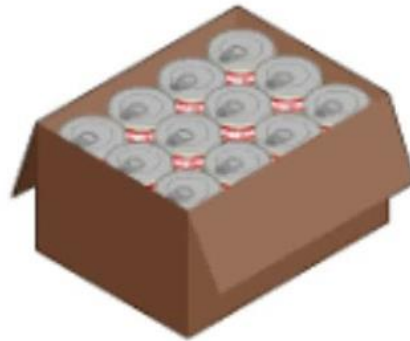
- Packaging touching the product.
- Boxes and wraps.
- Designed for individual items.
- Designed for shelf storage/display of single item.



Primary
packaging

SECONDARY PACKAGING

- Packaging bundling items of a product.
- Boxes and wraps.
- Designed for shelf storage/display.



Secondary
packaging

TERTIARY PACKAGING

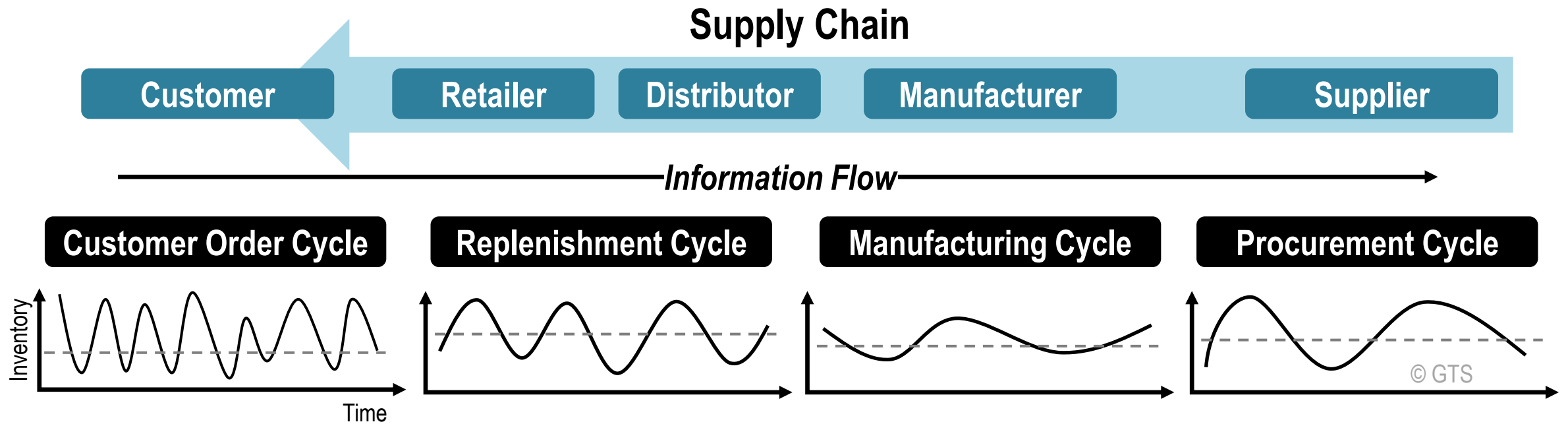
- Packaging bundling products for transport.
- Boxes, pallets and containers.



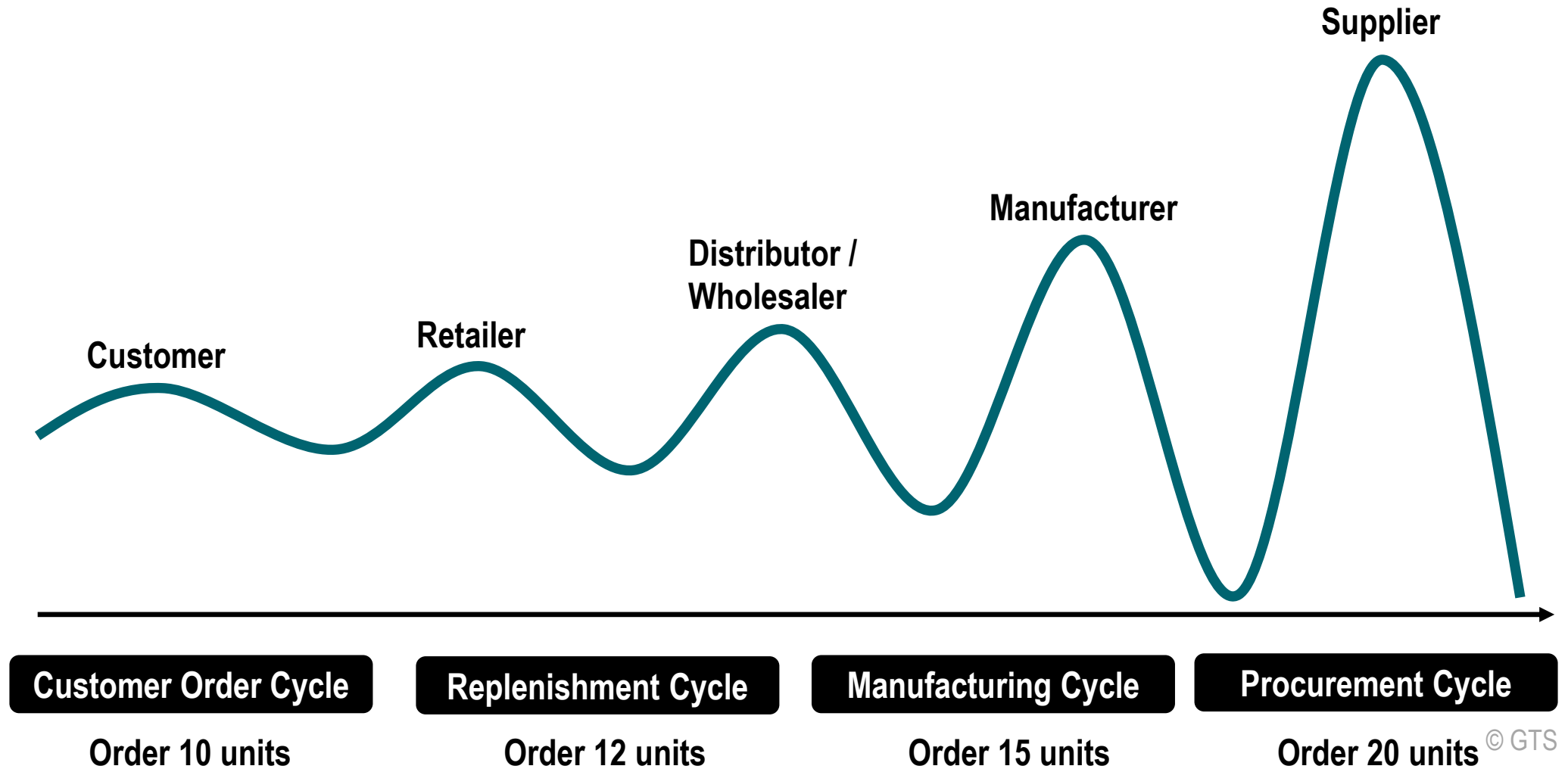
Tertiary
Packaging

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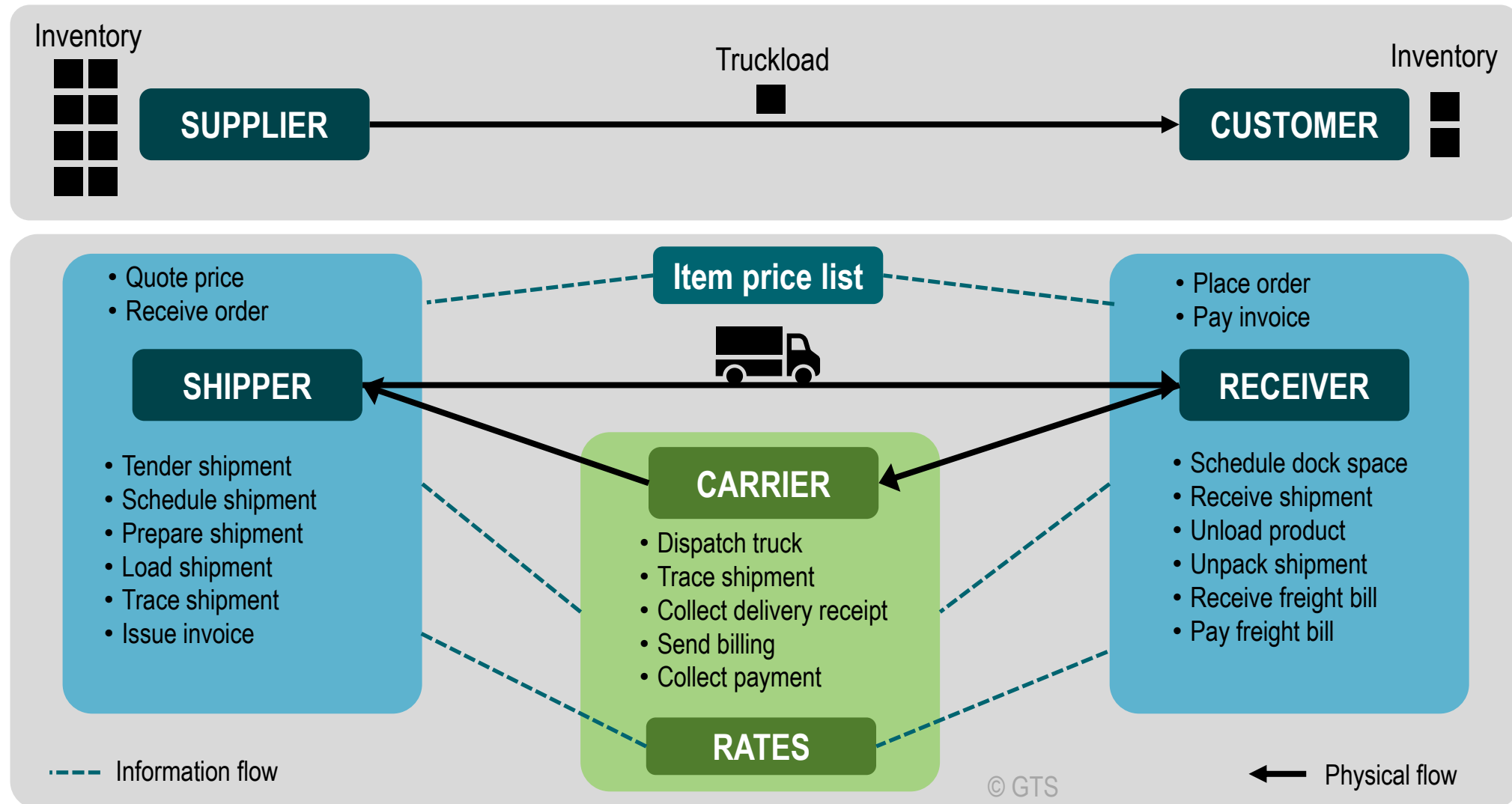
The Supply Chain and its Cycles



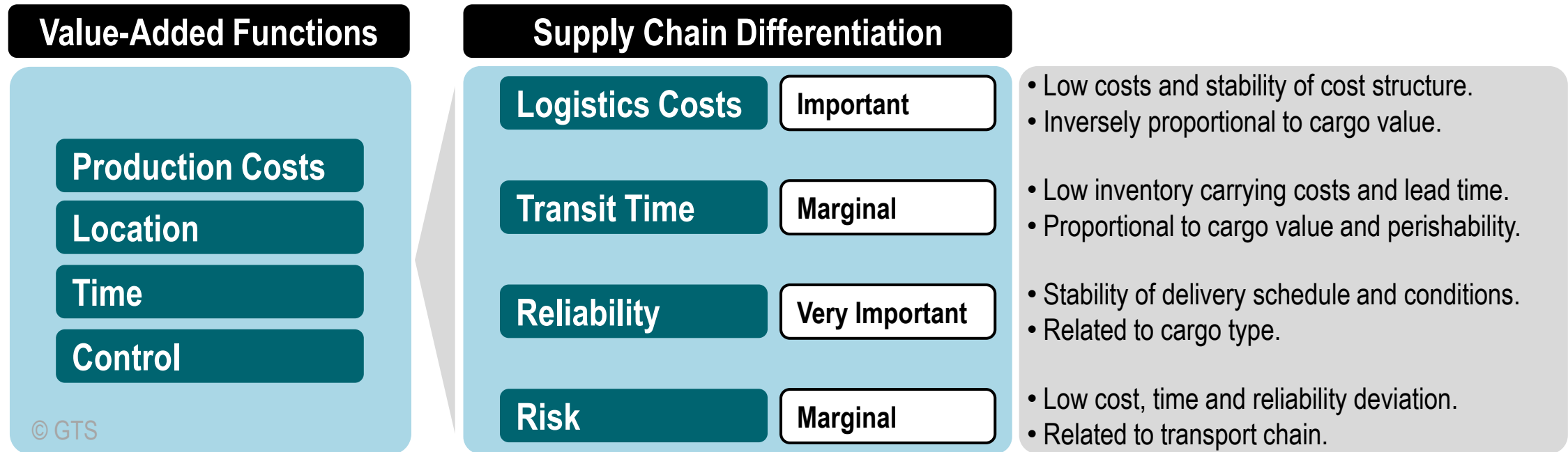
The Bullwhip Effect on Supply Chains



Distribution and Related Logistics Activities



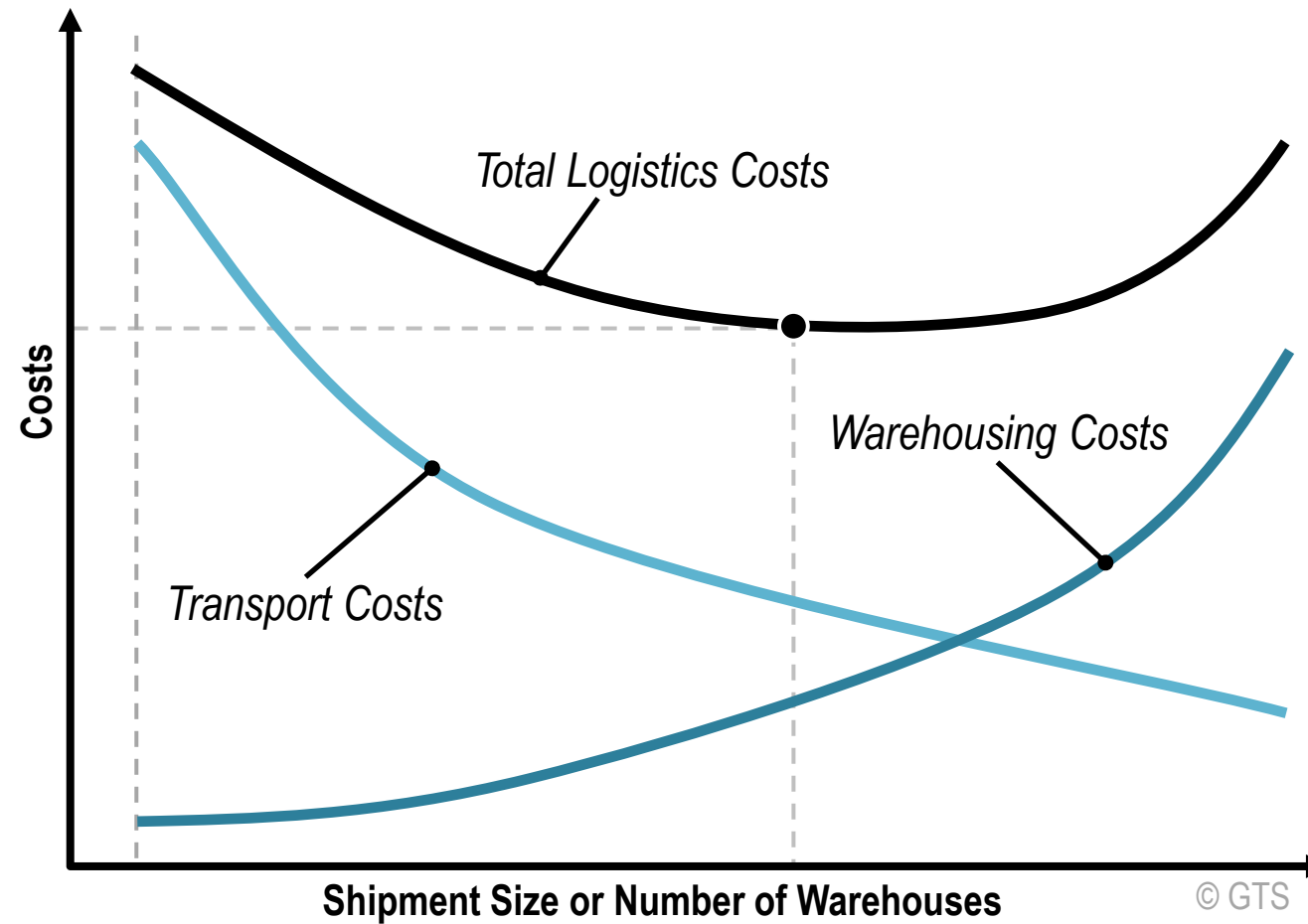
Value-Added Functions and Differentiation of Supply Chains



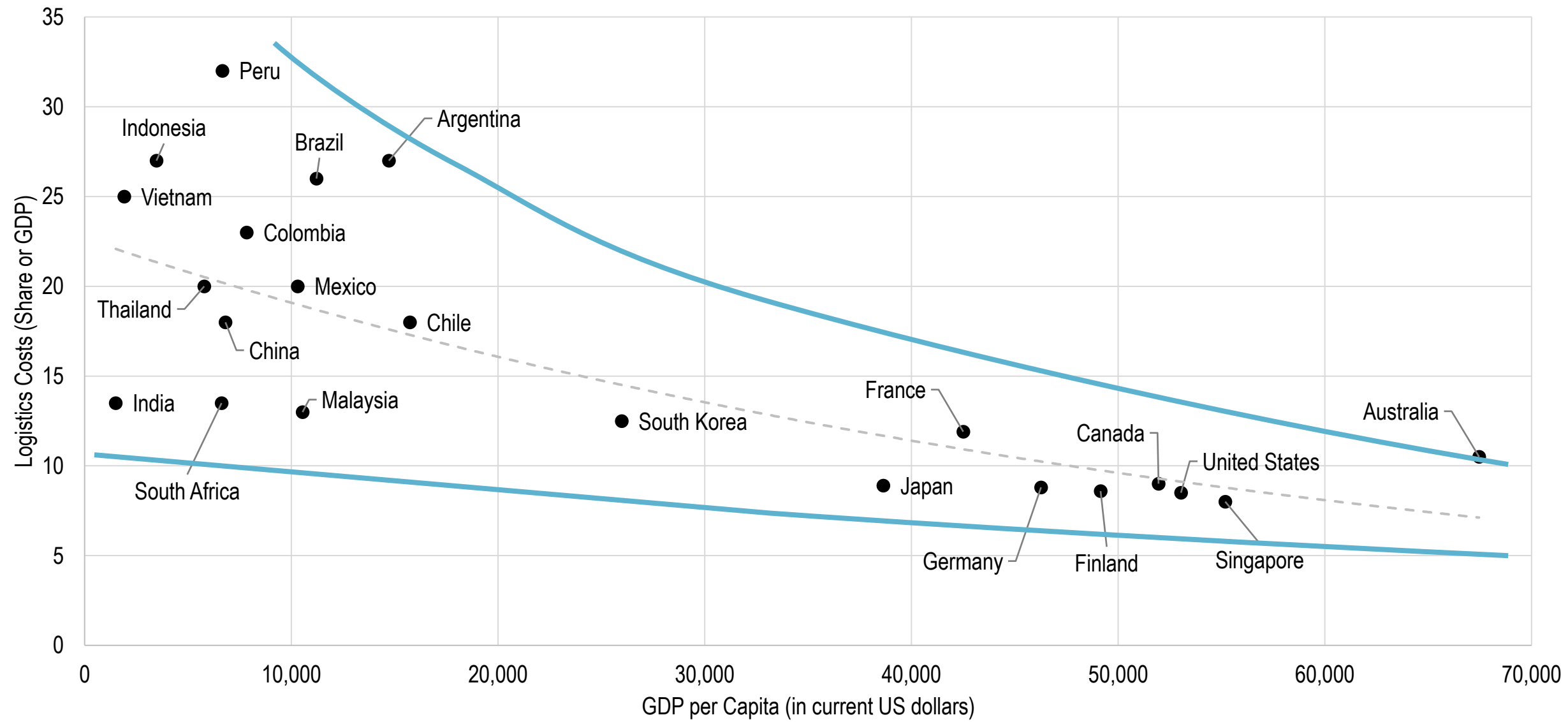
Taxonomy of Logistics Decisions

Level	Description
Production structures	Commercial decisions on outsourcing, offshoring and sub-contracting. Number, location and capacity of production units.
Transport structures	Choice of a freight network linking a company and its suppliers and customers. Choice of modes and terminals; the transport chain.
Distribution structures	Choice concerning the number, location and capacity of distribution centers. Frequency and timing of distribution (e.g. just-in-time).
Logistics structures	Usage of production, transport and distribution capabilities to fulfill short, medium and long term strategies (e.g. lower costs, gain market share, improve service efficiency, reduce response time, reduce environmental footprint). Usage of third party logistics providers.

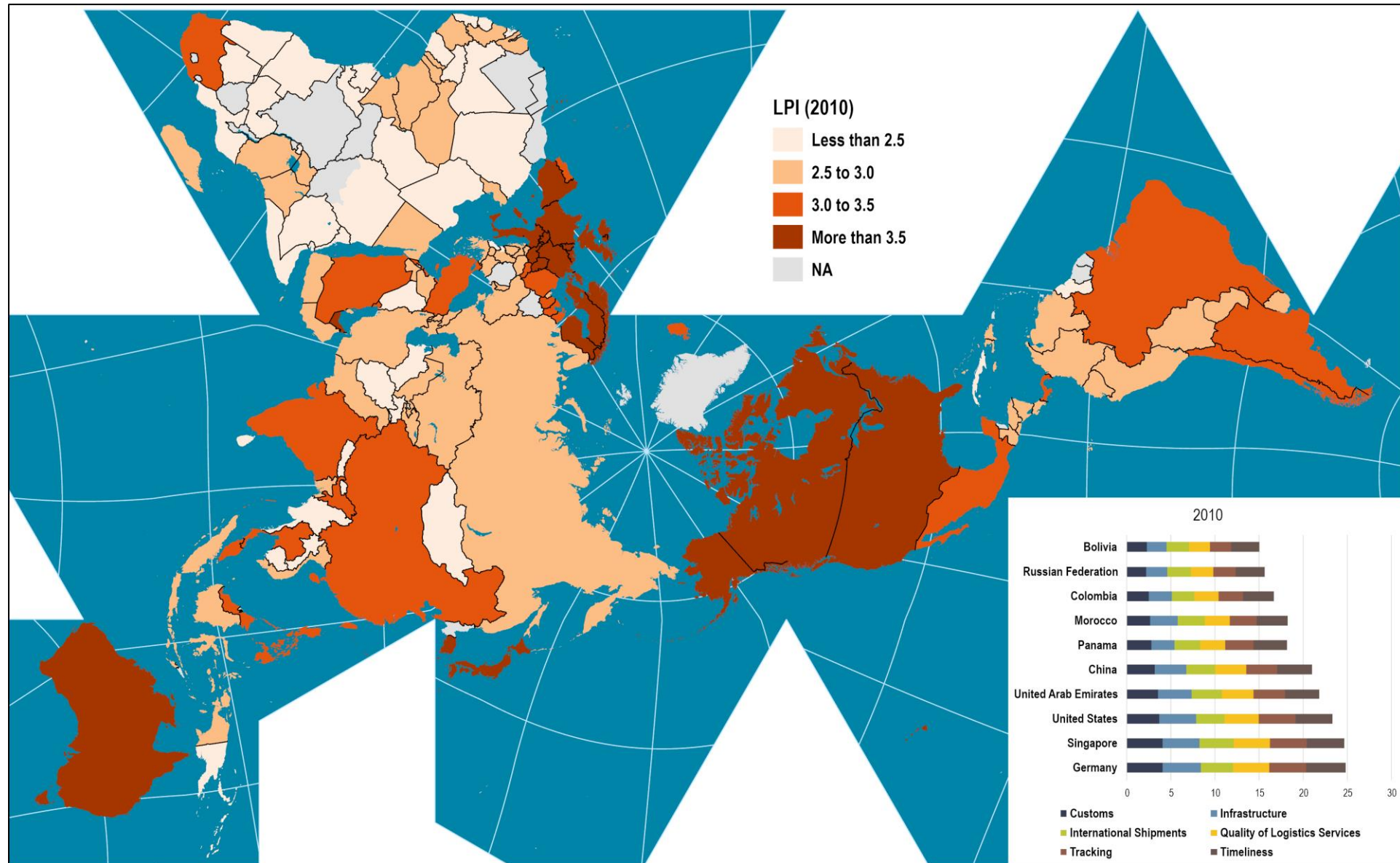
Total Logistics Costs Tradeoff



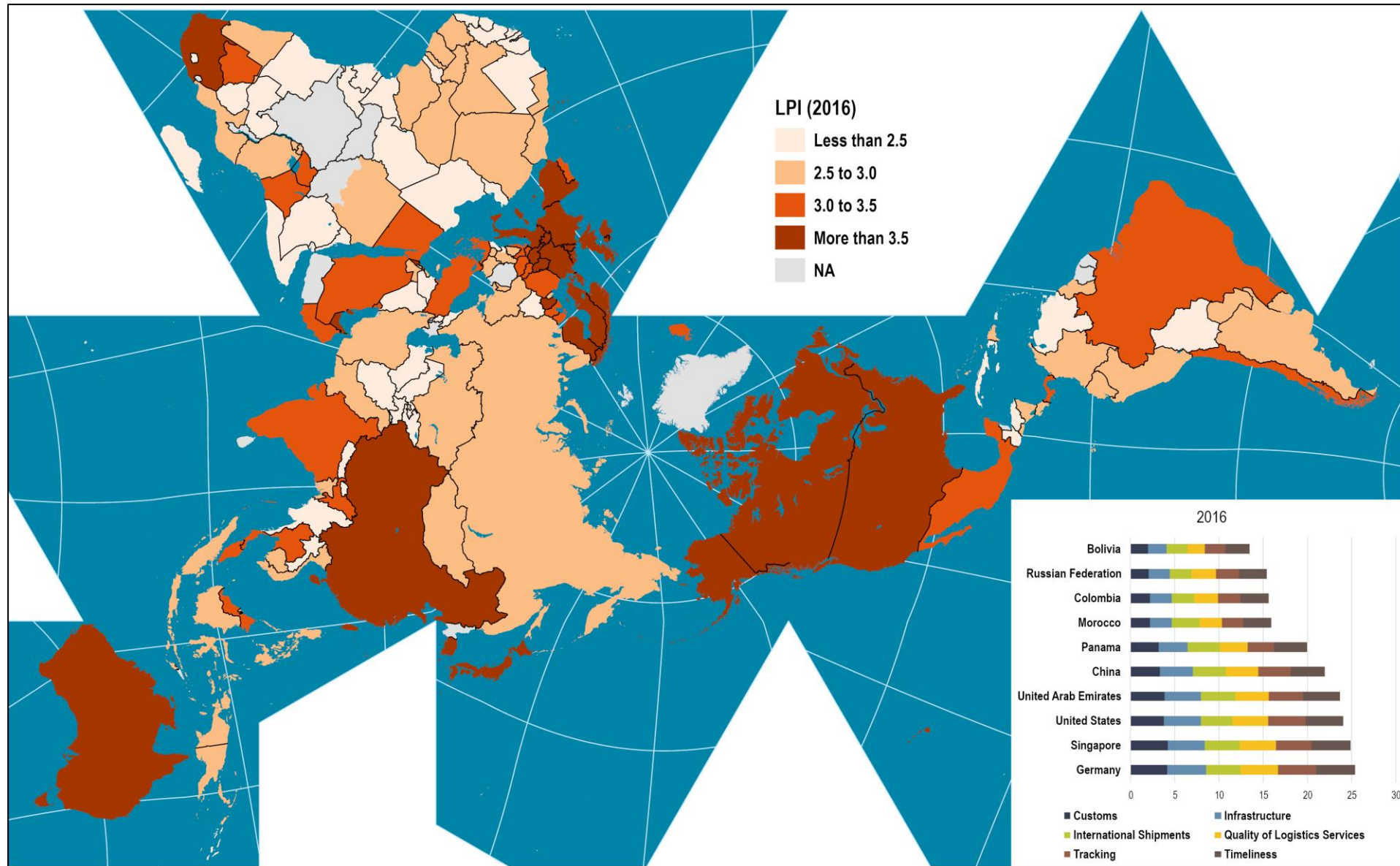
Logistics Costs and Economic Development



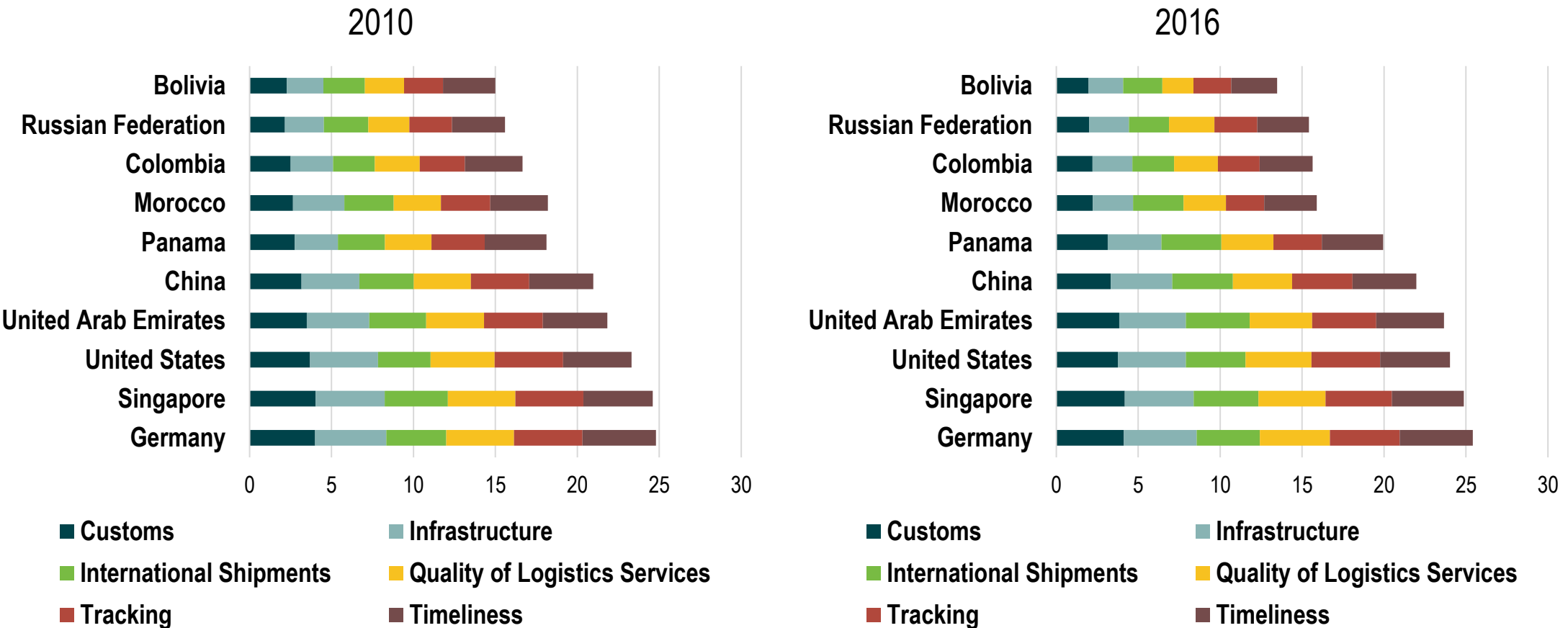
Logistic Performance Index, 2010



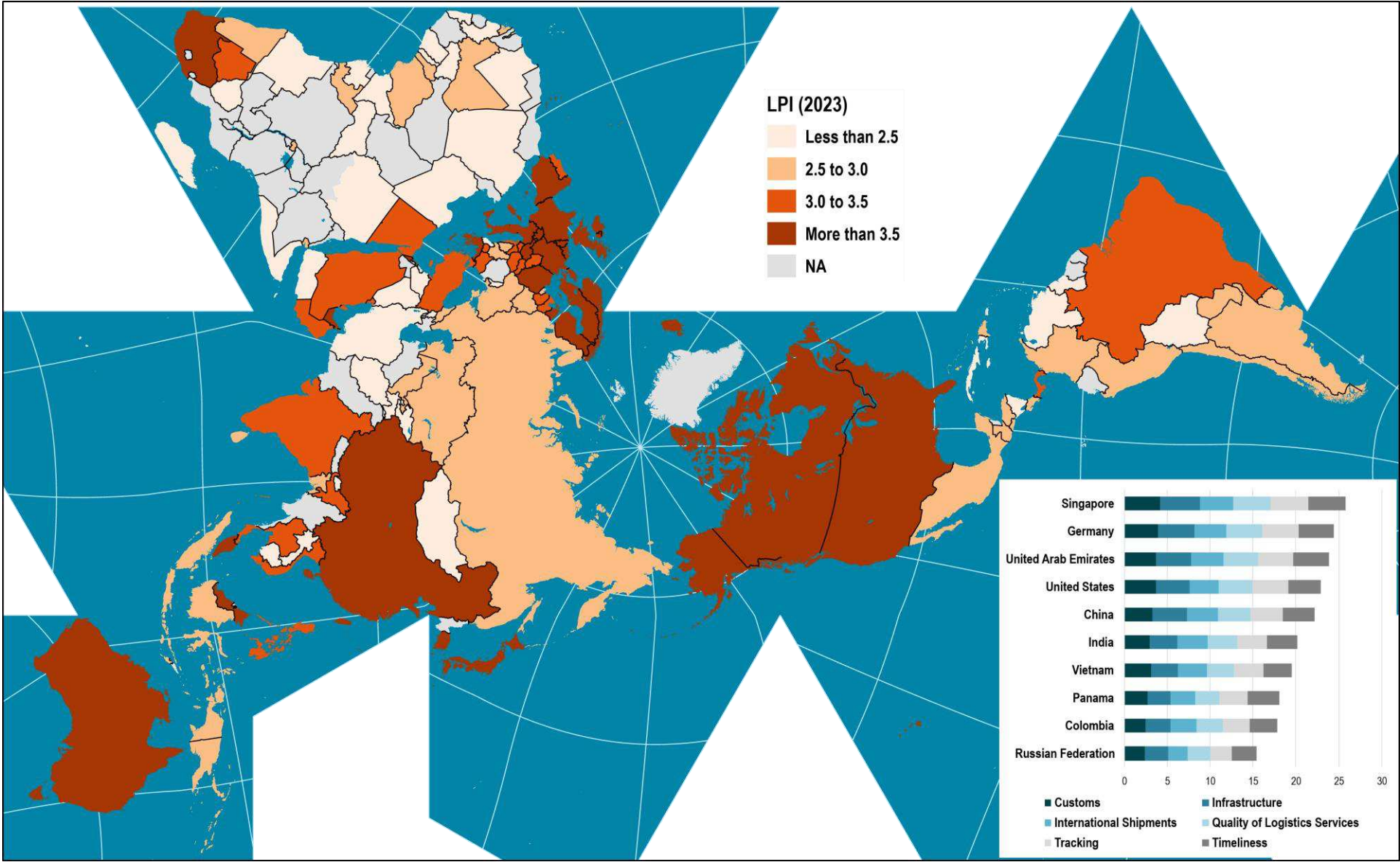
Logistic Performance Index, 2016



Composition of the Logistics Performance Index, Selected Countries



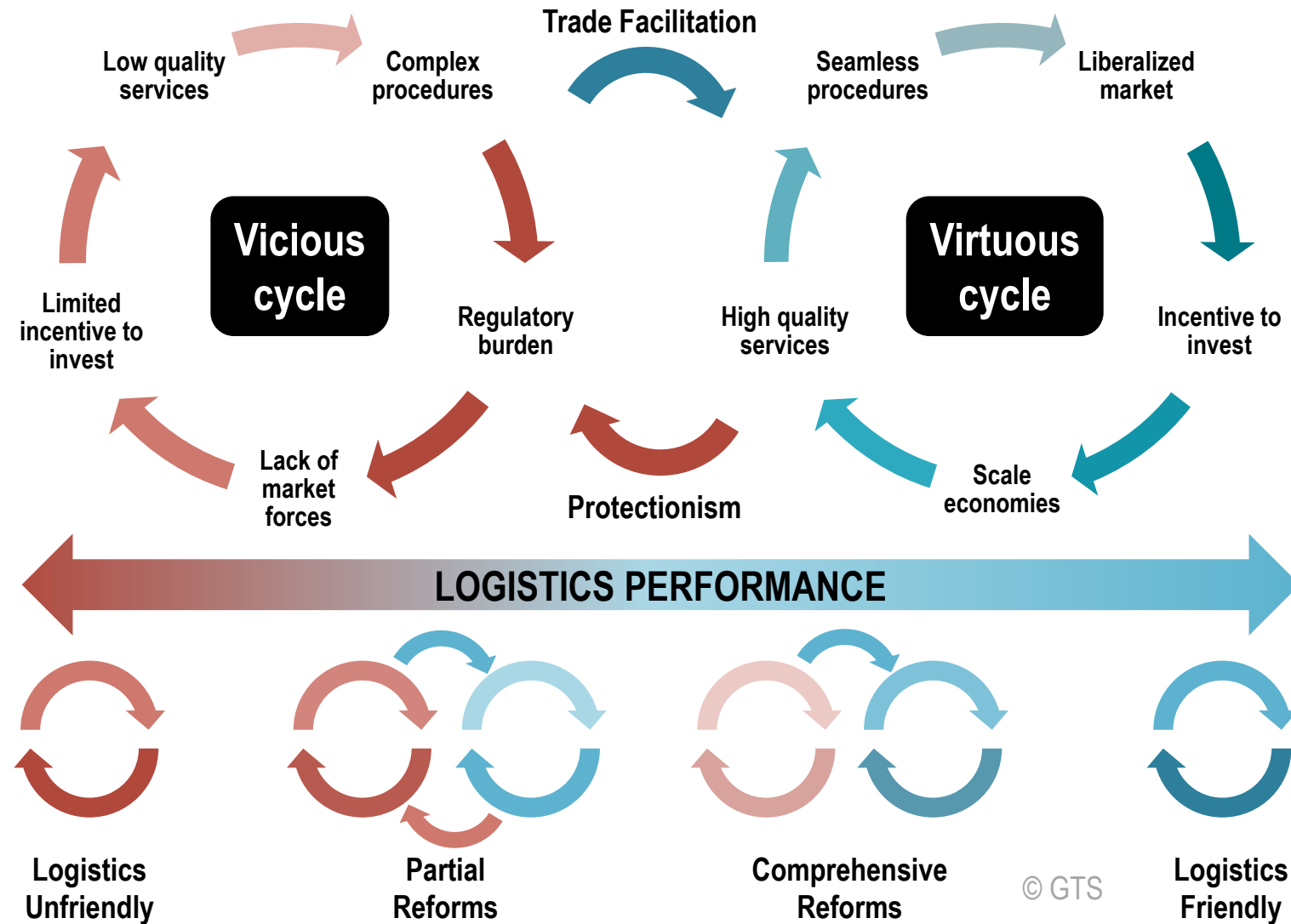
Logistic Performance Index, 2023



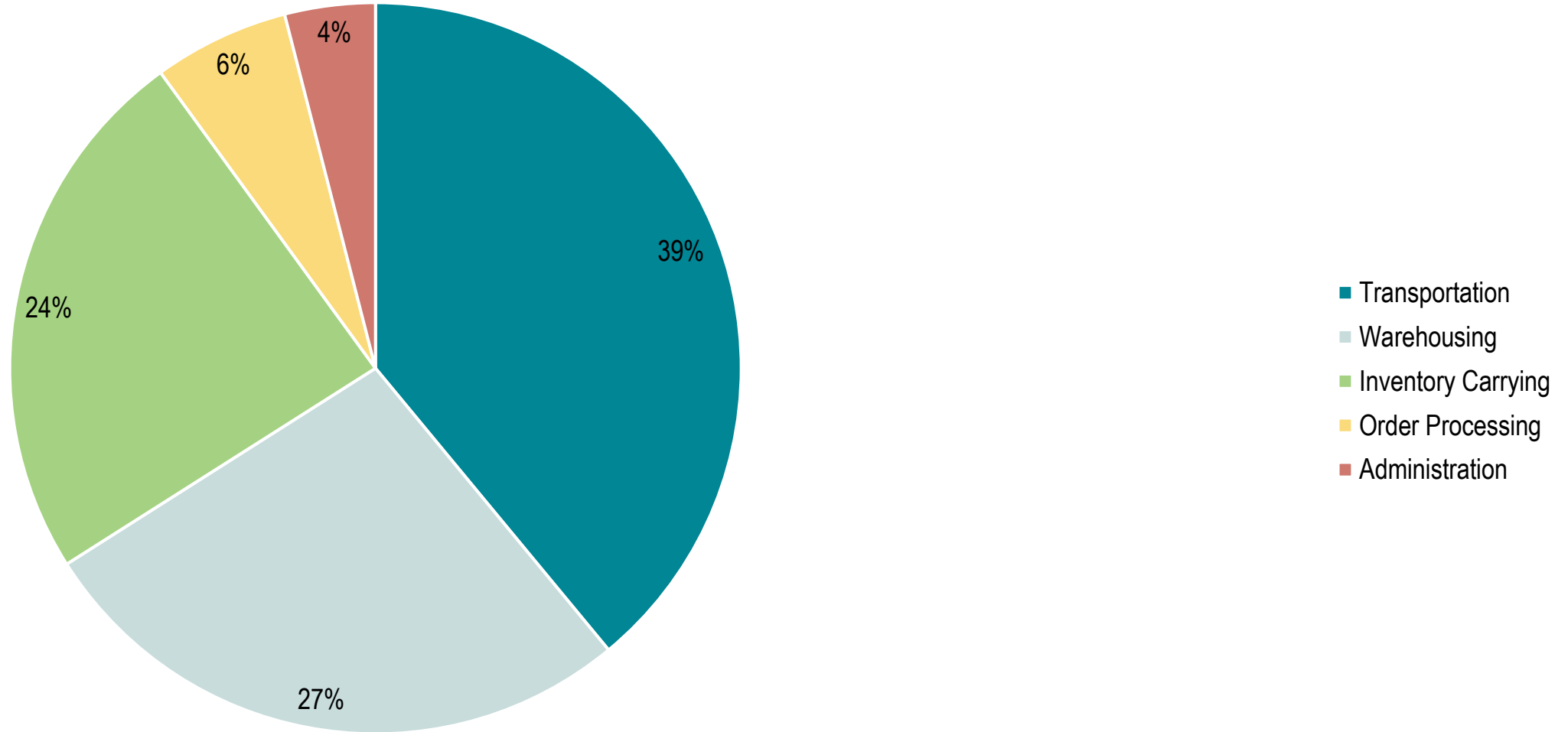
Composition of the Logistics Performance Index, Selected Countries



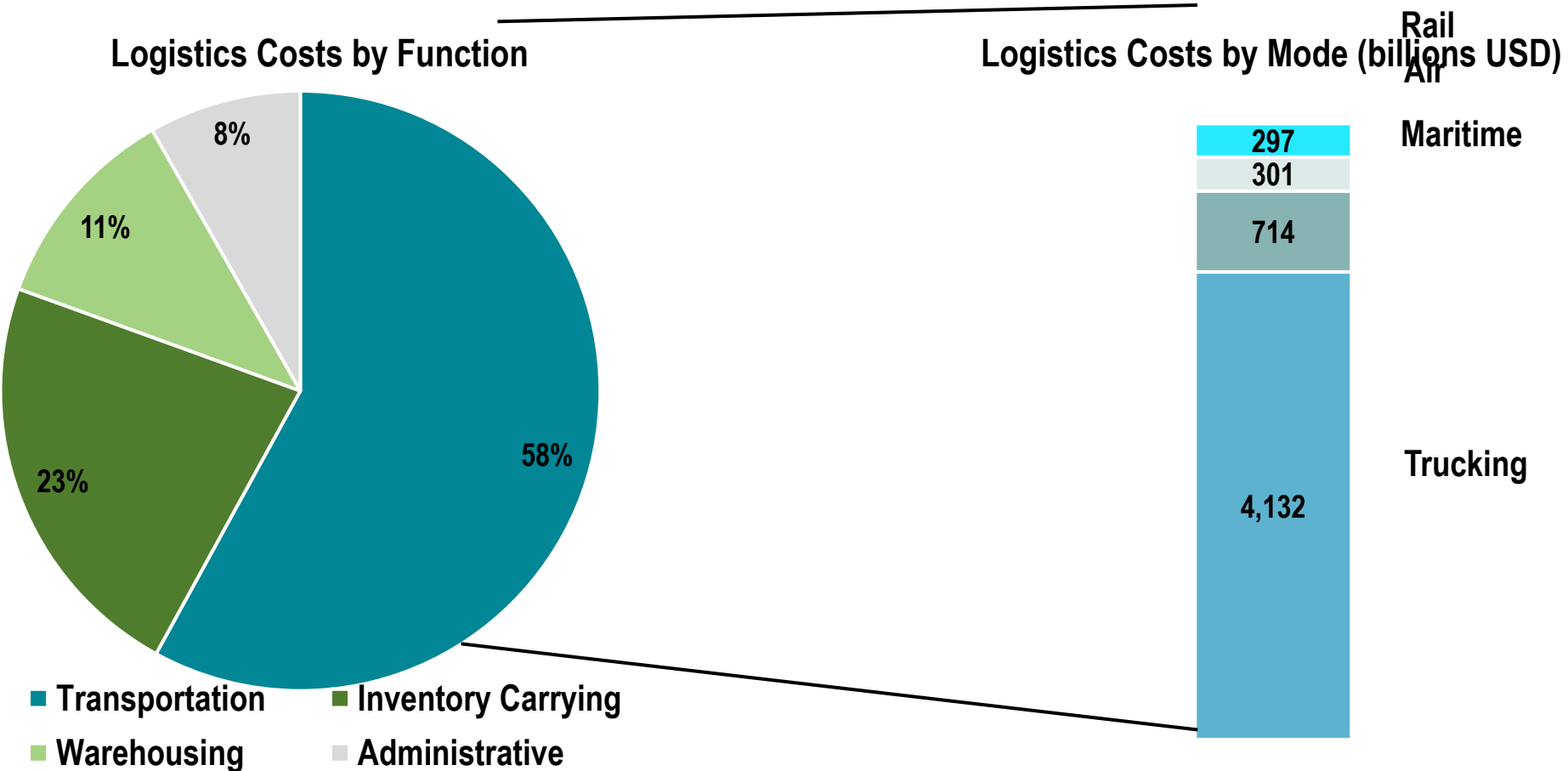
The Logistics Virtuous and Vicious Cycles



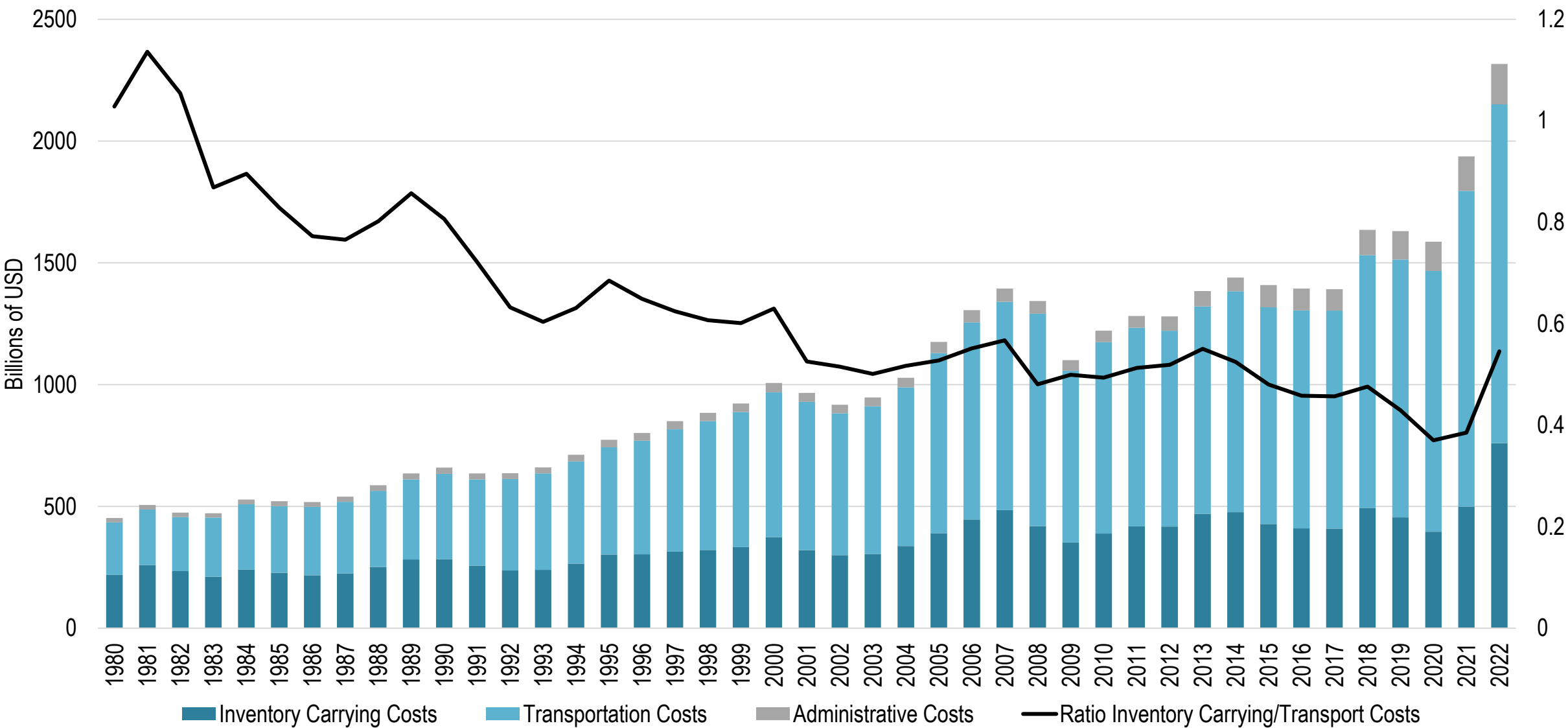
Worldwide Logistics Costs, 2002



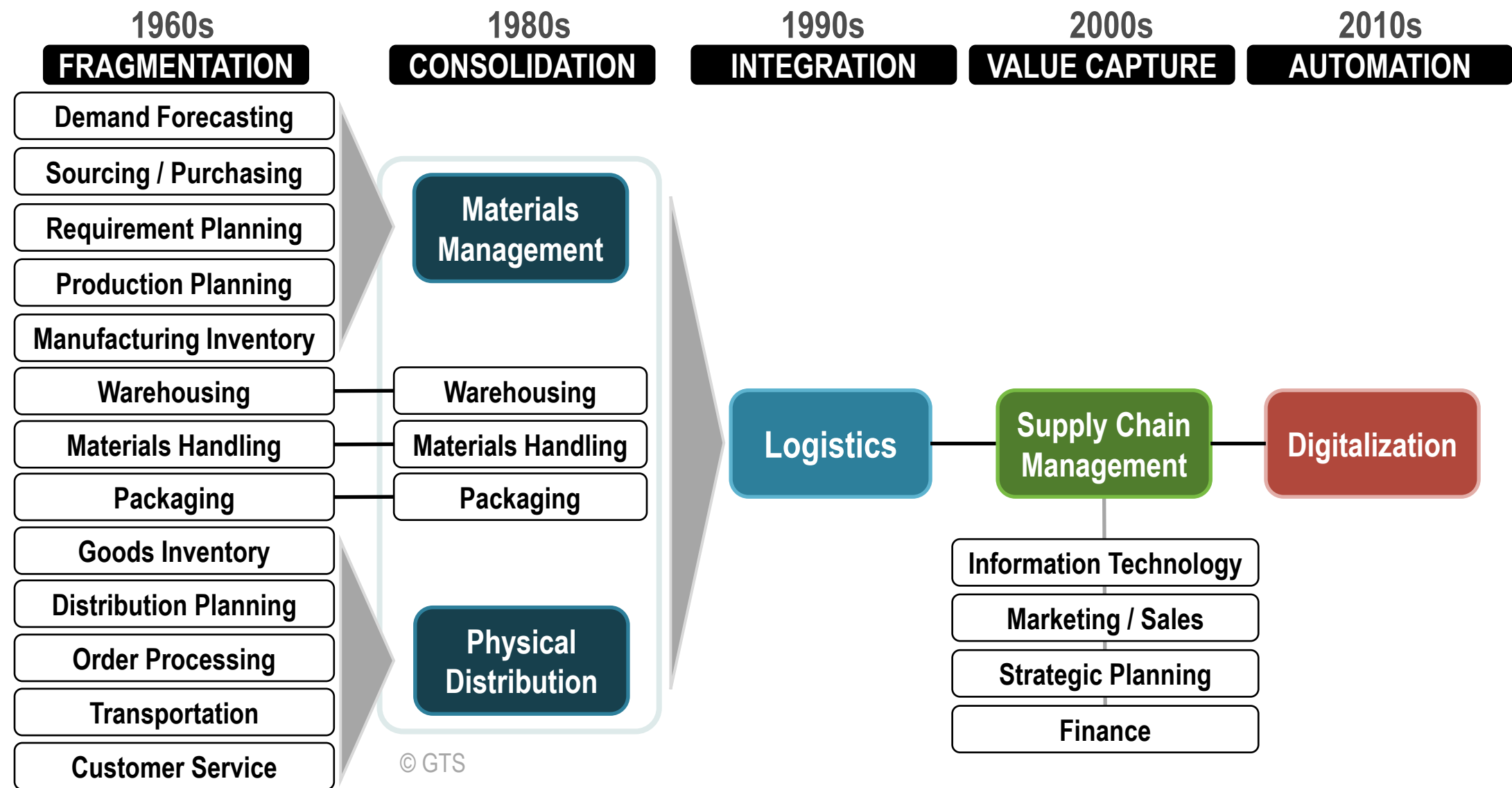
Global Logistics Costs by Function and Mode, 2018



Logistics Costs, United States, 1980-2022

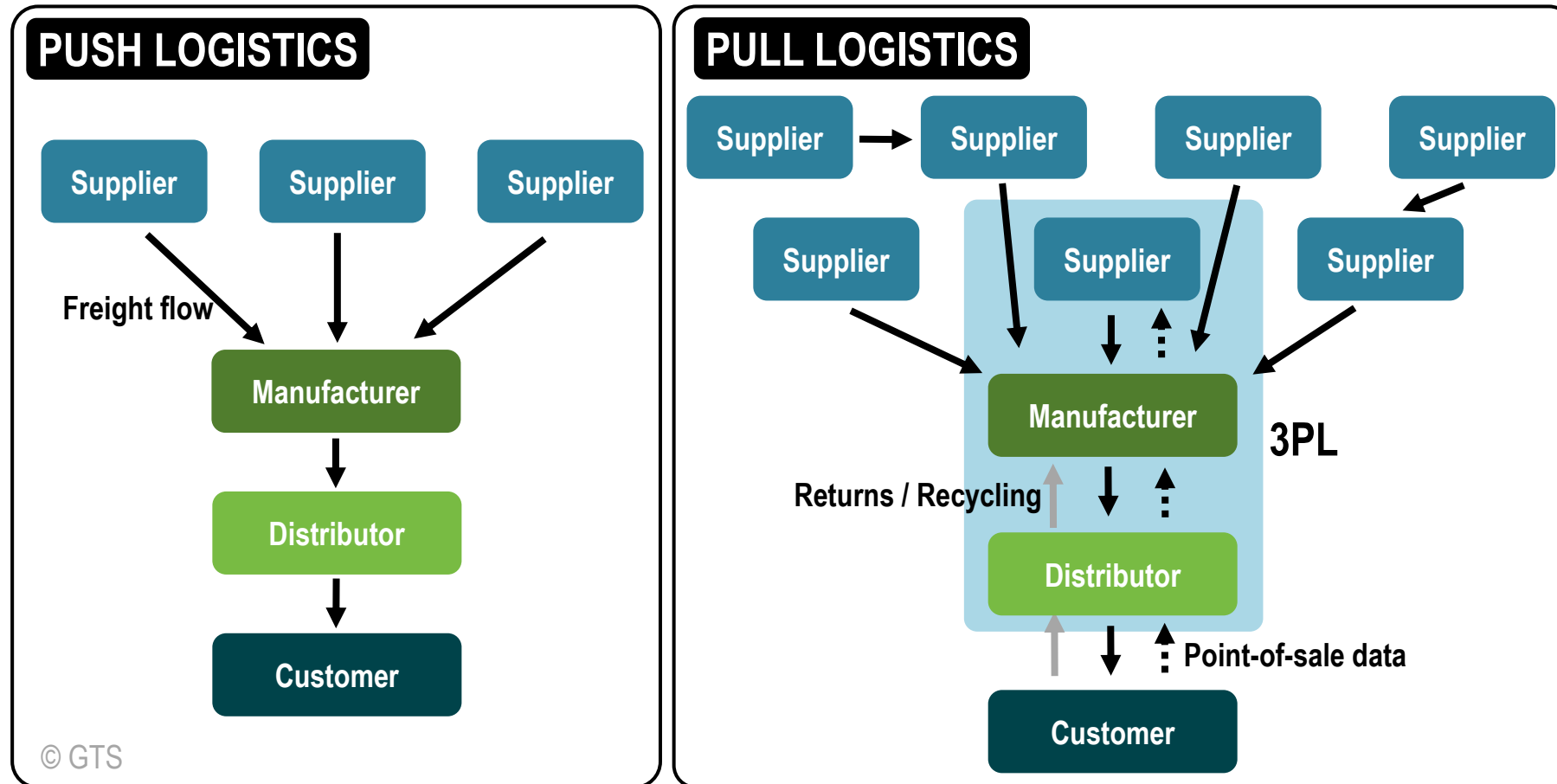


The Evolution of Logistics



Anticipation Stock • Cycle Stock • Safety Stock • Pipeline Stock •
Decoupling Stock

From Push to Pull Logistics



Warehouses and Distribution Centers



WAREHOUSE



Storage

- Supply-driven (storage).
- Buffer related function (inventory holding).
- Inventory stored for weeks or months.
- Cargo ownership usually by supplier / producer.
- Consolidation of cargo.
- Limited added value outside storage.
- Coping with unforeseen demand.

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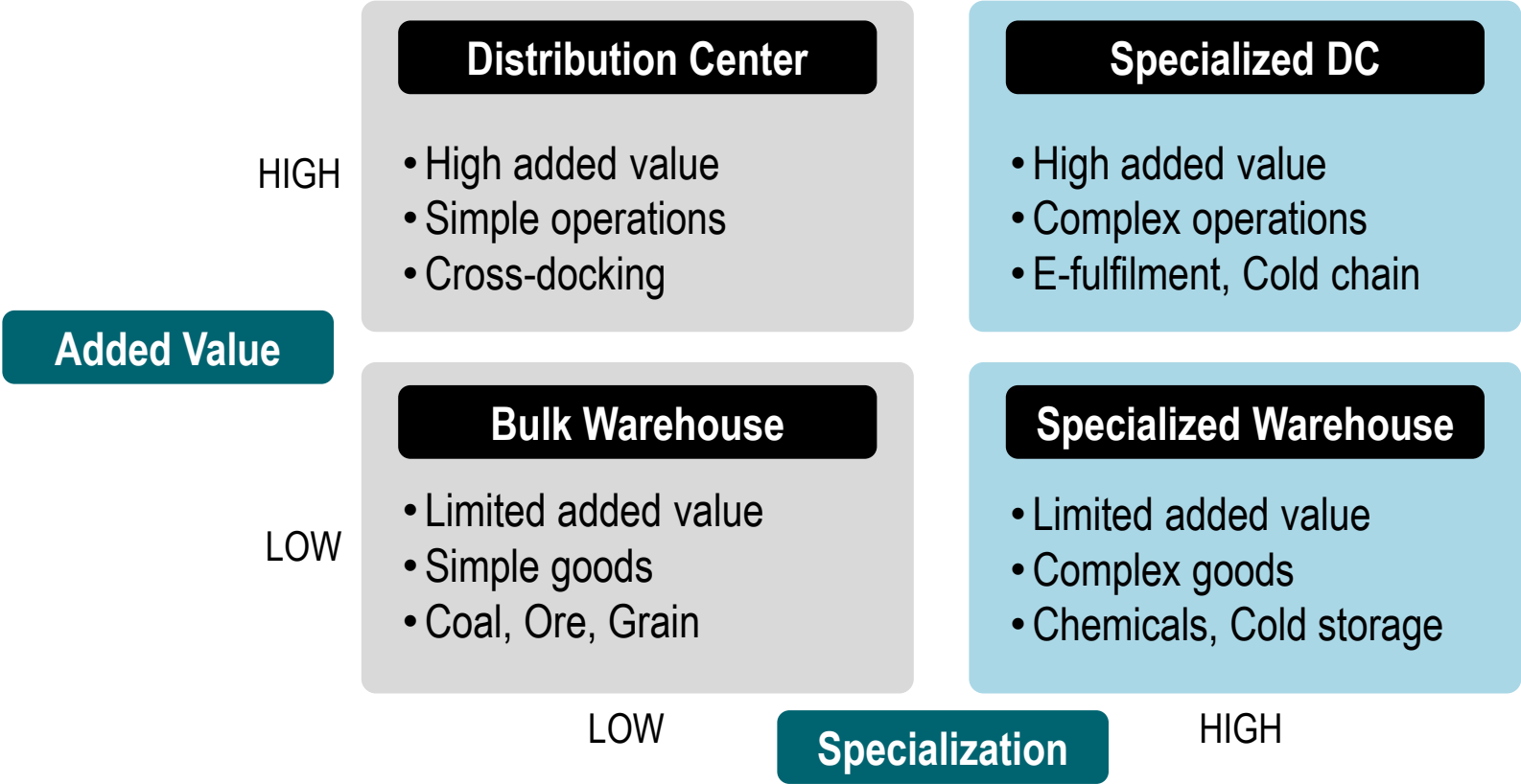
DISTRIBUTION CENTER



Throughput

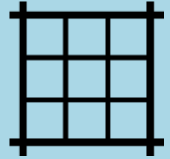
- Demand-driven (throughput).
- Fulfilling orders (processing and fulfillment).
- Inventory stored for days or weeks.
- Cargo ownership usually by distributor/customer.
- Consolidating, deconsolidating, sorting a cargo load or changing the load unit.
- Assembly, packaging and light manufacturing.
- Coping with stable and predictable demand.

A Typology of Warehousing



Advantages of Logistic Zones

GEOGRAPHICAL ADVANTAGES



Land

Availability (ownership or zoning).
Lower acquisition (or renting) costs.
Preferential taxation.



Accessibility and Connectivity

Proximity to terminals, suppliers and customers.
Lower distribution costs (distance).
Site accessibly 24/7.



Infrastructures

Provision of utilities and roads.
Leasing of warehousing space and equipment.

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OPERATIONAL ADVANTAGES



Planning and Regulations

“Fast track” (construction and operation).
Incremental development phases.
Compliance with regulations.
Foreign trade zone status.



Economies of Agglomeration

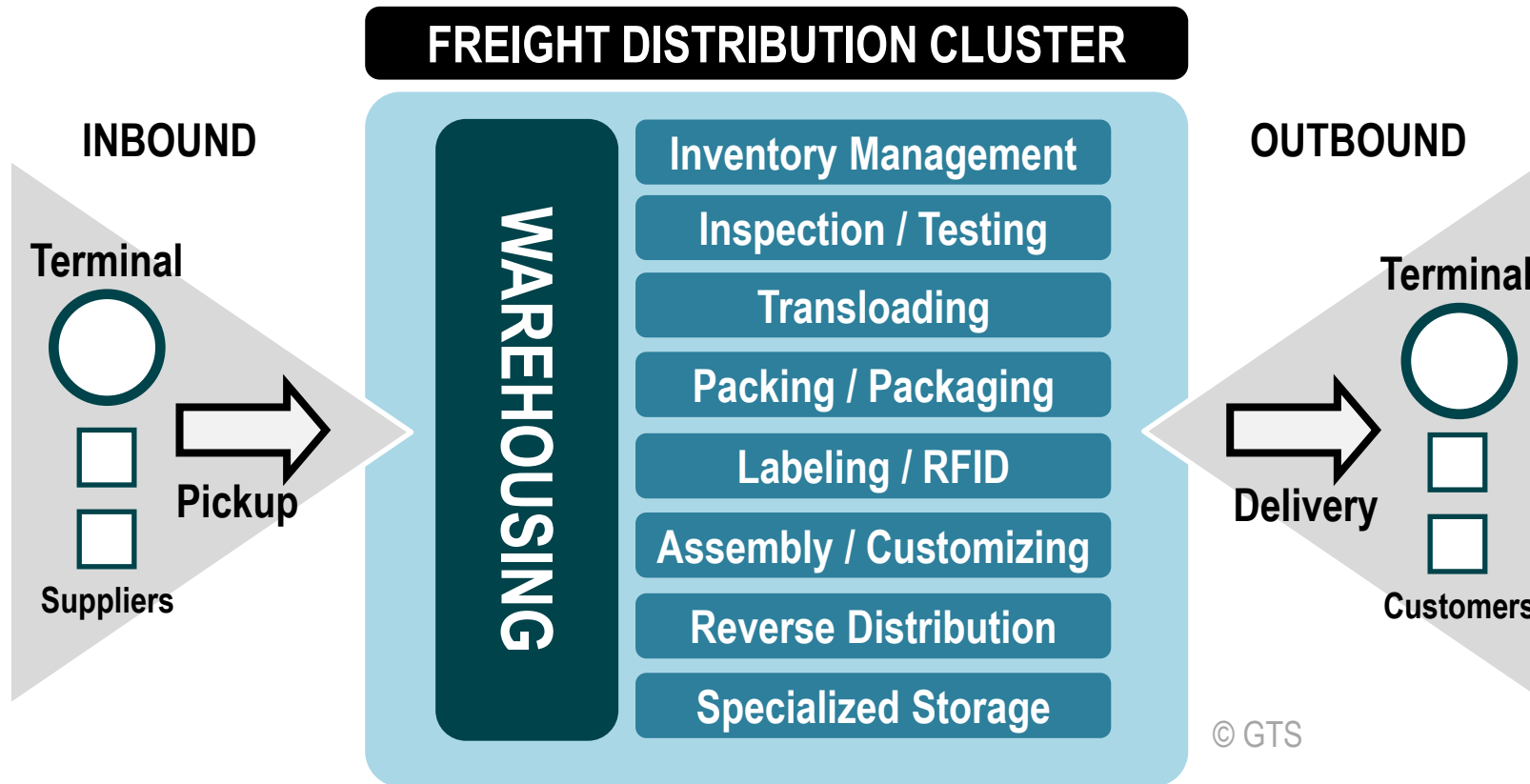
Lower distribution costs (scale).
More full truck loads.
Shared services (labor, transloading, telecommunications).



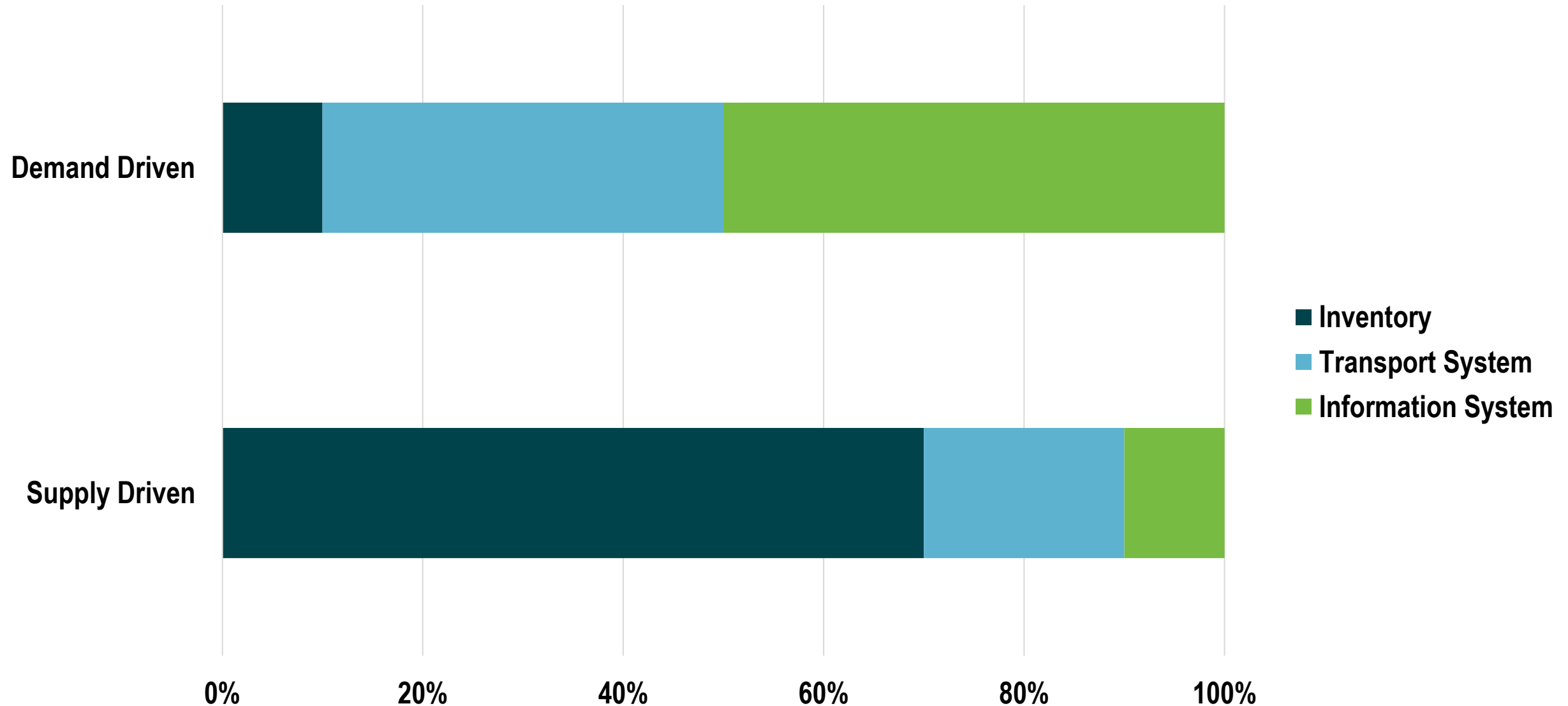
Multiplying Factors

Anchor tenants (major actors in logistics).
Diffusion of best practices (managerial, technical).
Service industries.

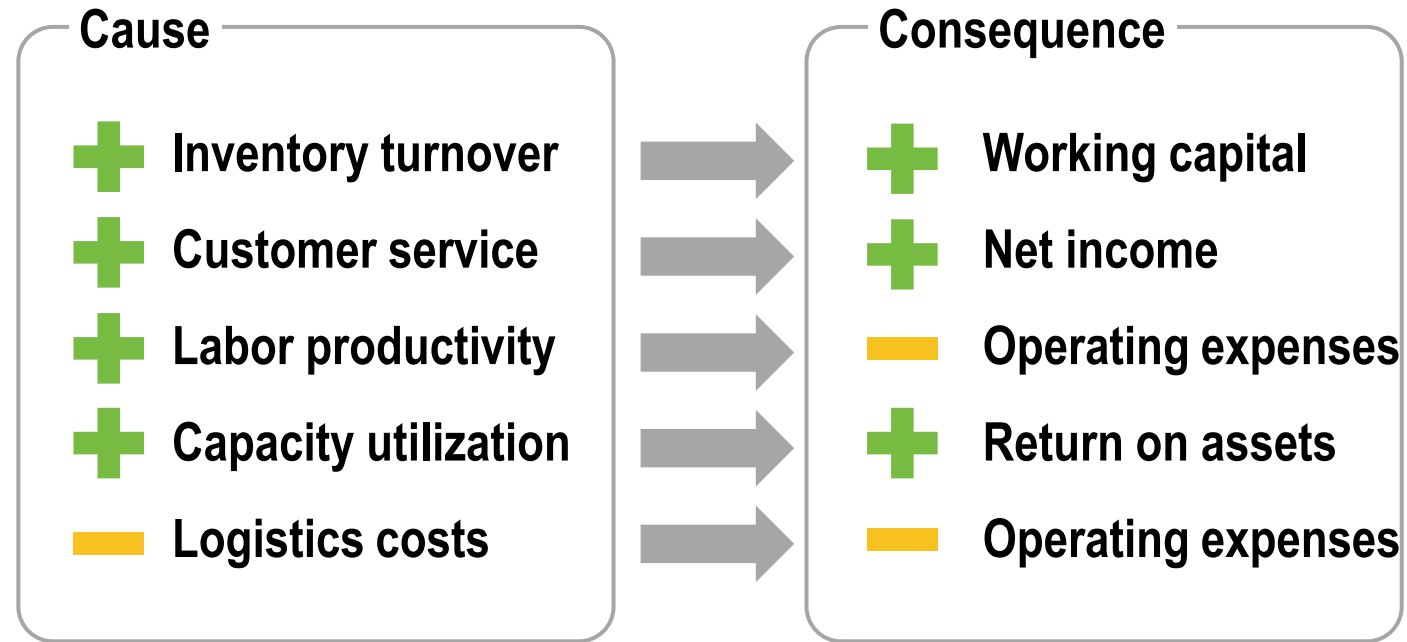
Value-added Activities Performed at Logistic Zones



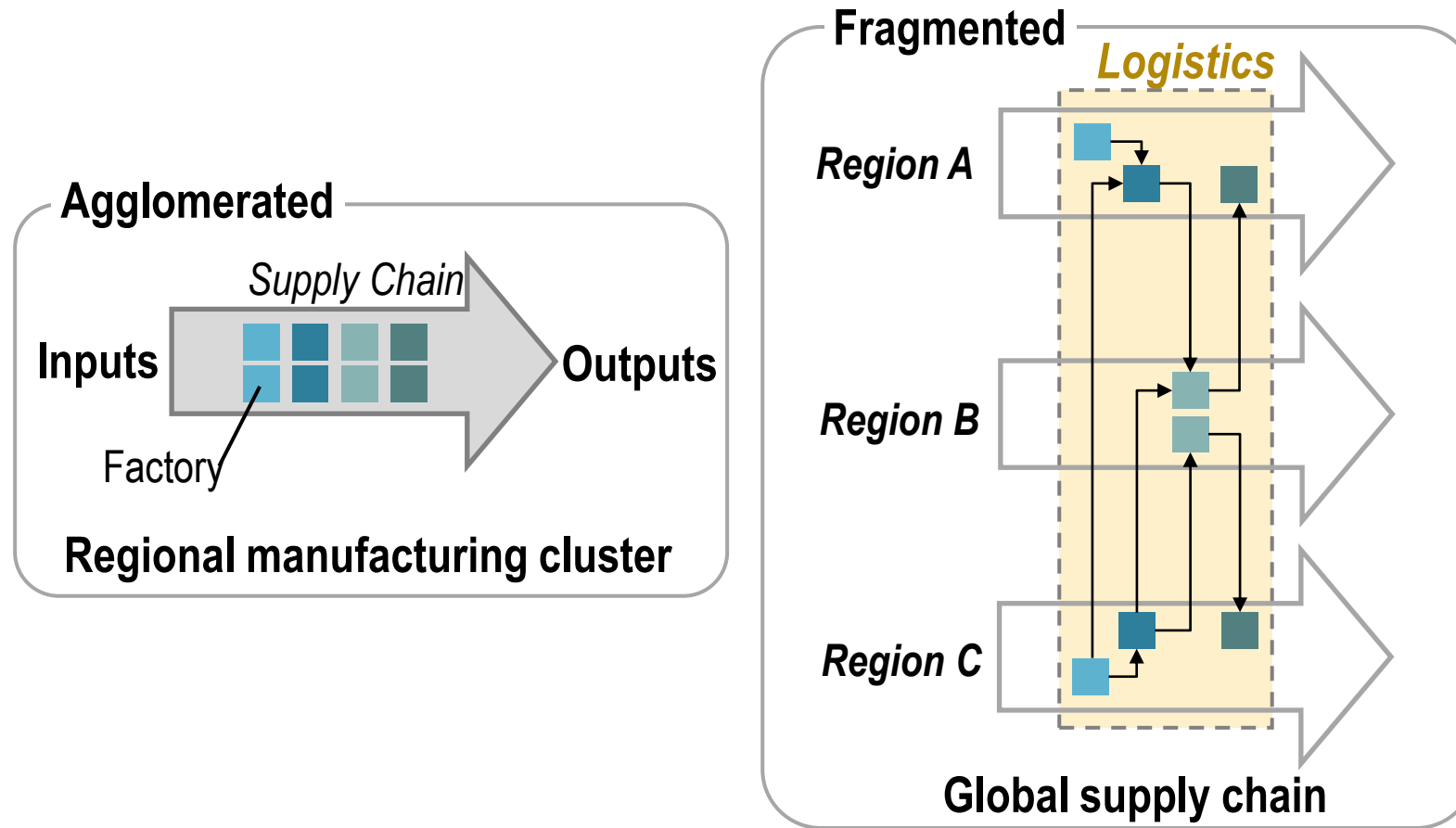
Changes in the Relative Importance of Logistical Functions in Distribution Systems



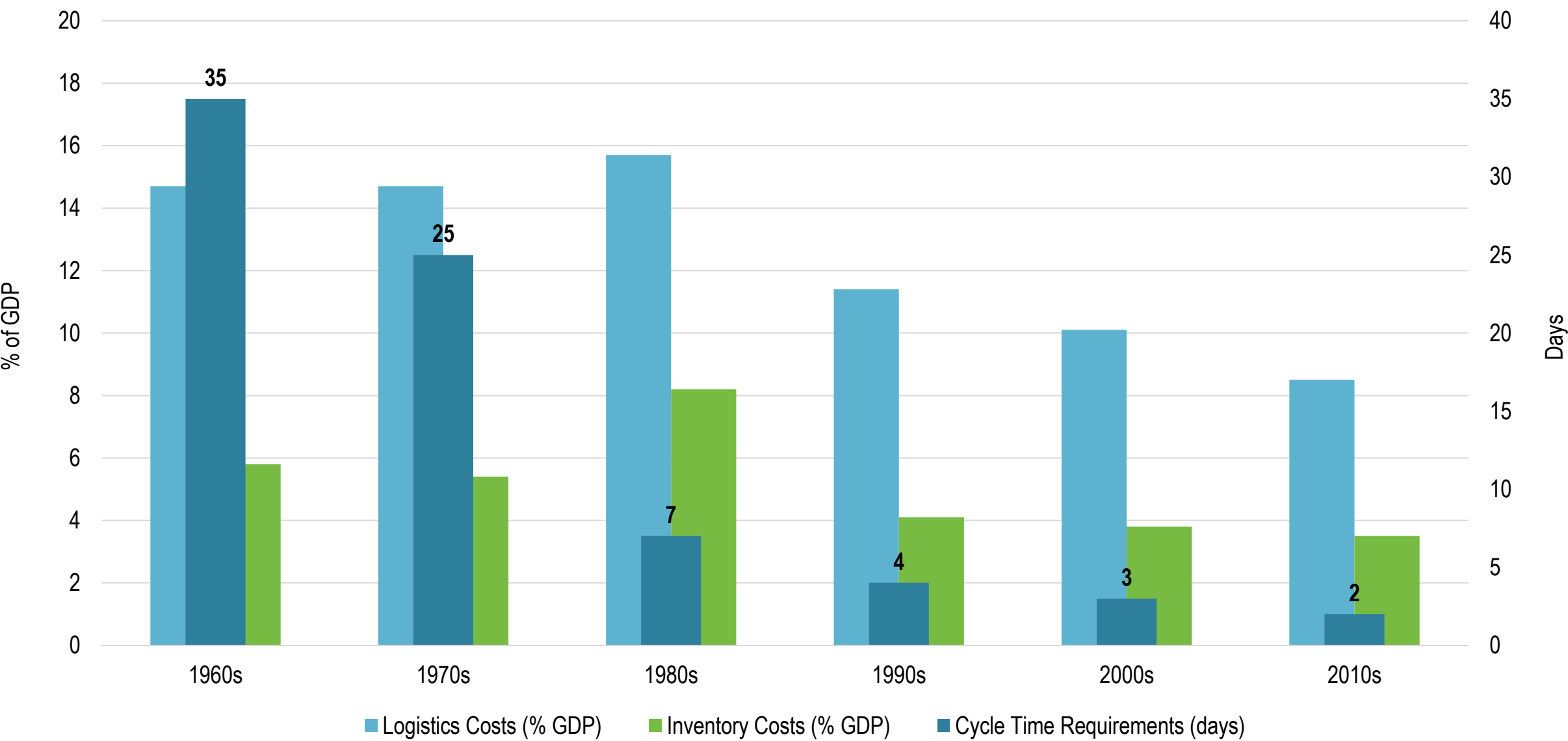
Benefits of Demand-Driven Supply Systems



Fragmentation of the Production System and the Logistics Industry



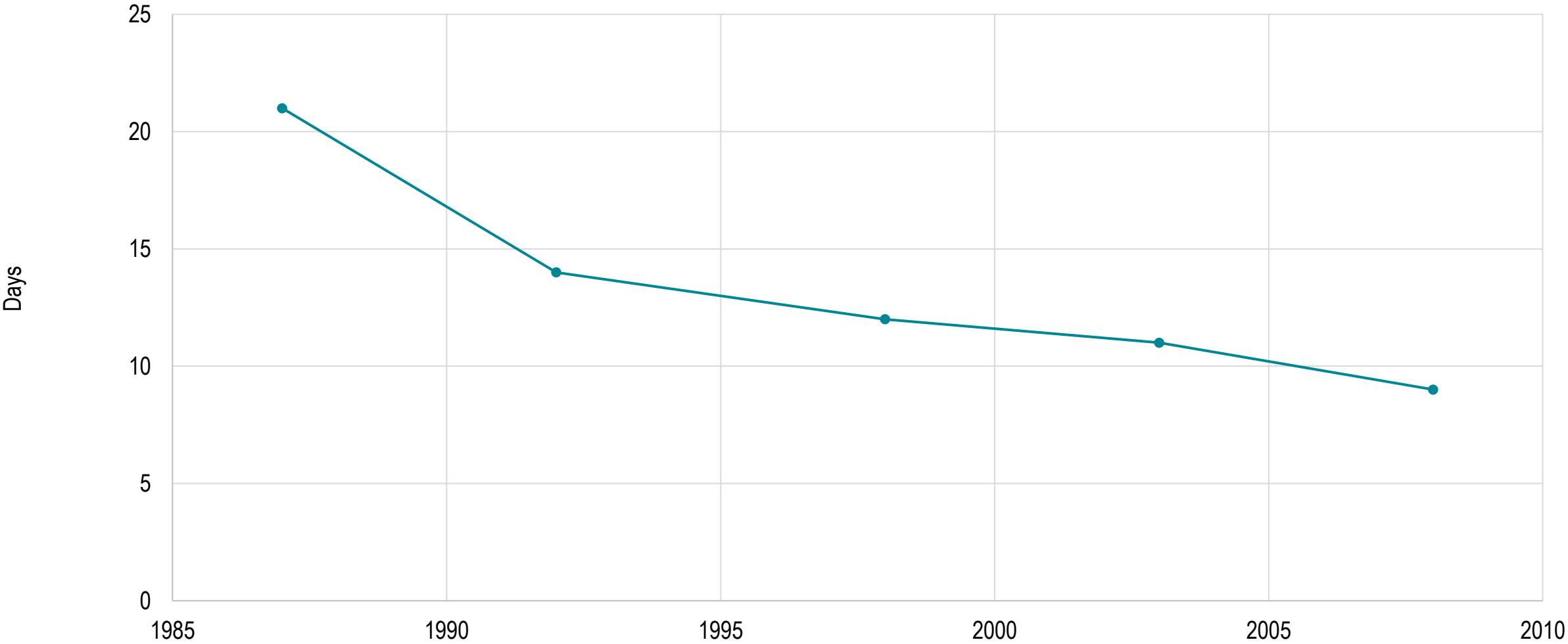
Logistical Improvements, Manufacturing Sector, 1960s to 2010s



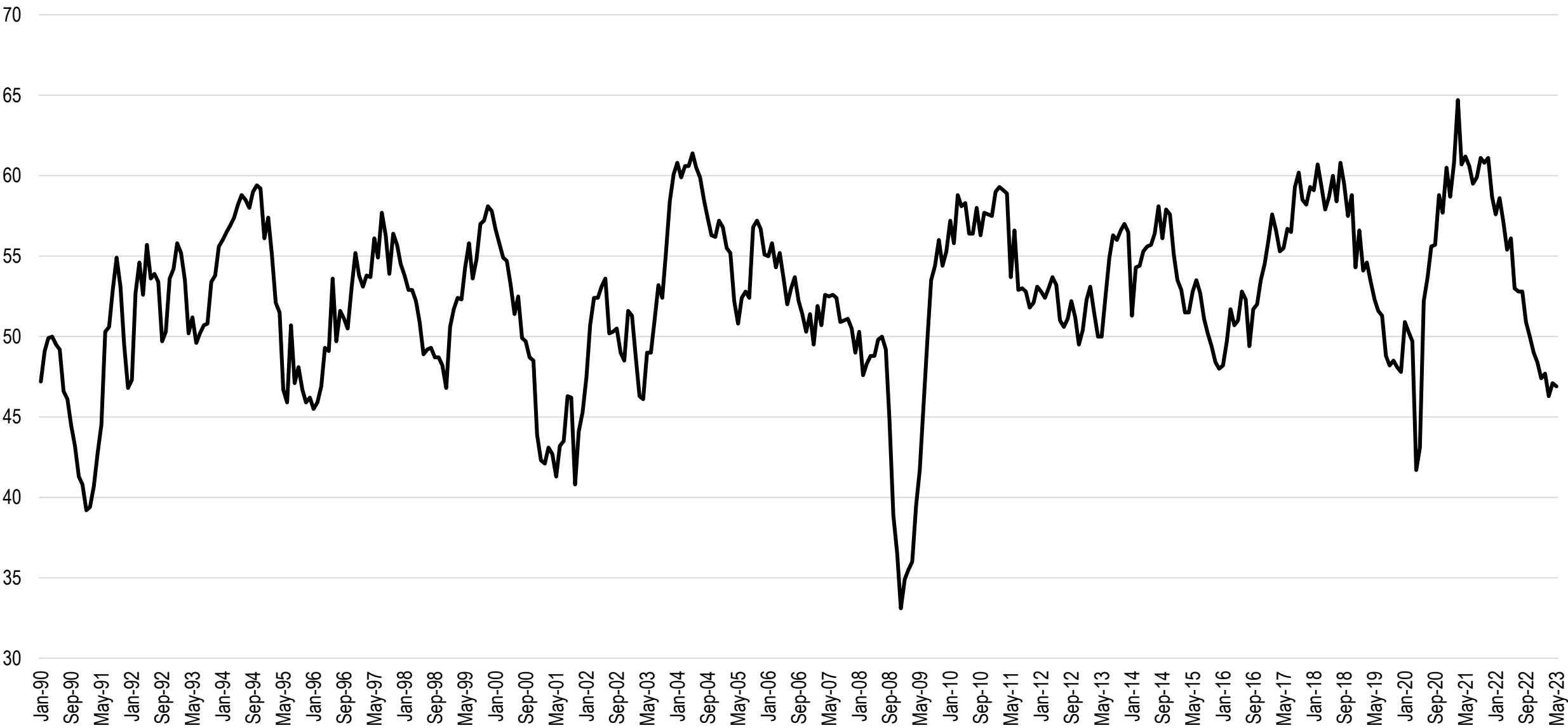
Some Issues in Supply Chain Management

Issue	Outcome
Location of inventory and production	Wider geographical sourcing and distribution of goods
Development of break-bulk / transshipment systems	
Concentration of international trade	Major port and airport gateways
Development of hub and spoke systems	Intermediary hubs,
Time management	Postponement, Nominated day delivery and timed delivery systems
Rationalization of the supply base	
Vertical disintegration of production	
Direct deliveries	
Green logistics	Reverse logistics

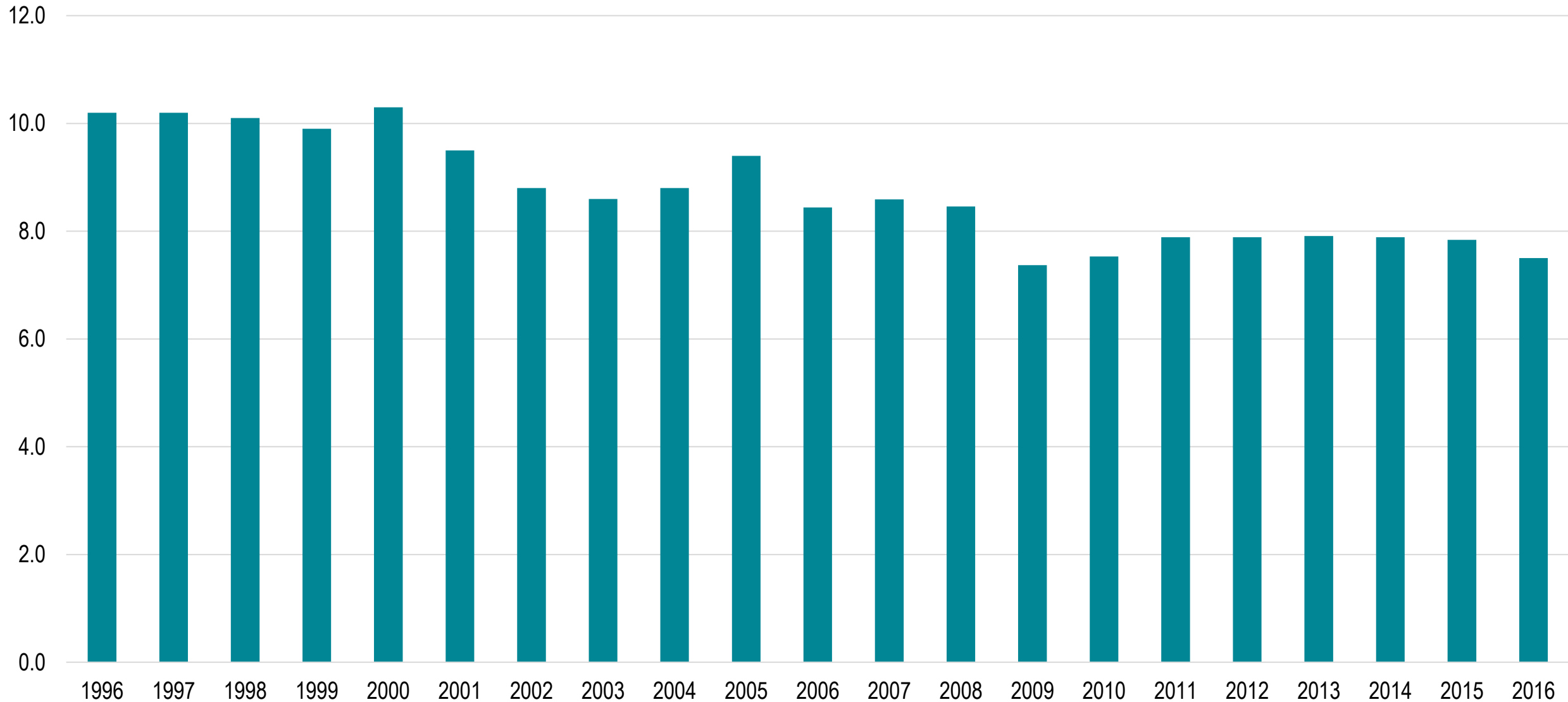
Average Order Lead Times of European Manufacturers, Wholesalers, and Retailers



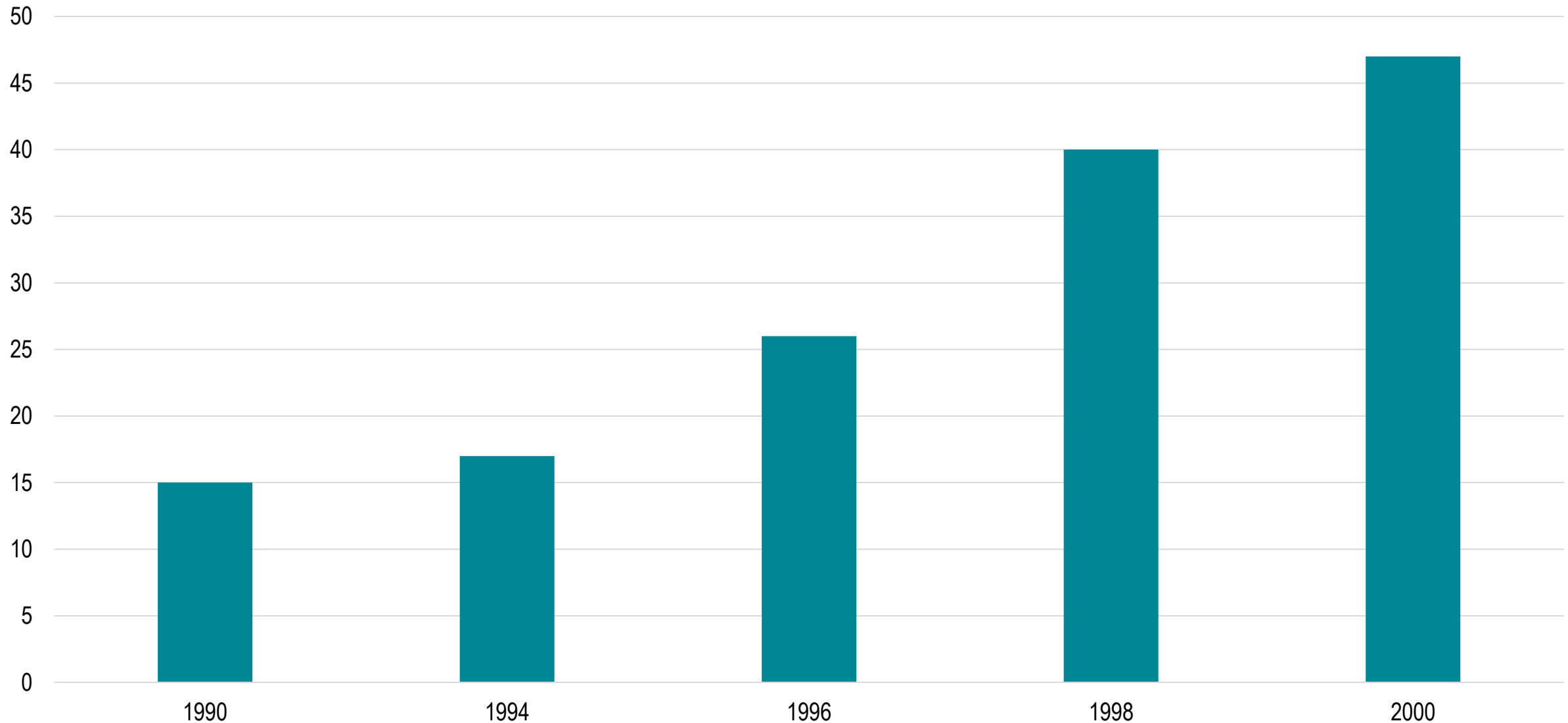
Purchasing Managers Index, 1990-2023



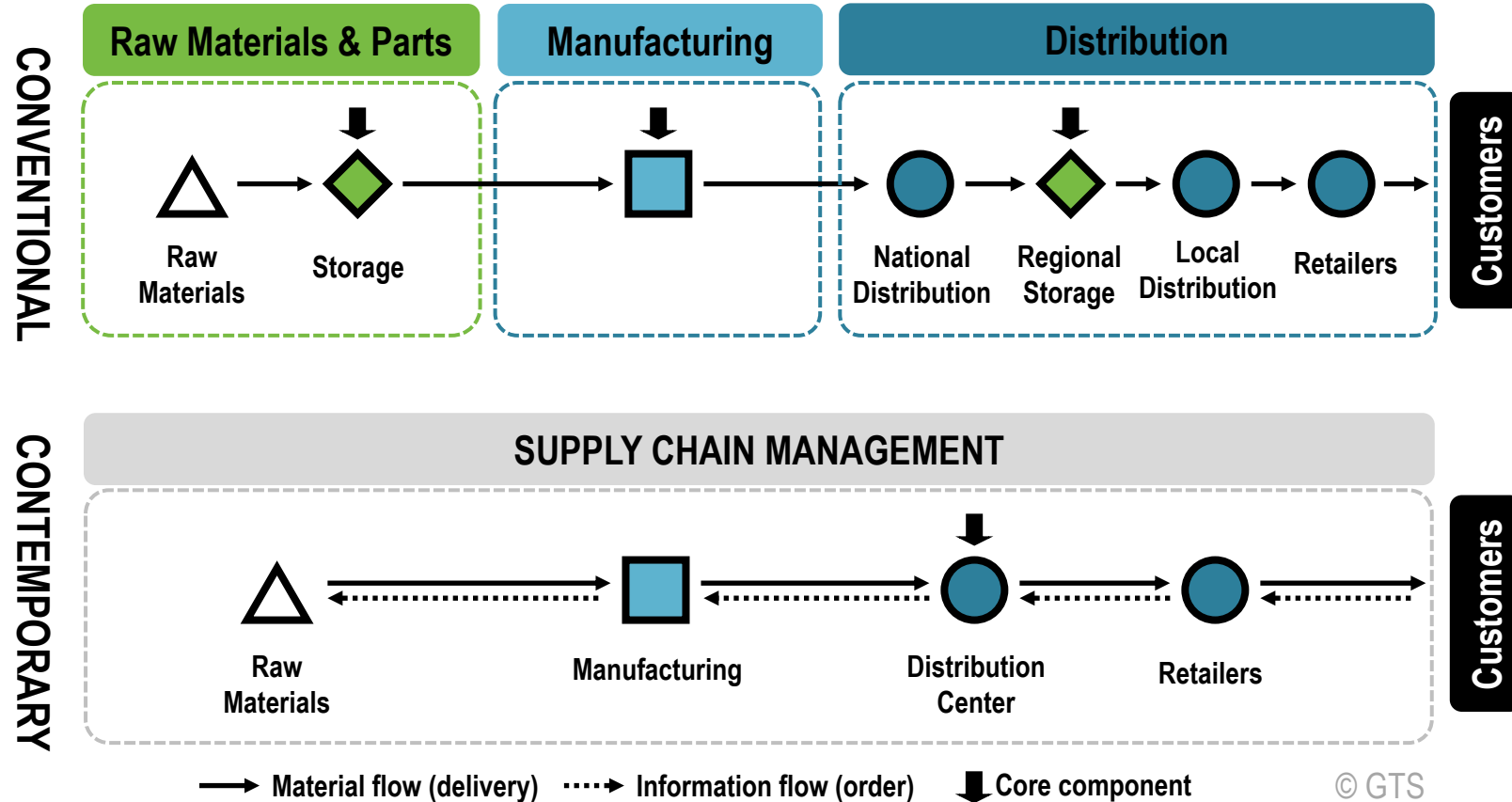
Logistics Costs as % of GDP



% of Products Shipped for “Just-in-Time” Manufacturing



Conventional and Contemporary Arrangement of Freight Flows



Logistical Activities Related to Containerization

Container Management



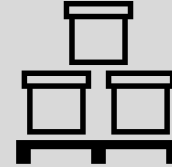
- Broking/Leasing.
- Inventory management.
- Transport routing.
- Container tracking.

Container Transportation



- Maritime shipping (Routing, Scheduling).
- Terminal operations (Transshipment, Storage/Stacking, Gate access).
- Inland transportation (Rail operations, Drayage, Repositioning).

Cargo Handling



- Loading (Packing, Palletizing and Bundling).
- Transloading (Re-bundling).
- Unloading (Unbundling, de-palletizing and Unpacking).

Container Maintenance



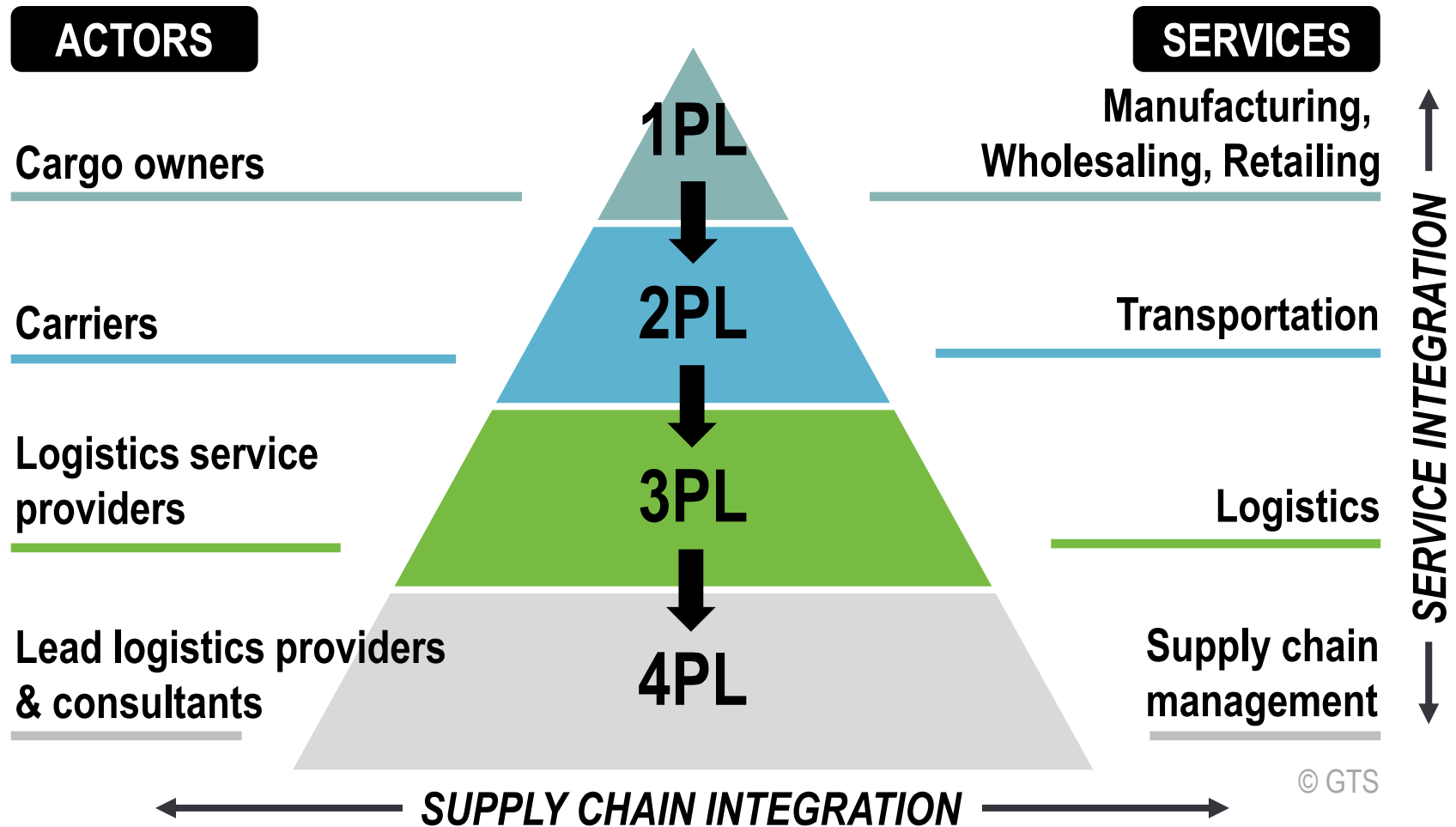
- Empty stacking.
- Inspection.
- Cleaning & Repair.

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Main Actors of the Logistics Chain



Layers to Logistics Services



[FIGURE 1] MAJOR ACQUISITIONS BY LARGE THIRD-PARTY LOGISTICS COMPANIES (3PLS), 2014–2015

Acquiring Company	Acquisition	Core Business	Estimated Acquisition Cost (US \$)	Announcement Date
DSV	UTi Worldwide	Non-asset-based international logistics, freight forwarding, and customs brokerage	\$1.35 billion	October 9, 2015
XPO Logistics	Con-way	Less-than-truckload (LTL), truckload (TL), and 3PL services	\$3.0 billion	September 9, 2015*
Geodis SA (Owned by French railway SNCF)	OHL (owned by private equity firm)	Value-added warehousing	\$800 million	August 17, 2015**
UPS	Coyote Logistics	Non-asset-based truckload (TL) carrier and freight brokerage	\$1.8 billion	July 31, 2015***
XPO Logistics	Norbert Dentressangle (France)	Contract logistics, global freight forwarding, brokerage, and transportation management	\$3.53 billion	April 28, 2015
Federal Express	TNT Express (Netherlands)	European package delivery	\$4.8 billion	April 7, 2015
Penske	Transfreight	Automotive 3PL services	Private transaction; no terms announced	March 23, 2015
Kintetsu World Express (Japan)	APL Logistics (Singapore)	Global logistics services/ ocean focus	\$1.2 billion	February 17, 2015
Norbert Dentressangle (France)	Jacobson Companies (owned by private equity)	Value-added warehousing	\$750 million	July 31, 2014****
Federal Express	Genco	Product lifecycle management and reverse logistics	\$1.4 billion	April 1, 2014
XPO Logistics	Pacer International	Intermodal services, including U.S.-Mexico	\$335 million	January 6, 2014

*Acquisition involves Con-way Freight, Menlo Logistics, Con-way Truckload, and Con-way Multimodal. All will be rebranded as XPO Logistics.
**The company is being sold by the private equity company, Welch, Carson, Anderson & Stowe and Hyde Park Holdings, LLC.
***The company is being sold by the private equity firm Warburg Pincus.
**** The company was sold by Oak Hill Capital Partners.

[SOURCE: COMPANY AND NEWS REPORTS]
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Key Drivers for Third- and Fourth-Party Logistics Providers

GLOBALIZATION



Supply chains and manufacturing increasingly global, requiring greater management of supply chains.

INNOVATION & MANAGEMENT



3PLs becoming increasingly sophisticated in supply chain management, making investments, realizing economies of scale.

CORE COMPETENCIES



Manufacturers and retailers are focusing on their core business and outsourcing logistics services to specialized firms.

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ASSET UTILIZATION



3PL model promotes greater asset utilization (e.g. balancing flows, backhaul, within their networks) and asset-sharing alliances.

Main Core Competencies of Third-Party Logistics Providers



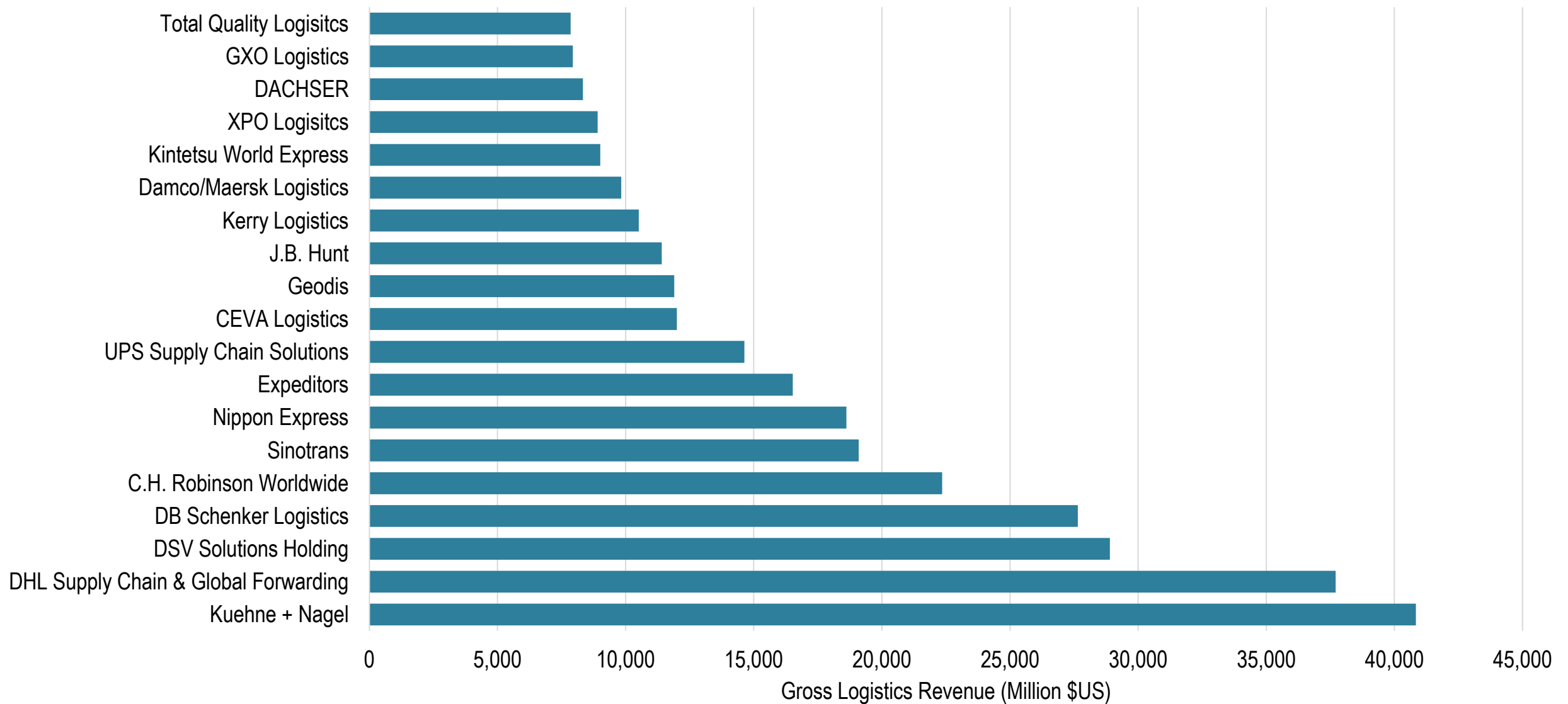
Services Offered by Third and Fourth Party Logistics Service Providers

3PL ►

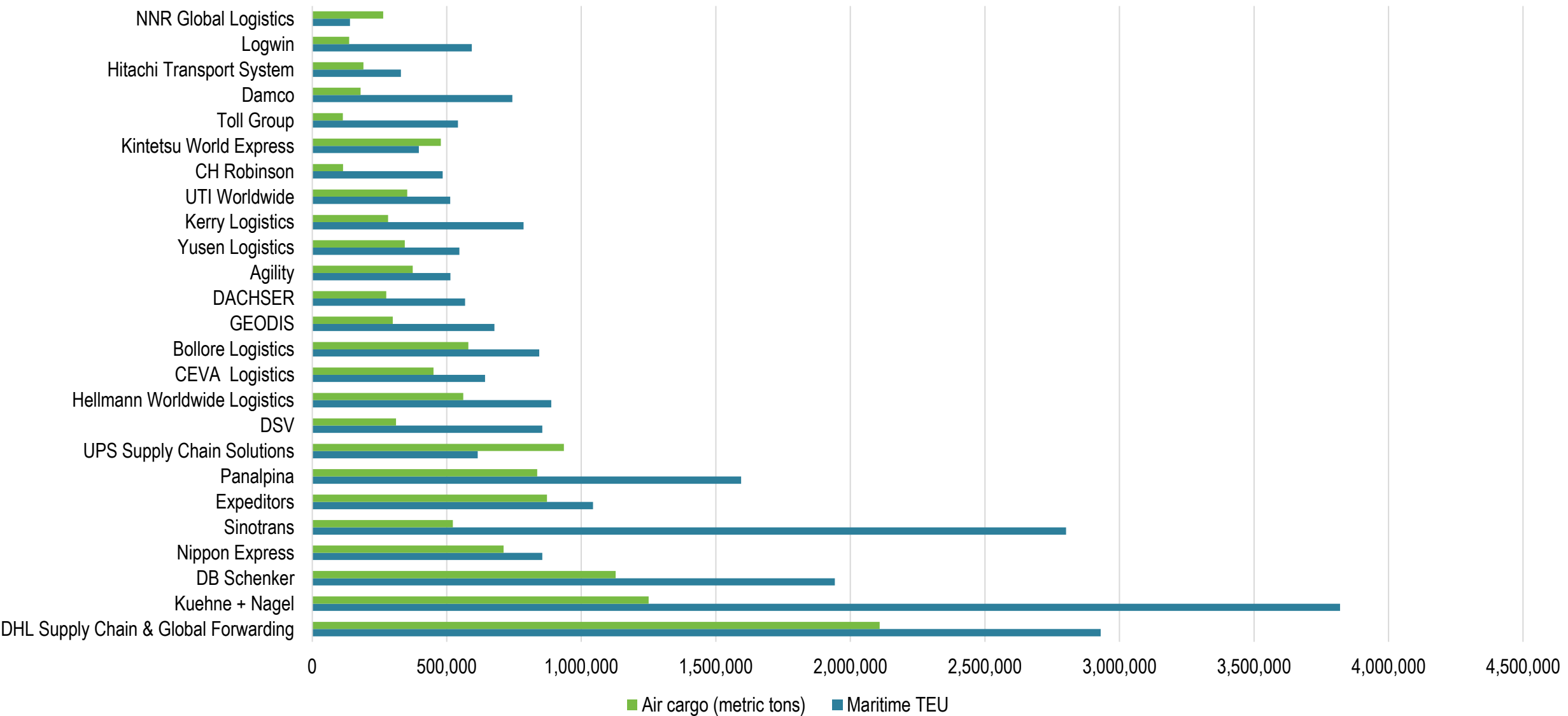
◀ 4PL

Standard	Advanced	Complete	Integrated
Transportation services	Vendor managed inventories	Order planning and processing	Production planning
Carrier selection	Stock accounting	Information and	Global sourcing
Rate negotiation	Customs clearance and	Communications Technologies	Multiple routing options
Fleet management	documentation	(ICT) management	Supply chain consulting
Warehousing	Assembly	Single invoice	Real time supply chain
Cross docking	Packaging and labeling	Landed duty paid cost	monitoring and adjustment
Pick and Pack	Managing product returns	Payment collection	
Distribution (direct to	Financing	Real time inventory updates	
store/home)	Retail delivery, set up and on	Just in Time (JIT) inventory	
Dispatching	site training	management	
Delivery documentation	Inventory tracking		
Shipment consolidation			

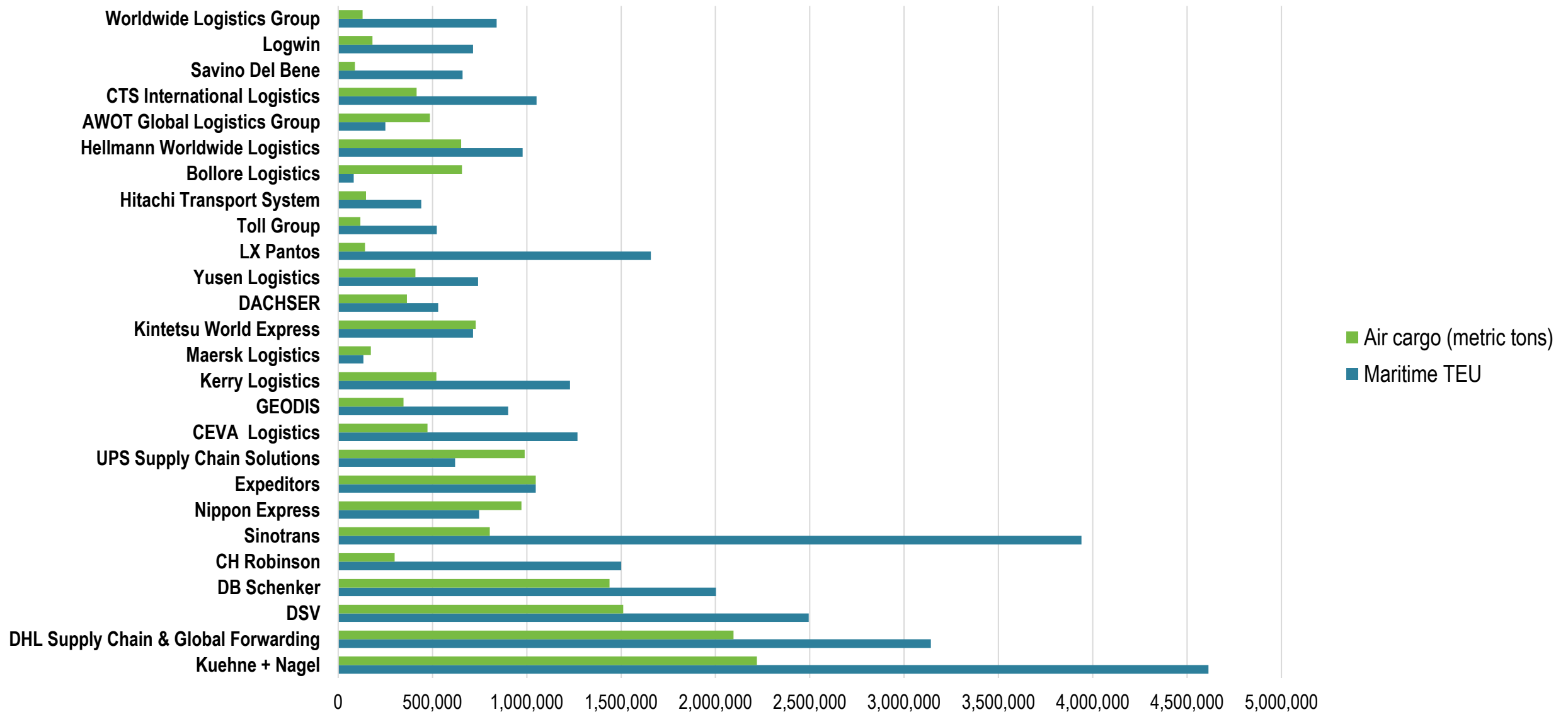
World's Largest Third-Party Logistics Providers, 2021



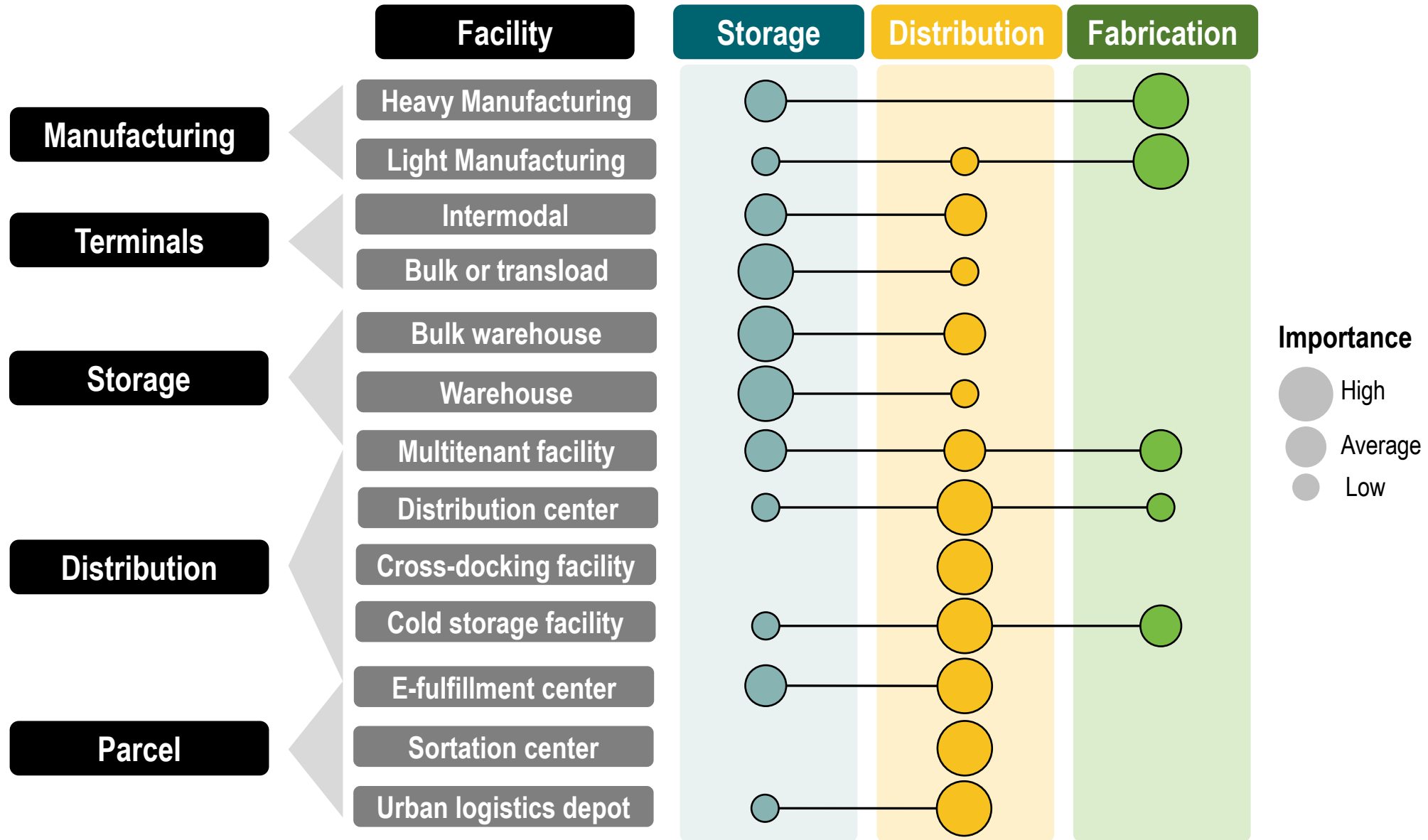
World's Largest Freight Forwarders, 2015



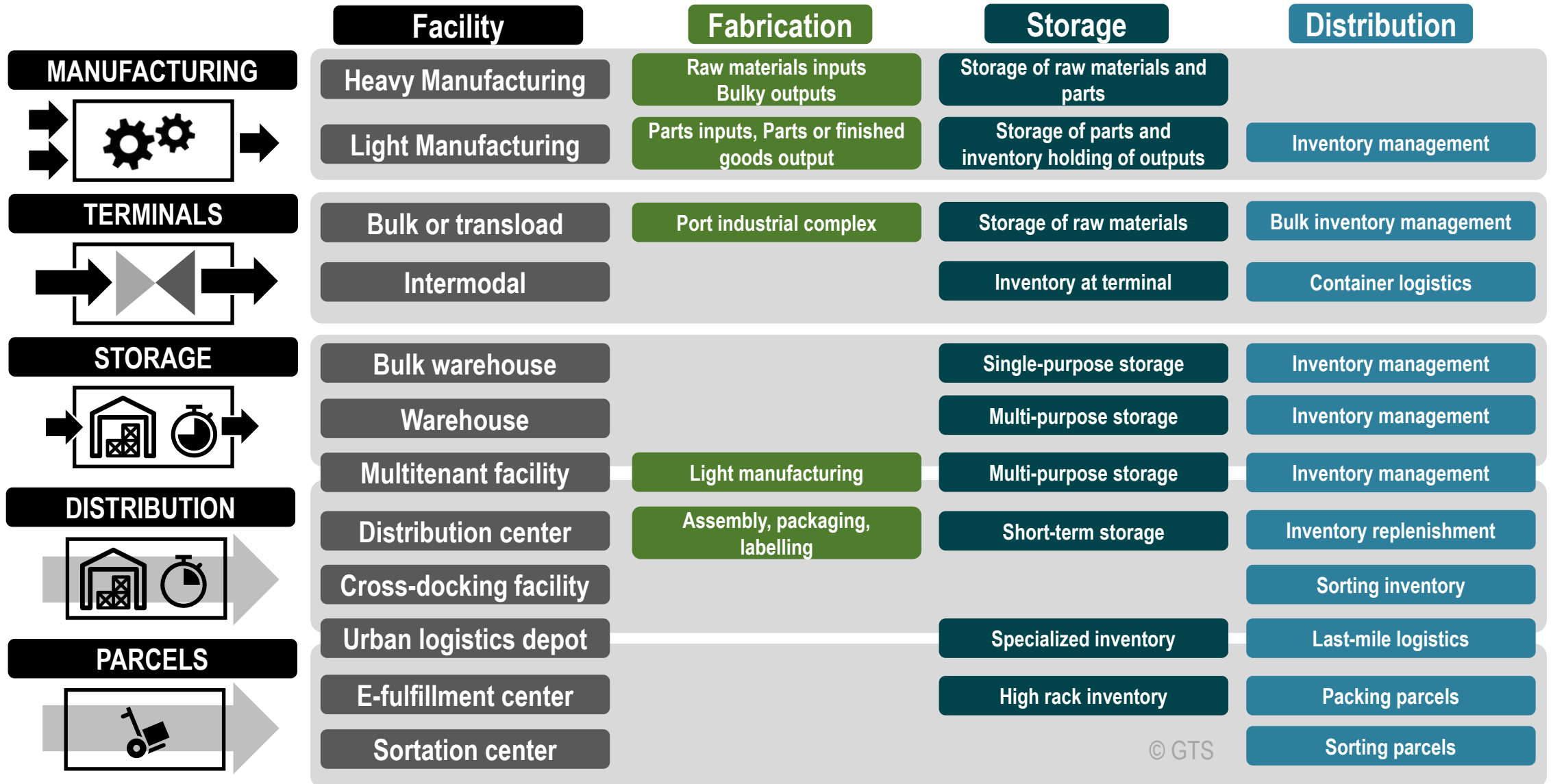
World's Largest Freight Forwarders, 2021



Types of Freight Facilities

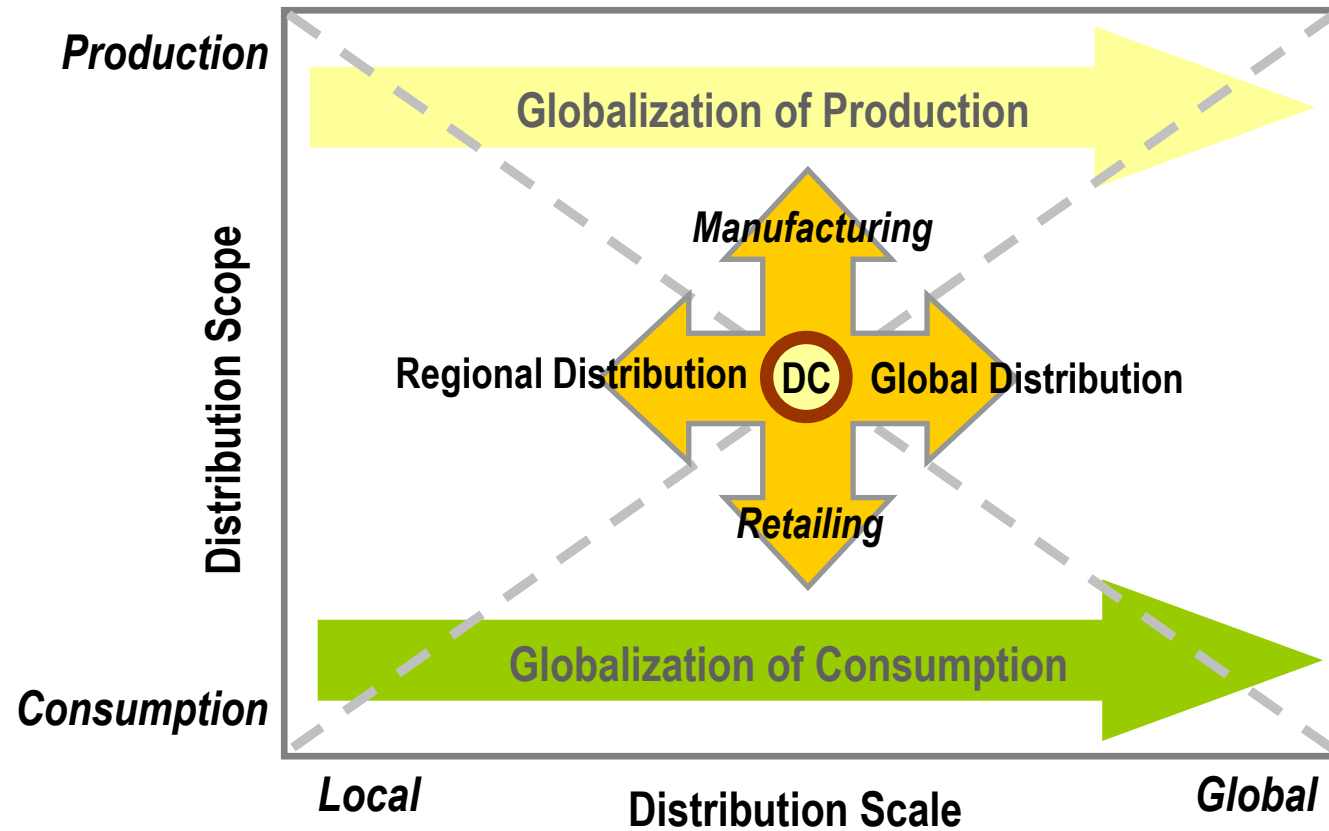


Types of Freight Facilities

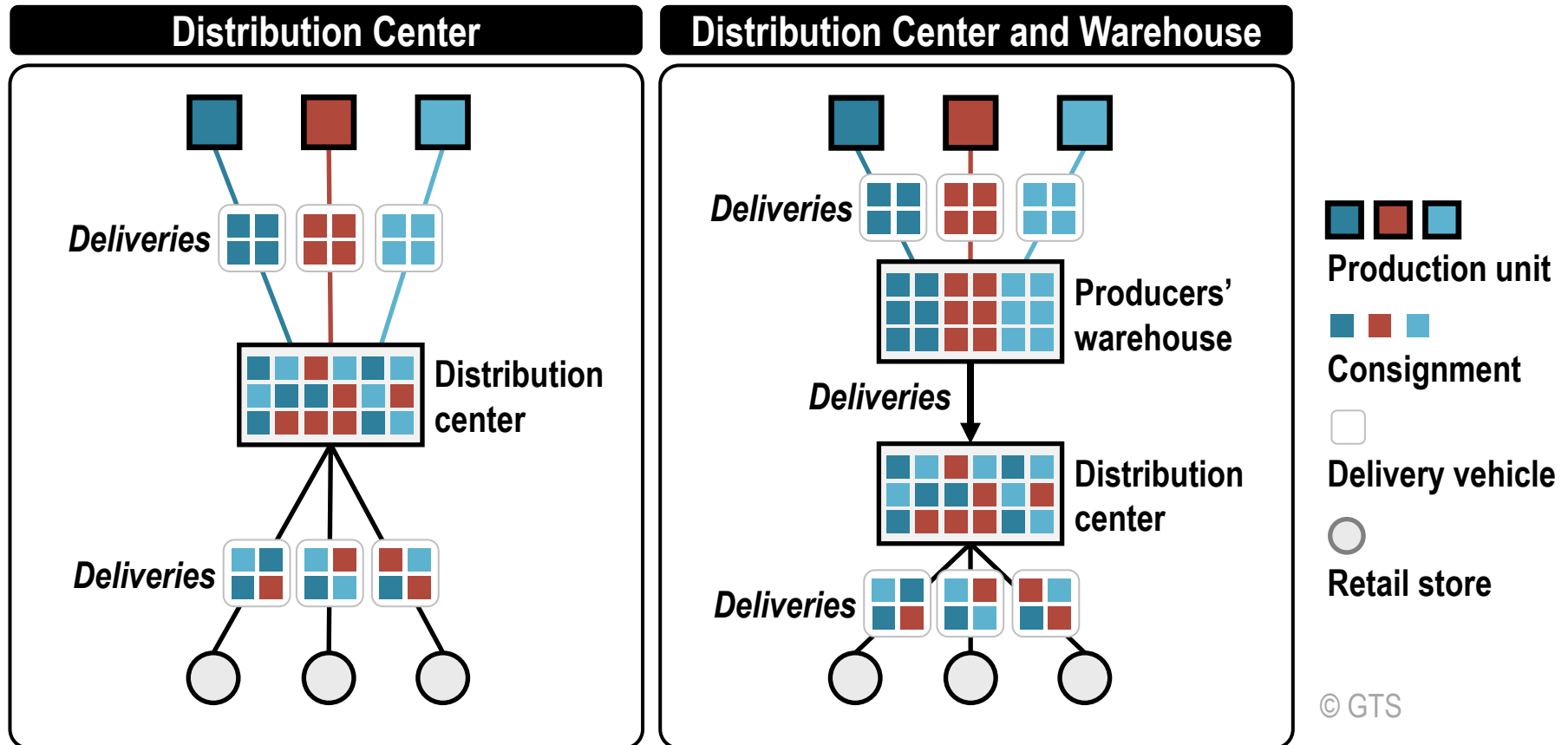


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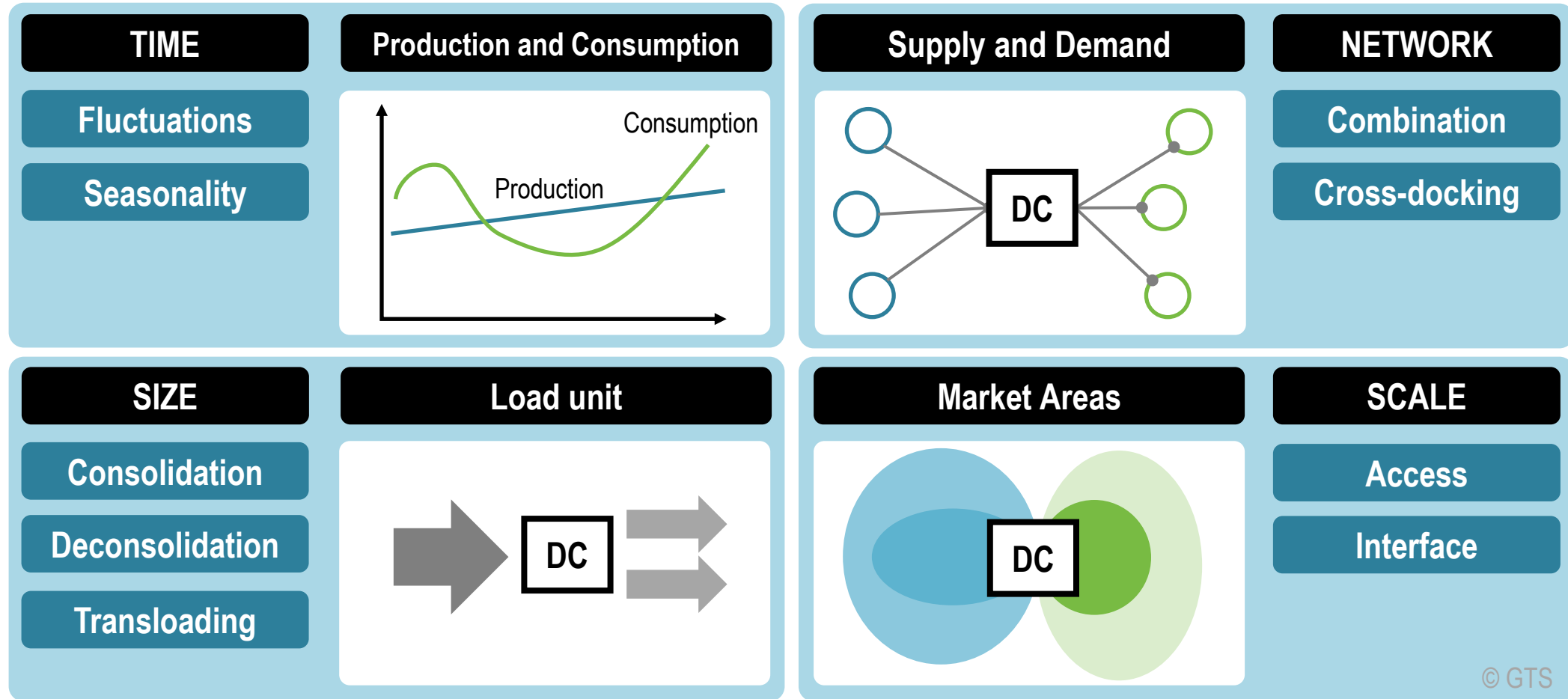
Nodes and Freight Distribution



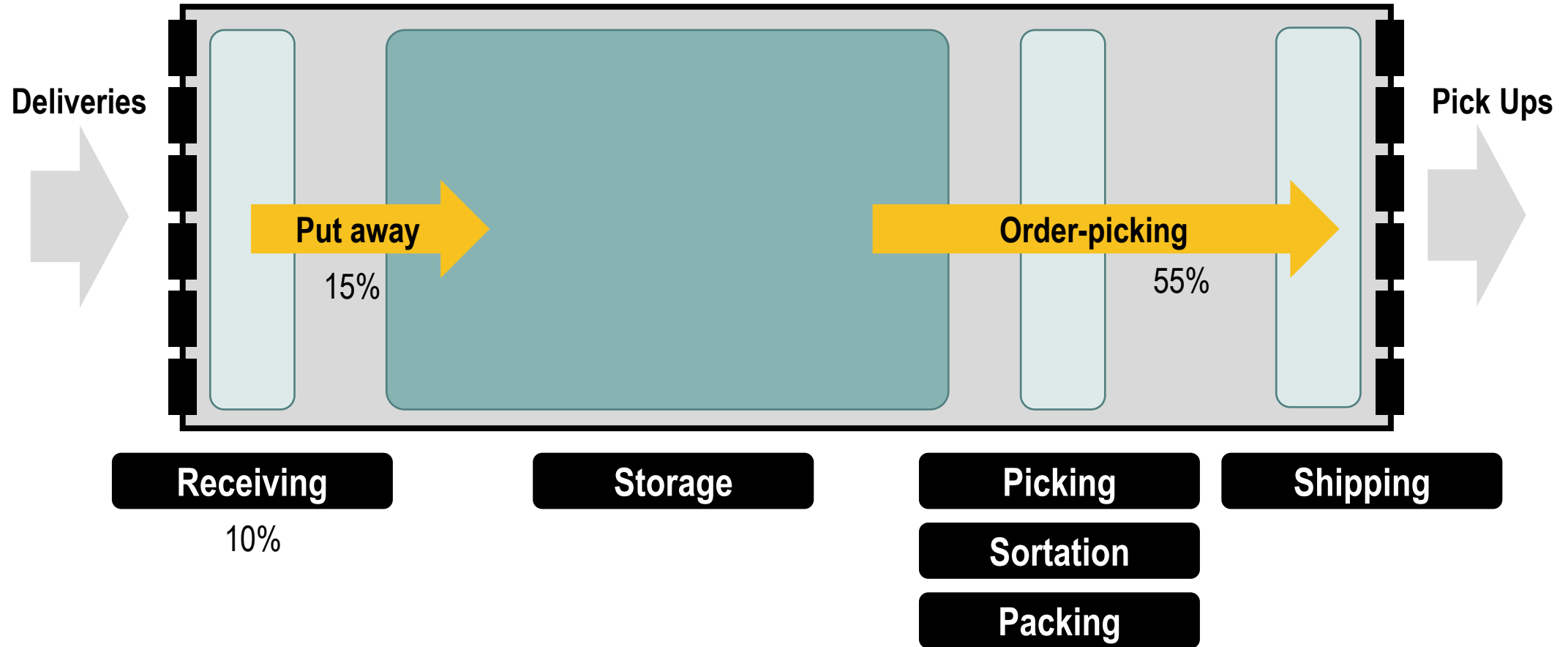
The Role of Distribution Centers and Warehouses



Asynchronism and Distribution Centers



Main Warehousing Operations



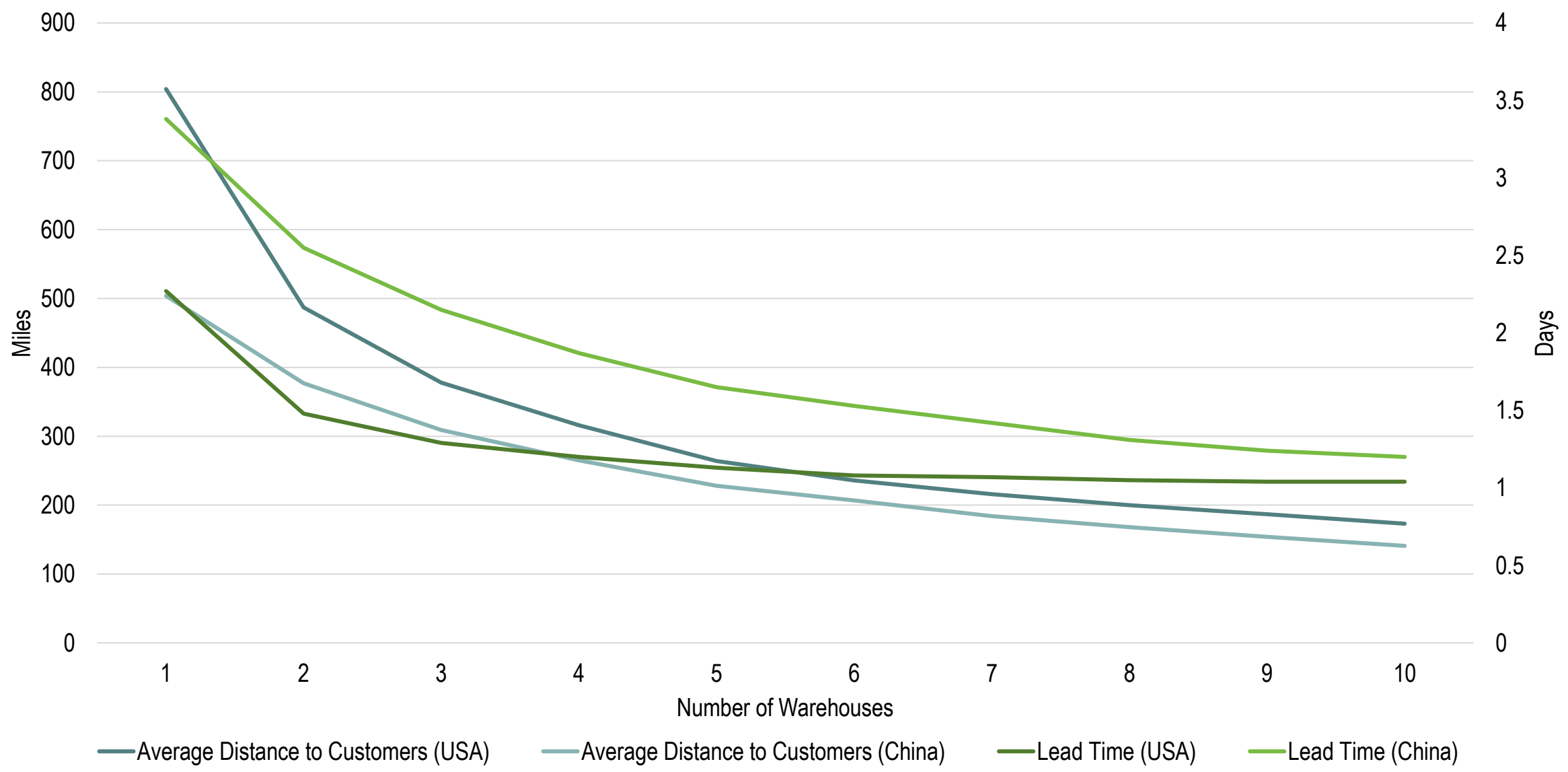
Location and Design Criteria for Distribution Centers

ATTRIBUTE	DRIVER	
Cost	Price sensitivity	Price per square foot; Operation costs (labor, utilities, taxes).
Footprint	Massification	Large surface; Parking space for trucks; Space for expansion.
Facility	Throughput	High clearance; Separate loading and unloading bays; Improved stacking density (from 20 to 80 feet); Potential for cross-docking.
Connectivity	Co-location	Continuous turnover (pick-up and deliveries often LTL); Access to corridors; Co-location with rail, air and port terminals.
Accessibility	Lead time	Market access; Shorter lead times; Less than 48 hours service window.
Technology	Automation	Sort inventory; Control movements from receiving docks to shipping docks; Management systems controlling transactions.

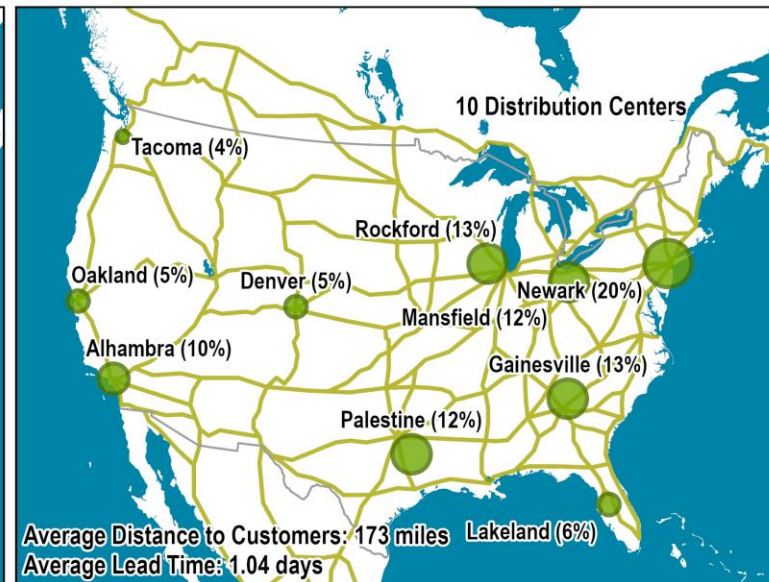
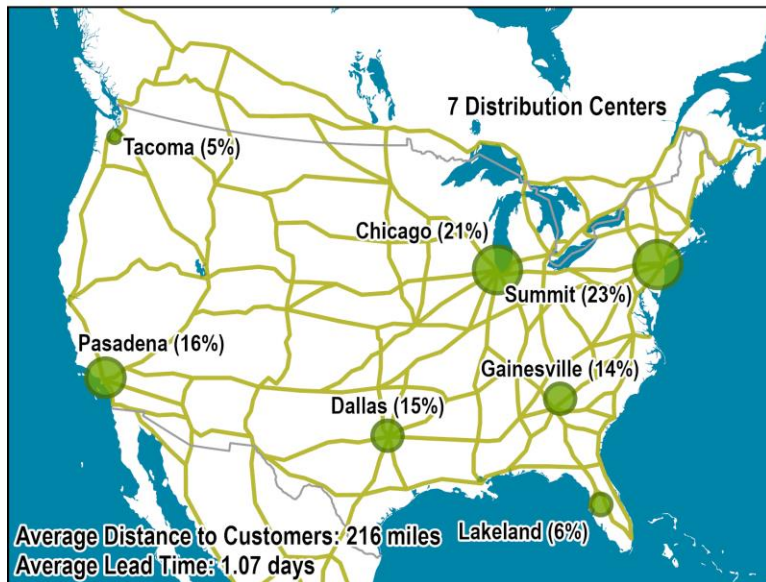
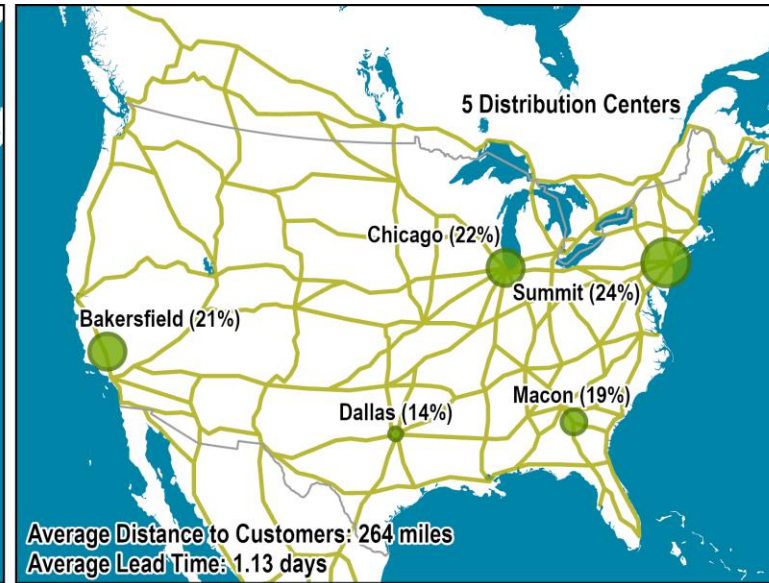
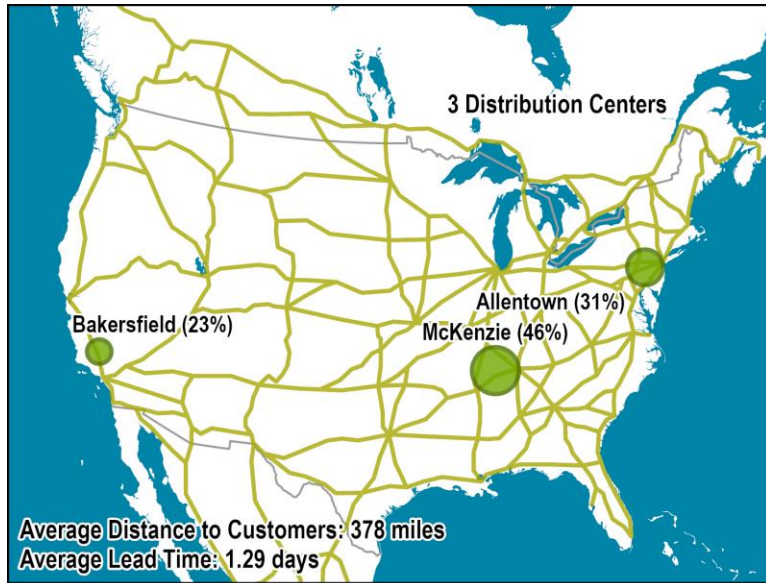
Typology Criteria of Agglomerations of Logistical Activities

Accessibility	
Internal Structure	
Function	
Governance	

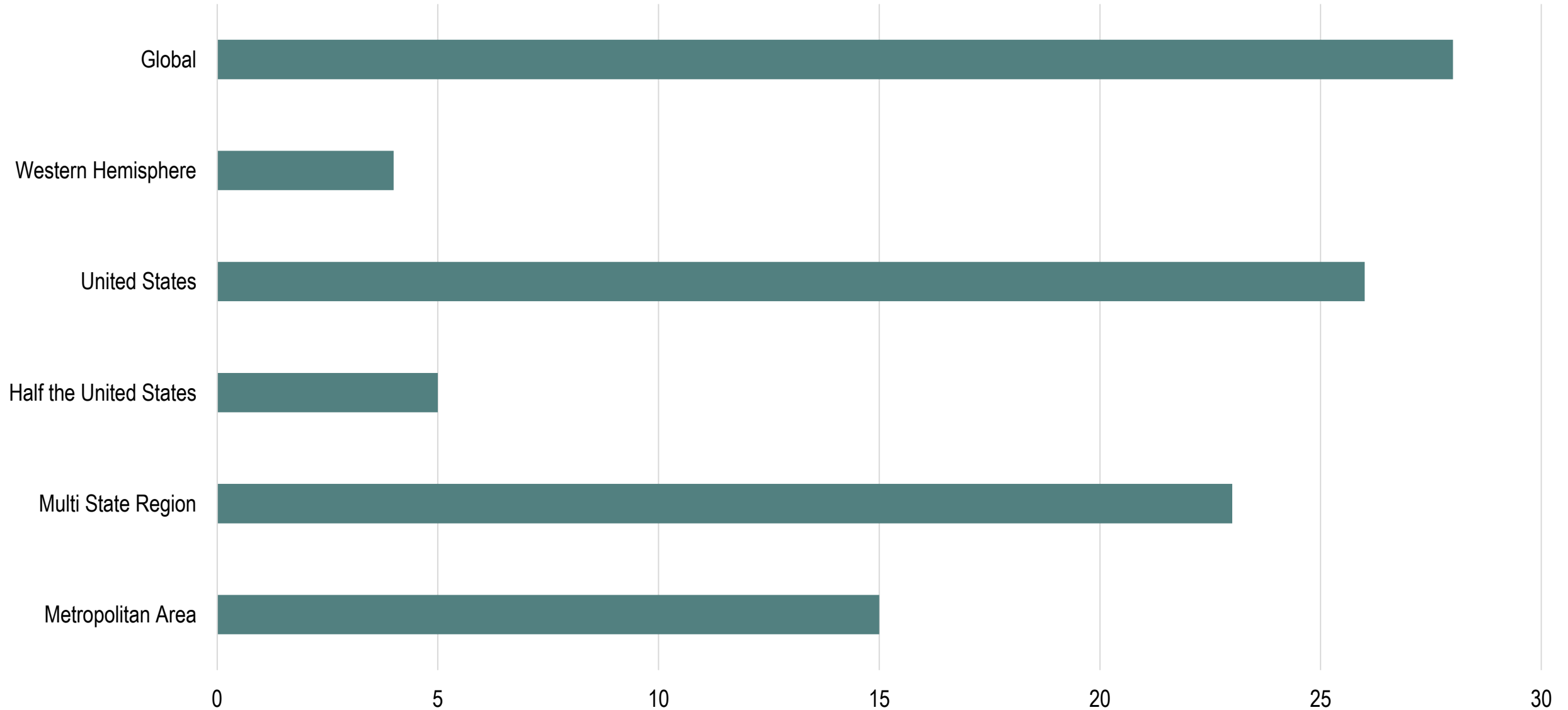
Basic Operational Characteristics by Number of Warehouses, United States and China, 2009



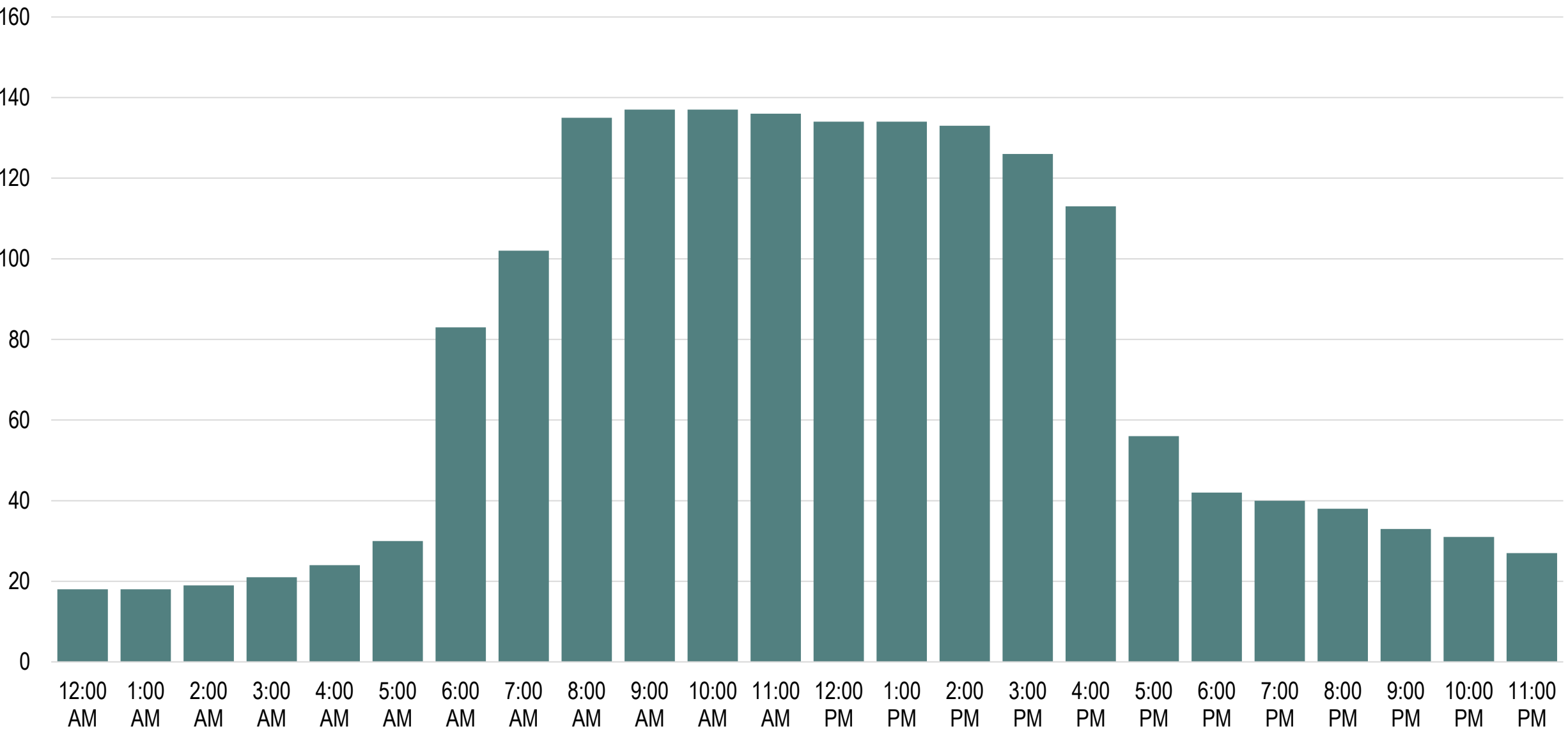
Optimal Location and Throughput by Number of Freight Distribution Centers



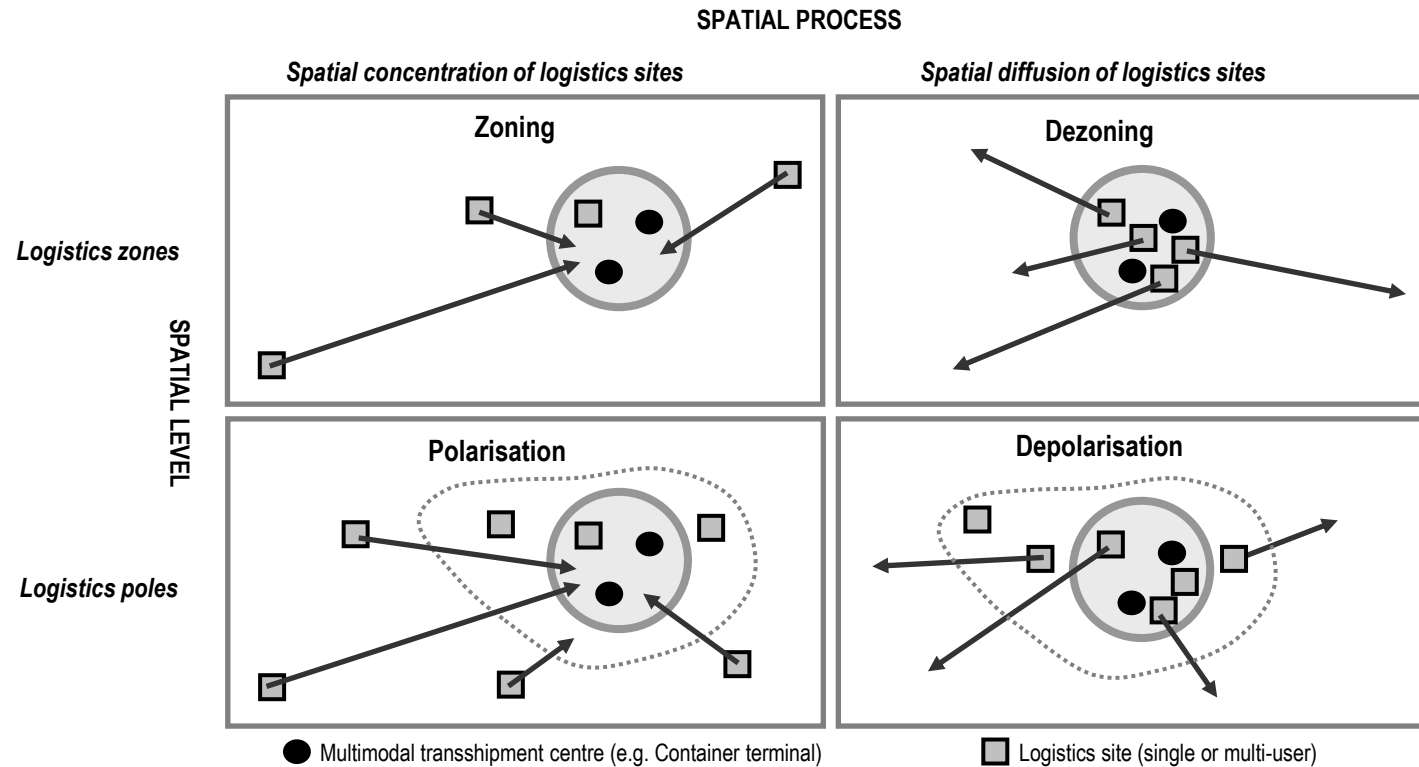
Market Area of Distribution Centers Located in the United States, 2012



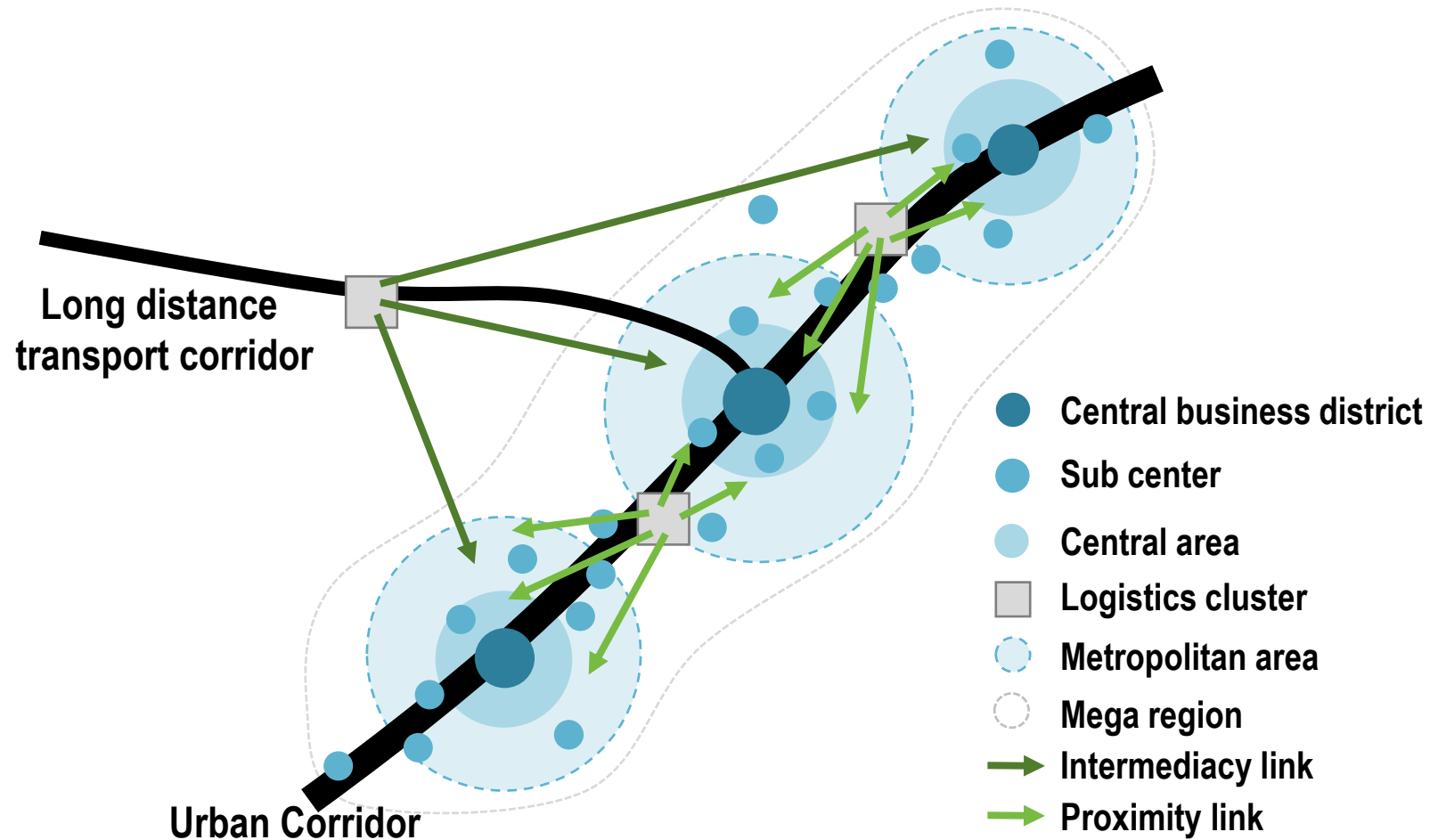
Operating Hours of Distribution Centers



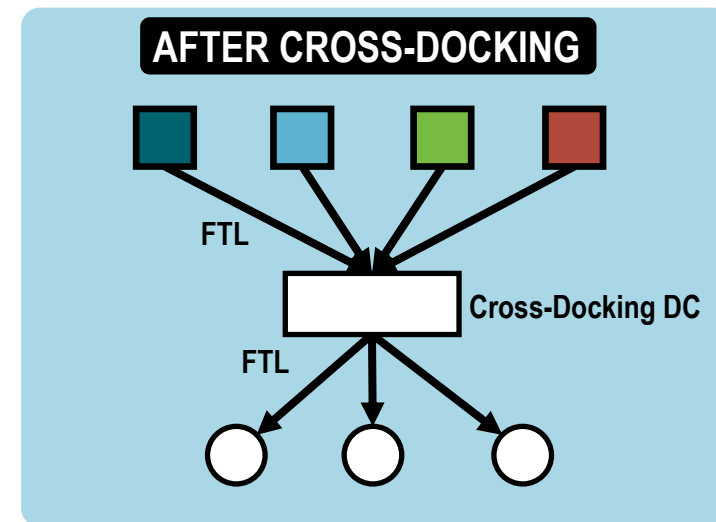
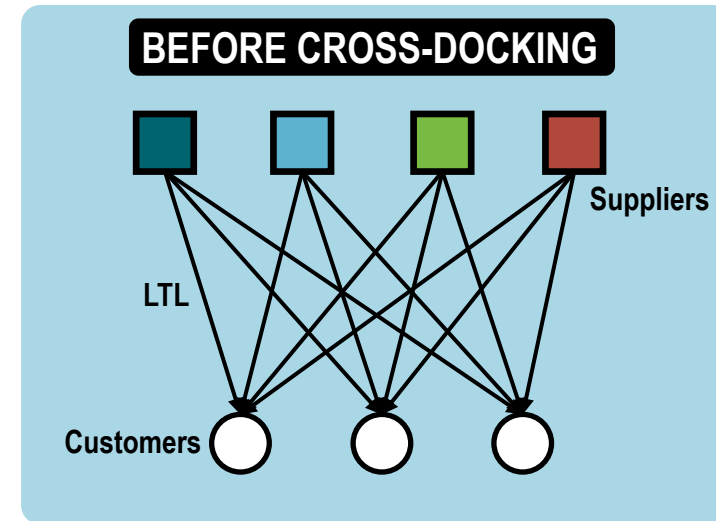
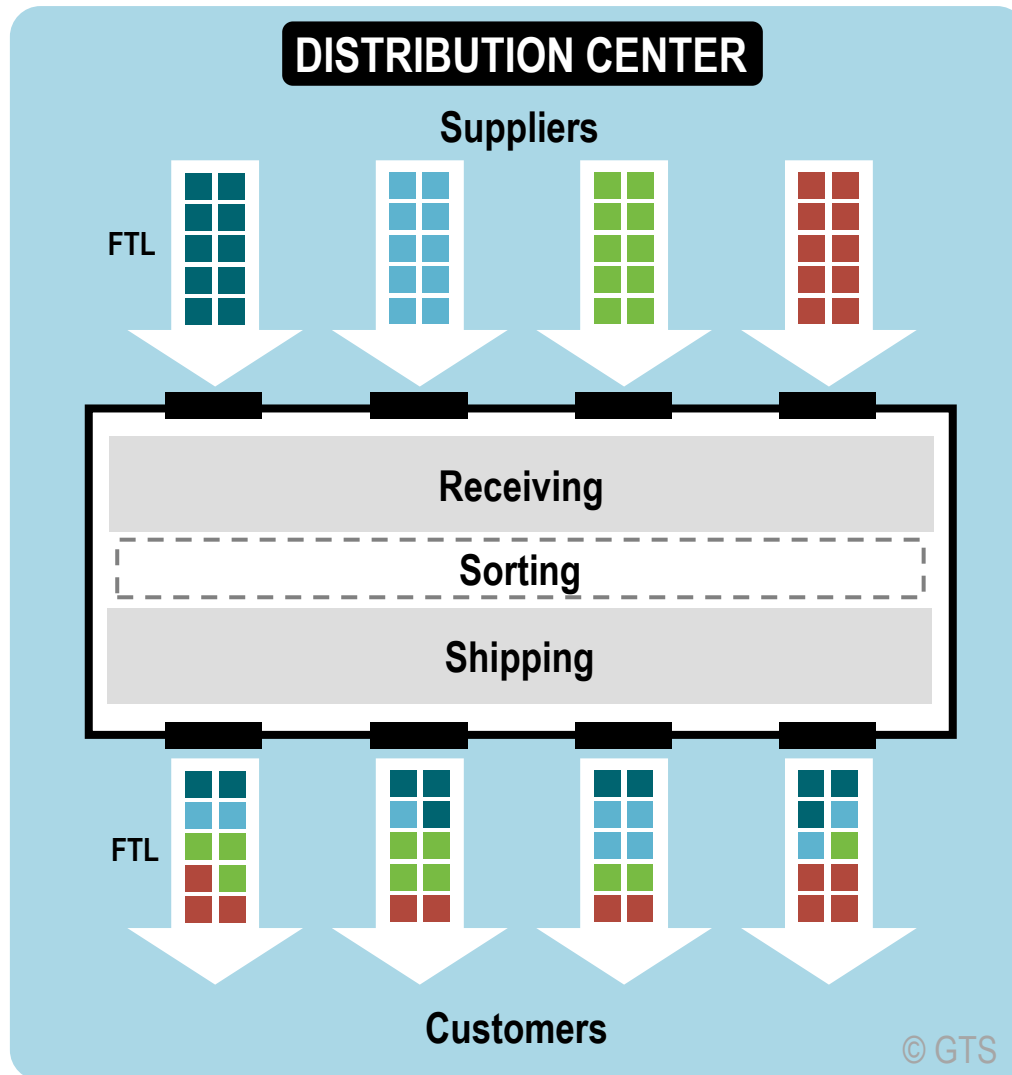
A Typology of Spatial Dynamics in the Location of Logistics Sites



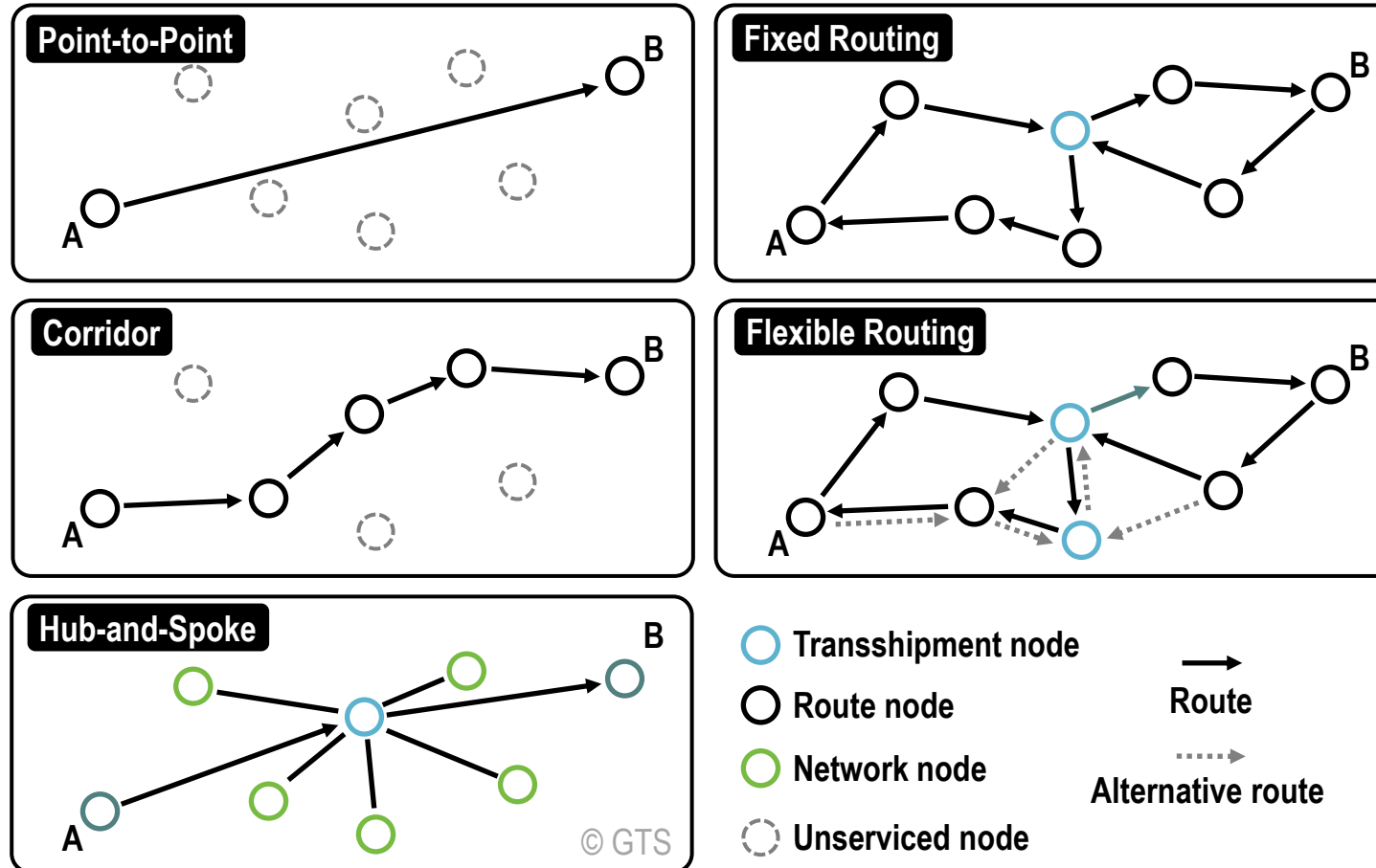
Proximity and Intermediacy for Distribution Clusters



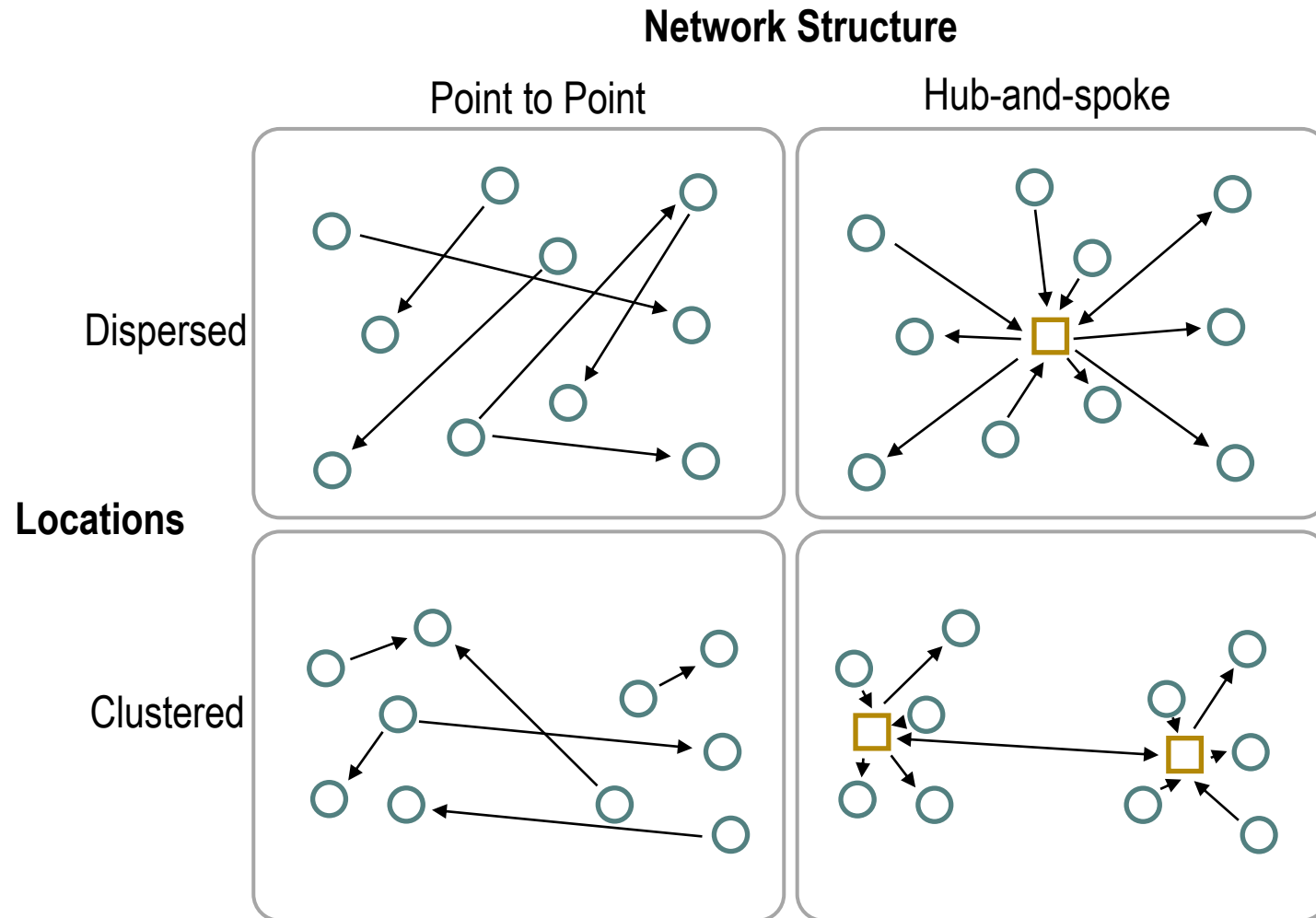
Cross-Docking Distribution Center



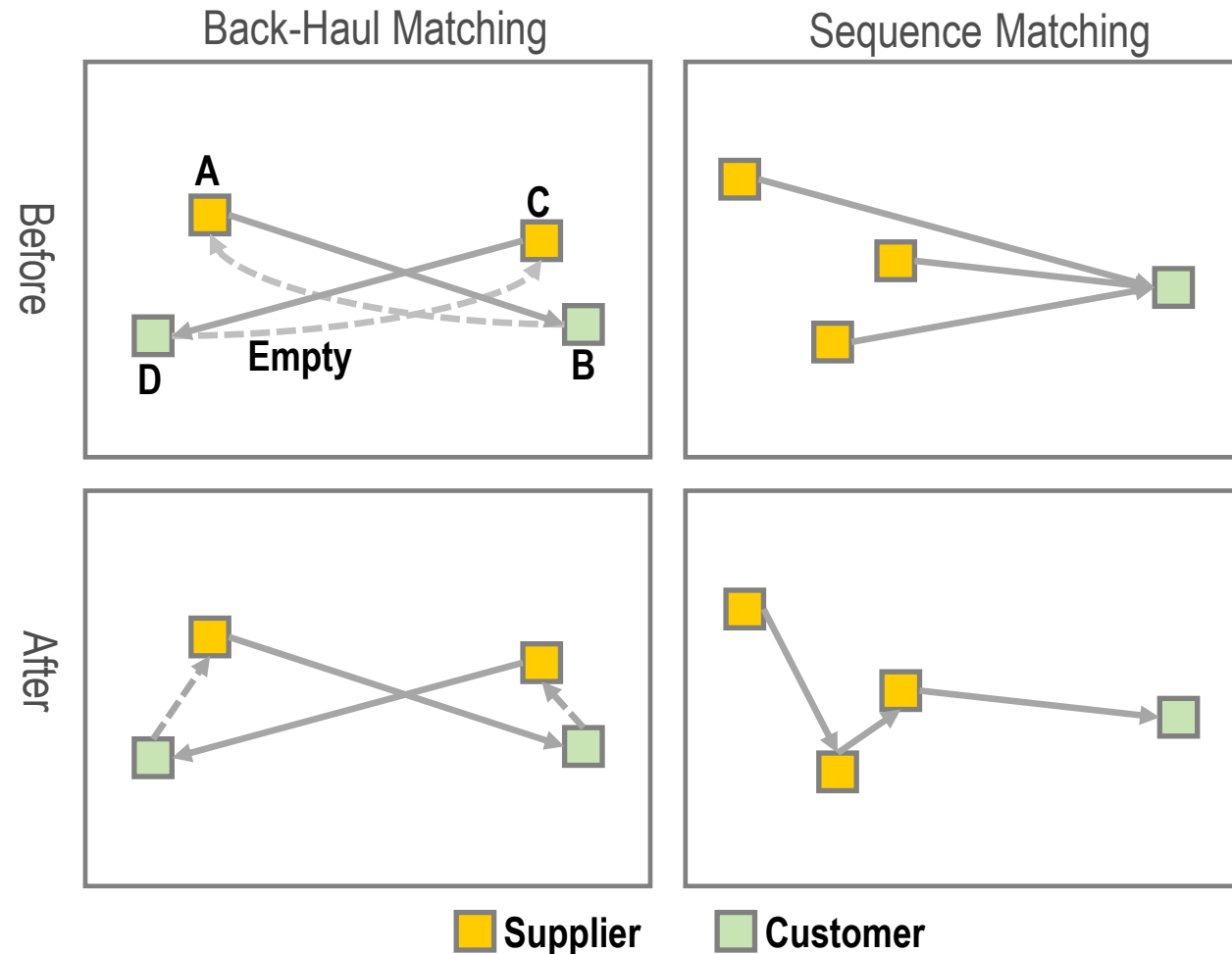
Freight Distribution and Network Strategies



Logistics Networks



Collaborative Distribution



Logistical Strategies to Cope with Higher Transport Costs

Shipping less

Demand responsive systems.

Reduce returns.

Shipping timing

Allow longer shipping time and outside rush (high cost) periods.

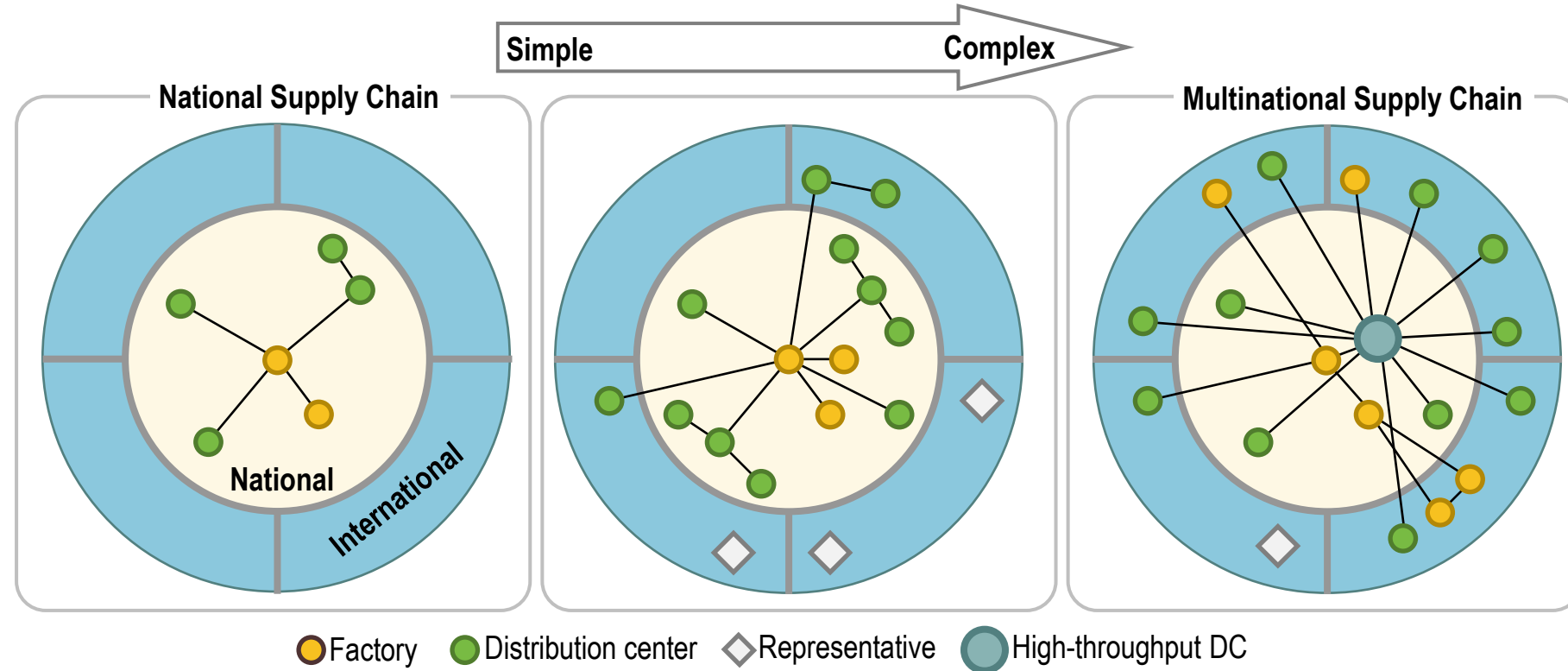
Efficient packaging

Reduce the shipment size (volume) of the same load.

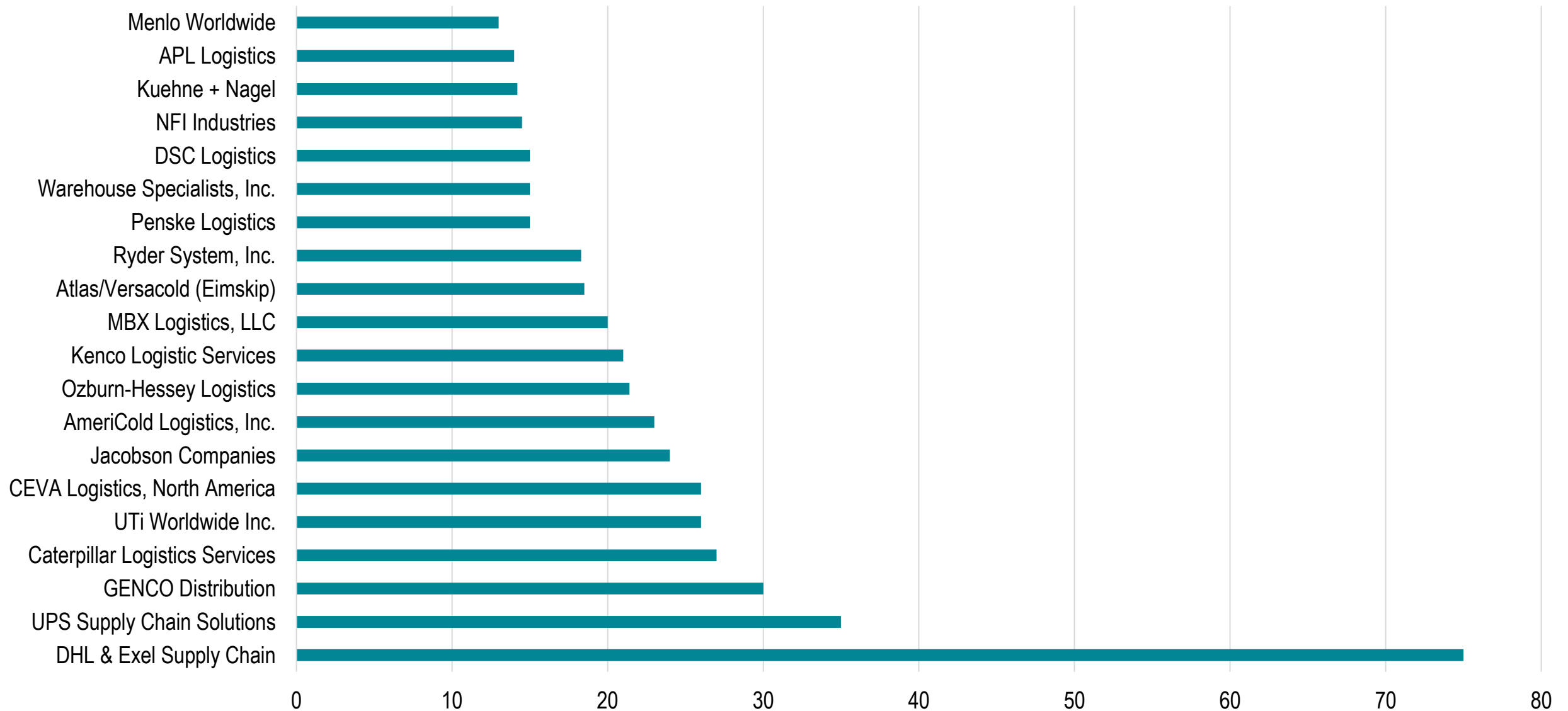
Modal shift

Use a mode that is less impacted by congestion.

Complexity of the Supply Chain



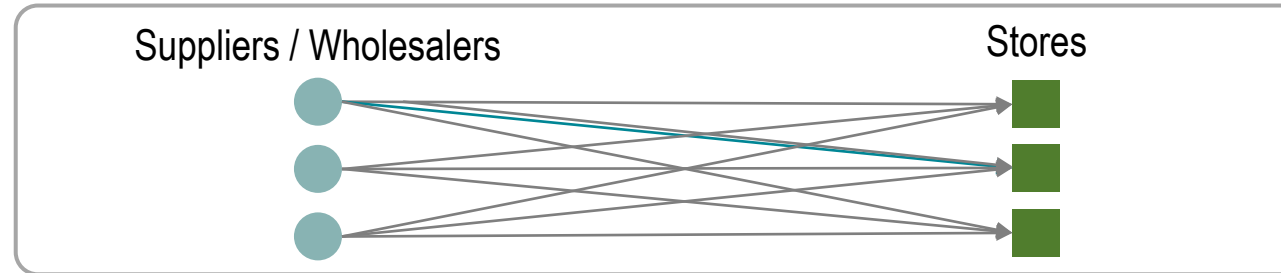
20 Largest North American Warehouse Operators, 2007



The Evolution of Retail Logistics

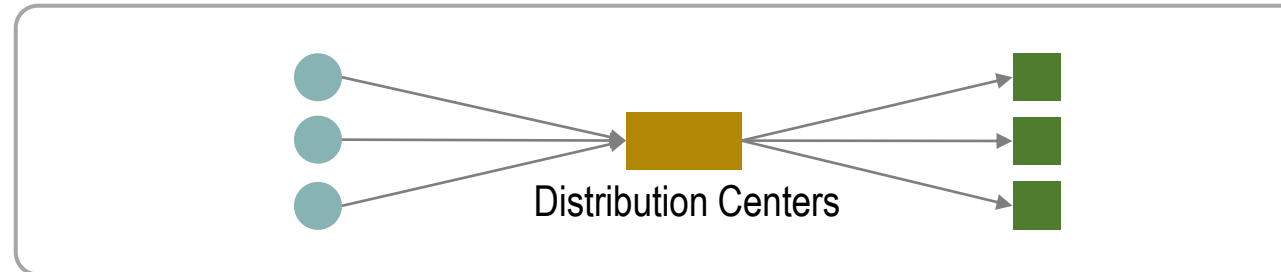
1970s

Direct
replenishment



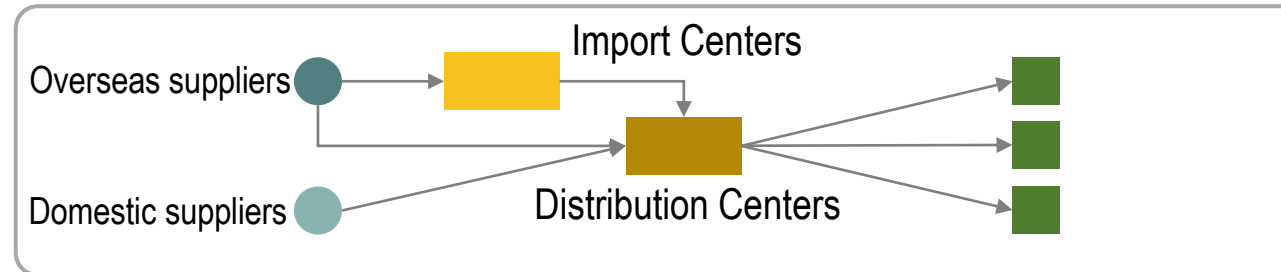
1980s

Rationalization



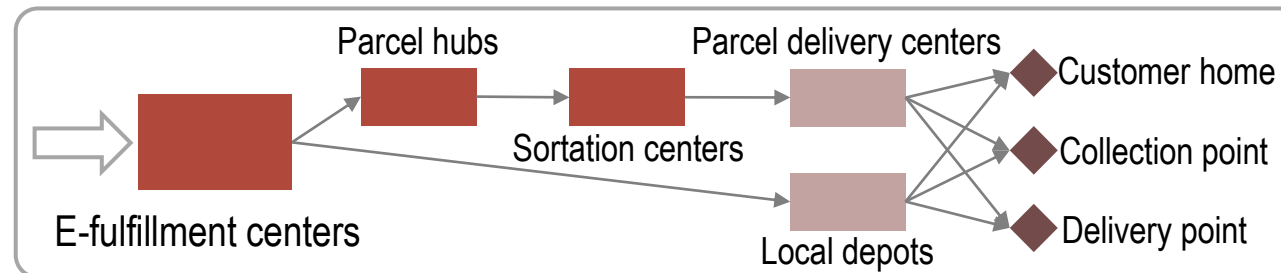
1990s

Global sourcing

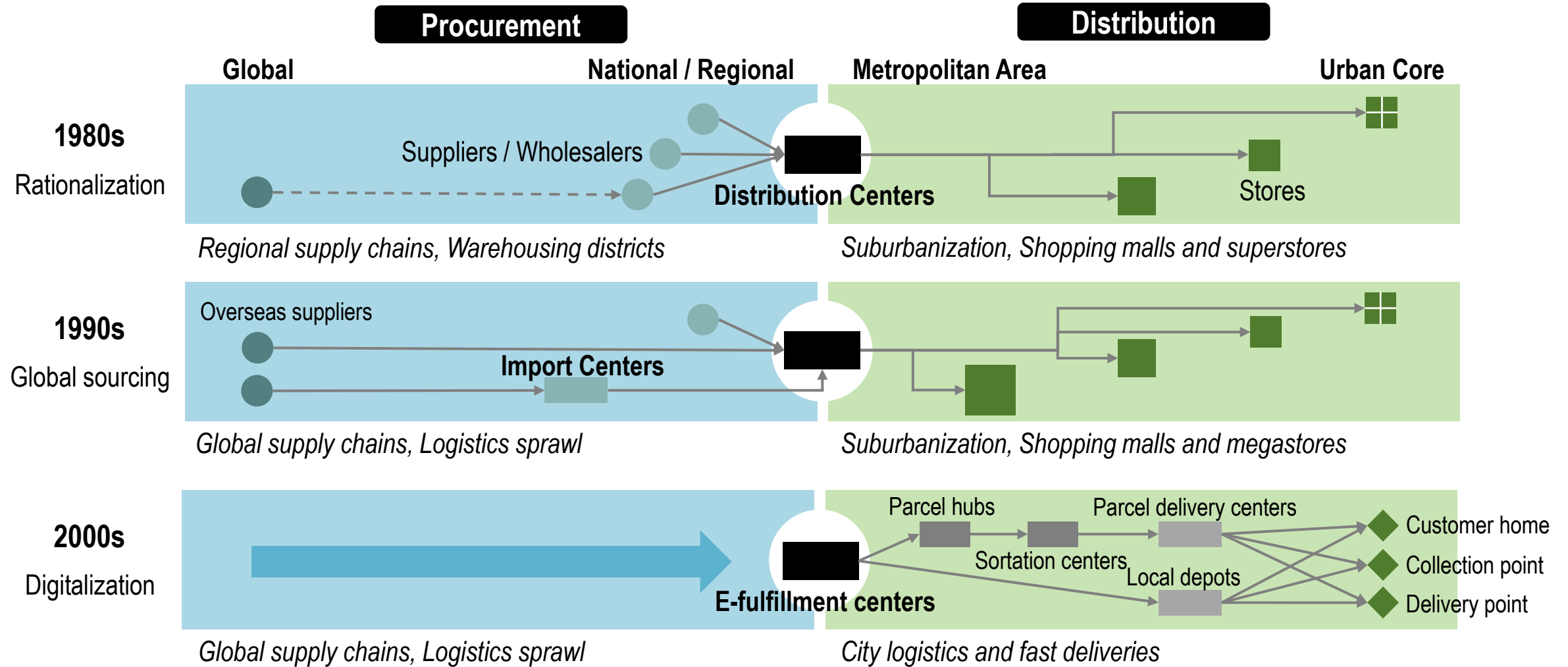


2000s

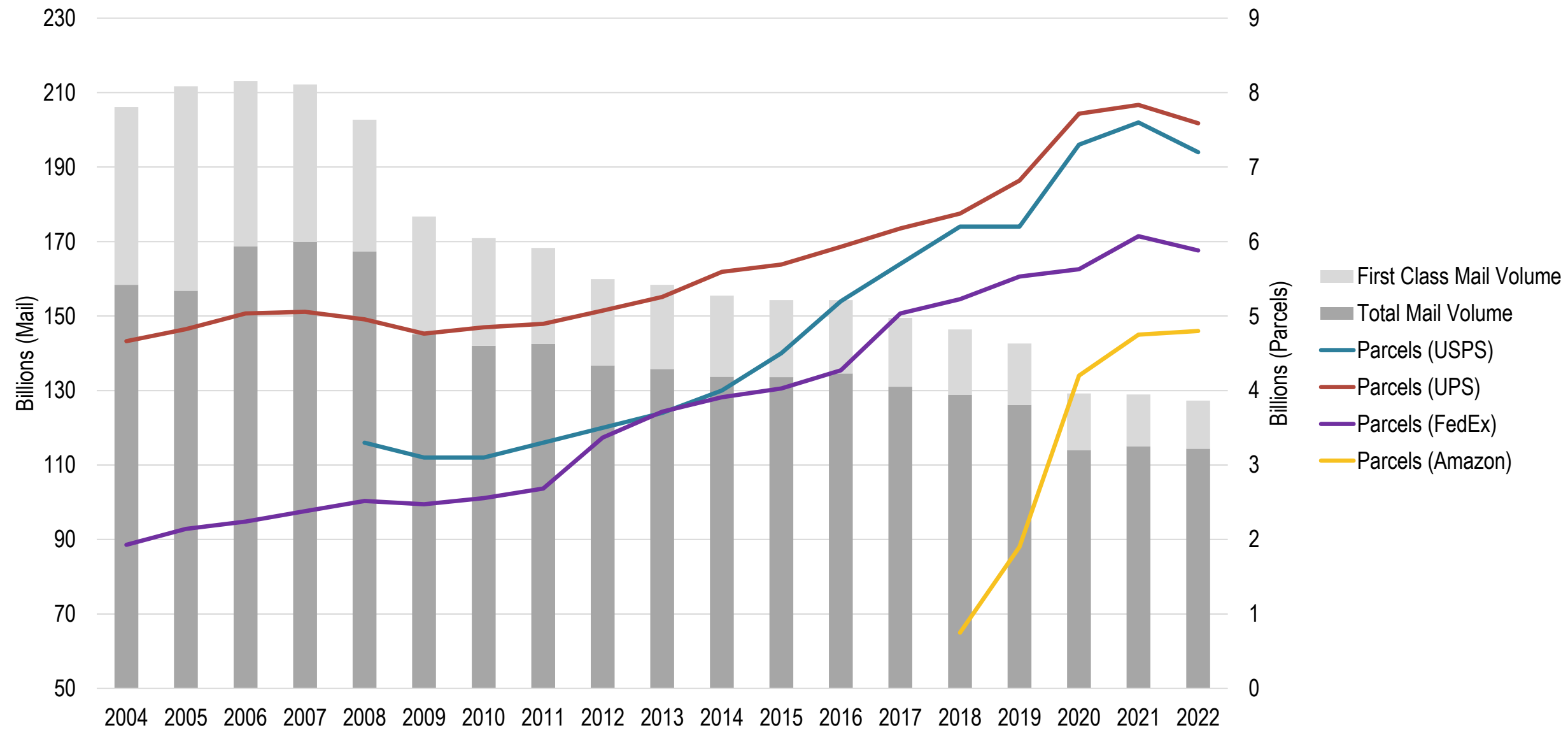
Digitalization



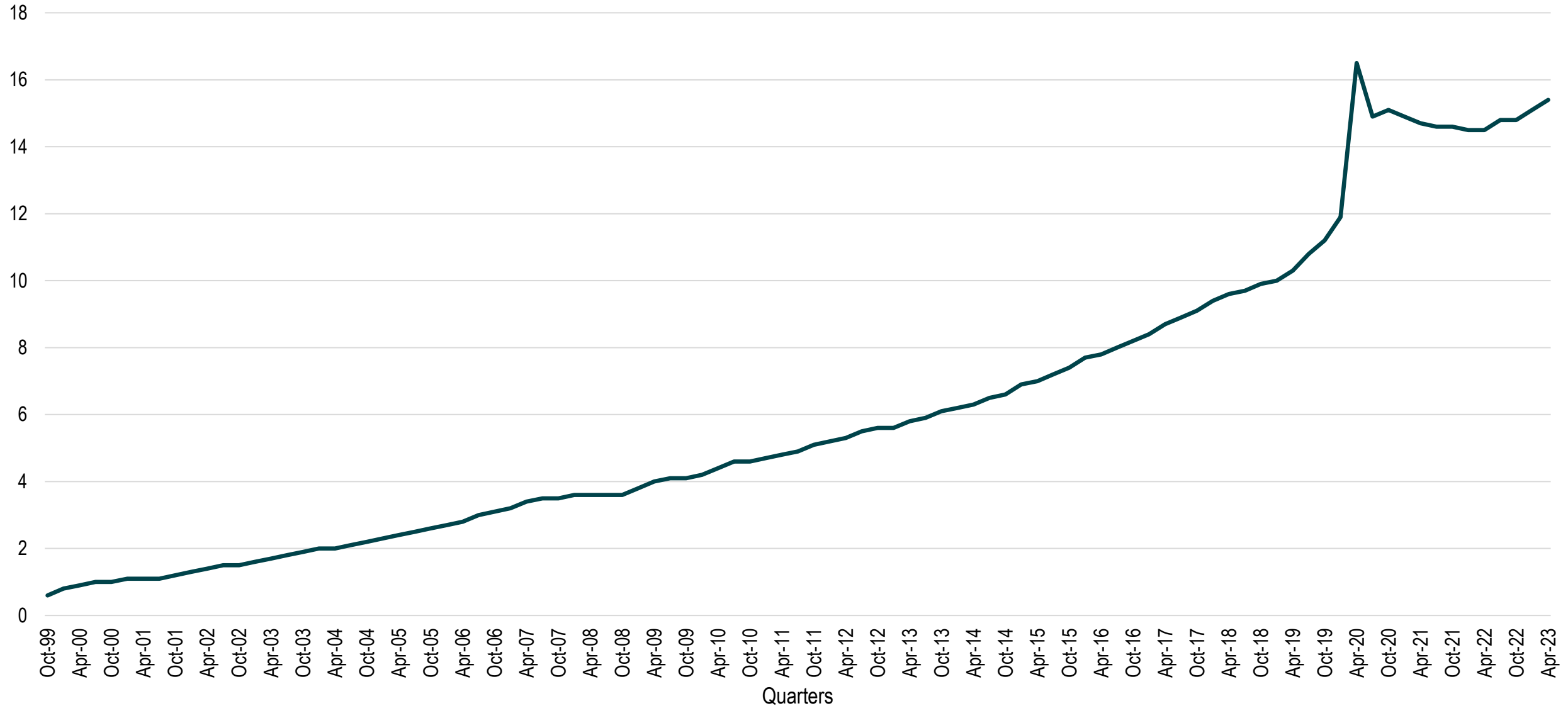
The Evolution of Retail Logistics



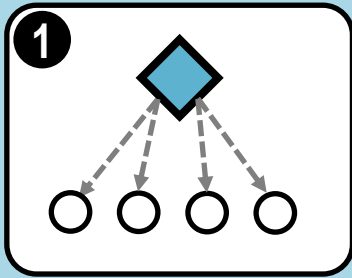
Mail Carried by USPS and Parcels Carried by Major Carriers, United States, 2004-2022



E-Commerce Retail Sales as a Percent of Total Sales, United States, 1999-2023

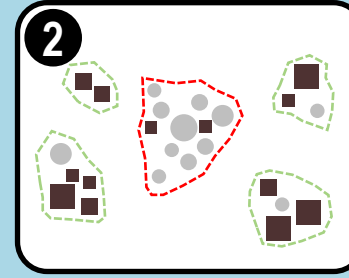


The Impacts of E-commerce on Freight Distribution



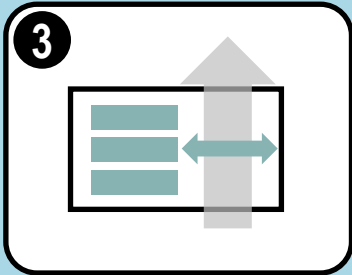
DISTRIBUTION PATTERN

- Distributional consumption.
- Growth in B2C deliveries.
- Changes in last mile logistics.



REAL ESTATE FOOTPRINT

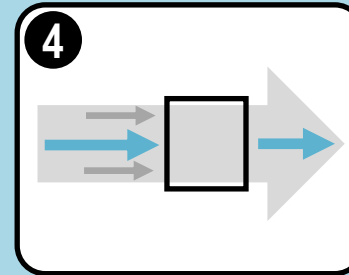
- Shift of the real estate footprint from retail to distribution.
- Changes in locational dynamics.



LOGISTICAL FACILITIES

- New logistical facilities (E-fulfillment, Sortation center, Urban logistics depot).
- Automation of fulfillment and inventory management.

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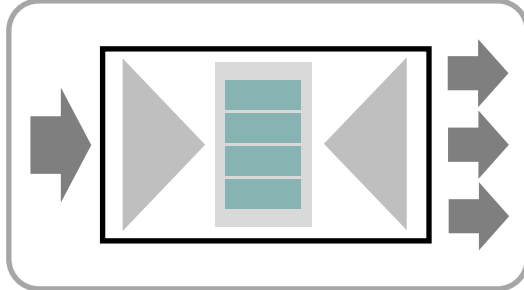


VERTICAL INTEGRATION

- Development of 3PL and 4PL services.
- Dedicated carrier services (truck, air, non-vessel operating common carrier).

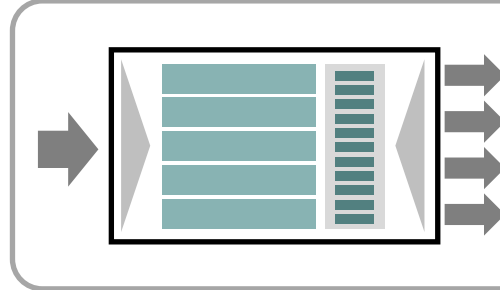
Logistics Facilities Supporting E-commerce

Inbound Cross Dock



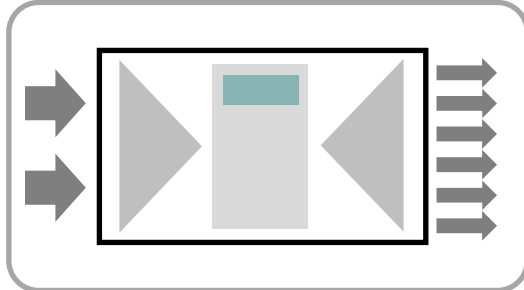
- Large-sized.
- Receiving containers and holding inventory.
- Double-side cross-docking configuration.
- Close to intermodal terminals.

E-Fulfillment Center



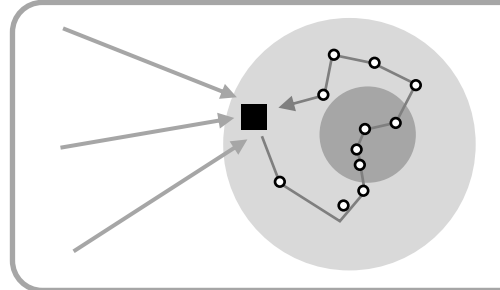
- Large-sized.
- Single-side cross-docking configuration common.
- High racks automated storage.
- Item specialization.
- Access to a major parcel hub.

Sortation Center



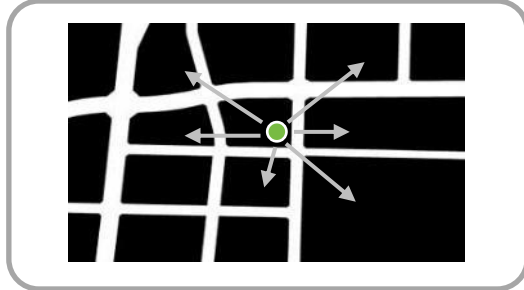
- Medium to large-sized.
- Cross-docking configuration for loading trucks.
- Automated and semi-automated sortation.
- Accessibility to regional distribution.

Delivery Station



- Medium to small-sized.
- Cross-docking configuration for loading delivery vehicles.
- Periphery or central areas of metropolitan areas.

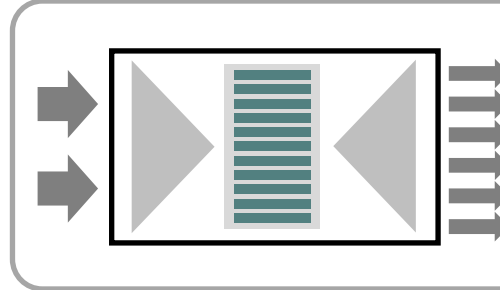
Local Freight Station



- Small or micro-sized.
- Store-like facility (pickup location).
- Locker banks (freight station).
- High-density neighborhood locations.

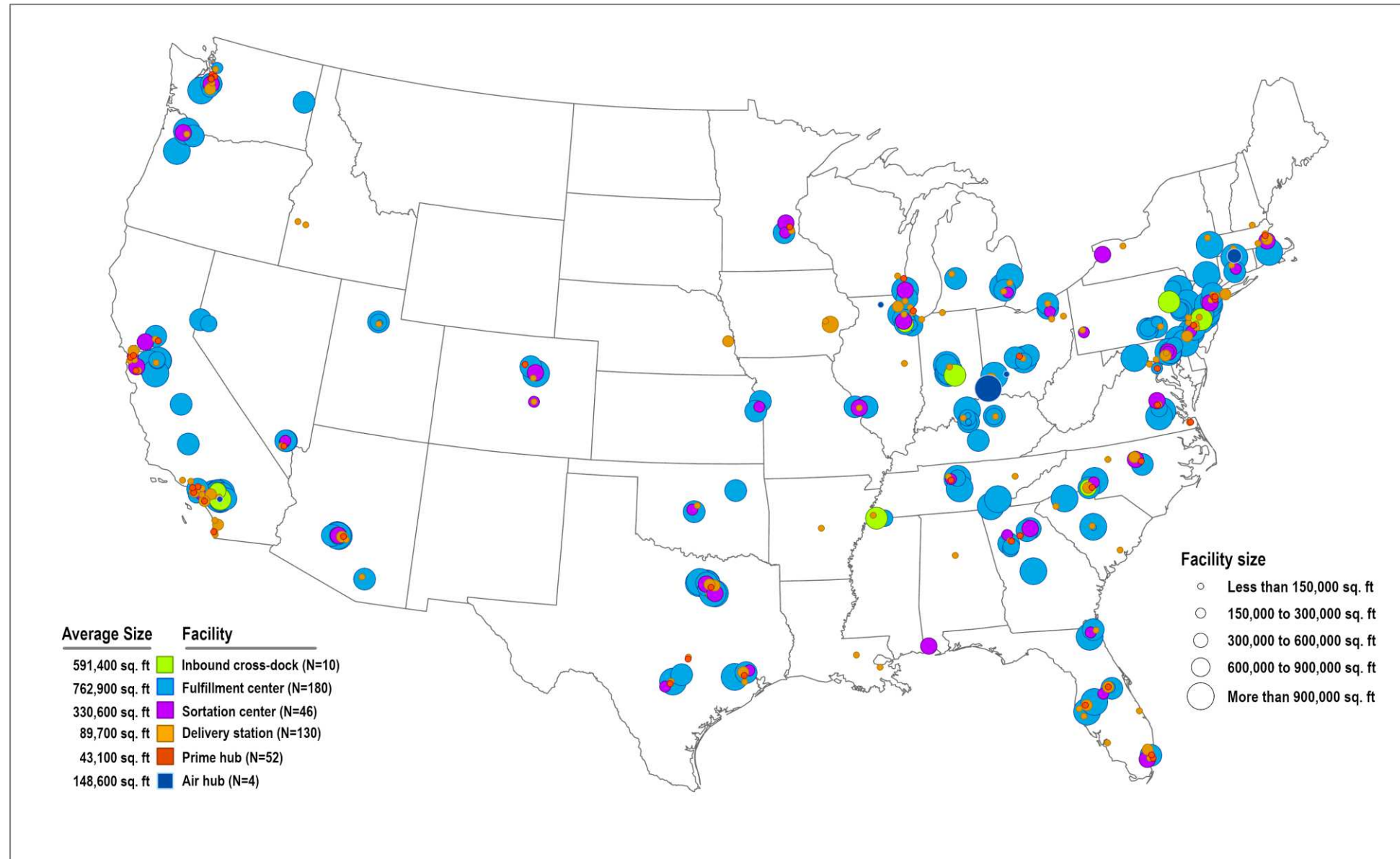
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Fast Delivery Hub

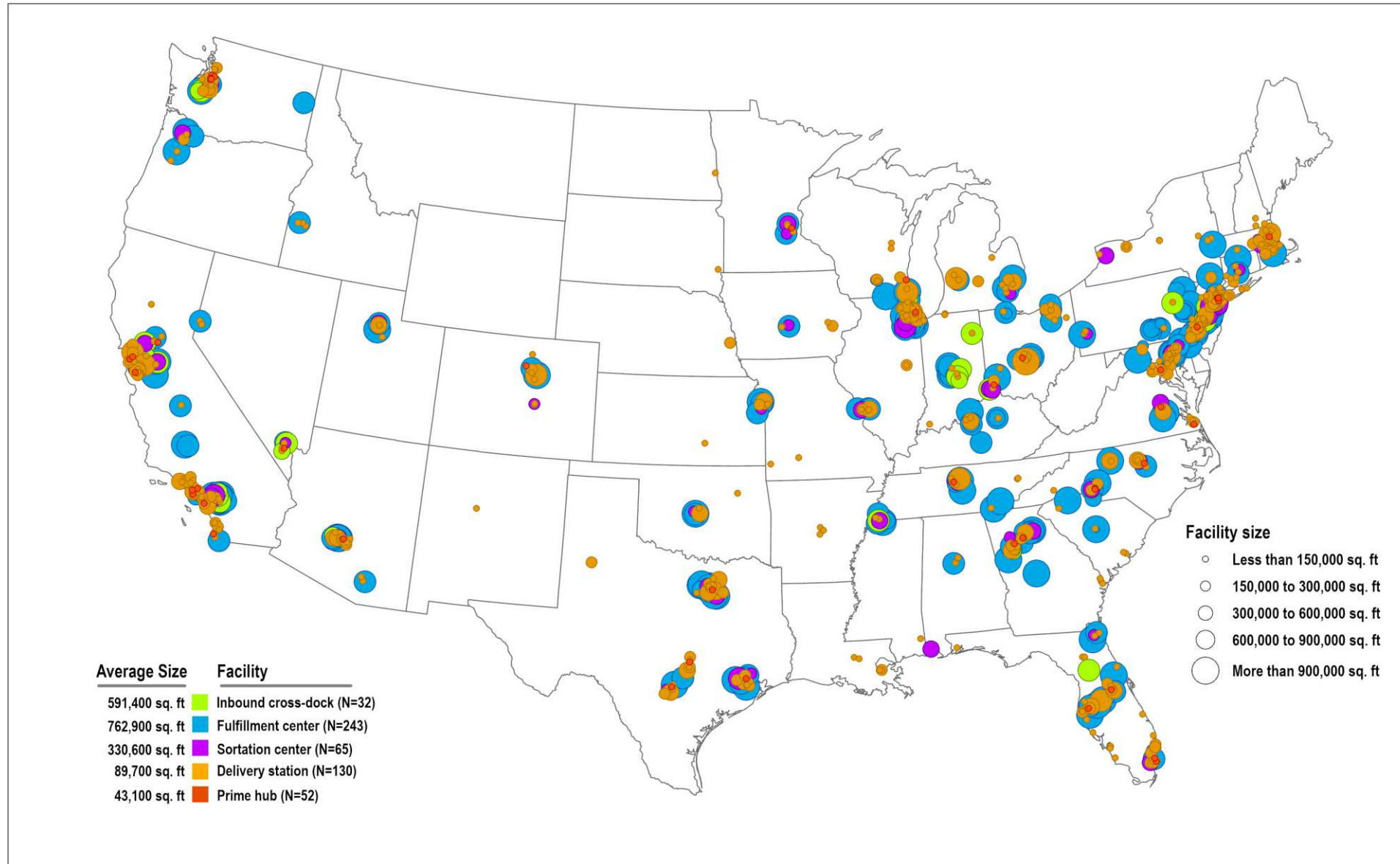


- Small to medium-sized.
- Near large metropolitan areas.
- Limited inventory of high-demand items.
- Some co-location with e-fulfillment centers.

E-Commerce Facilities Operated by Amazon in the United States, 2019

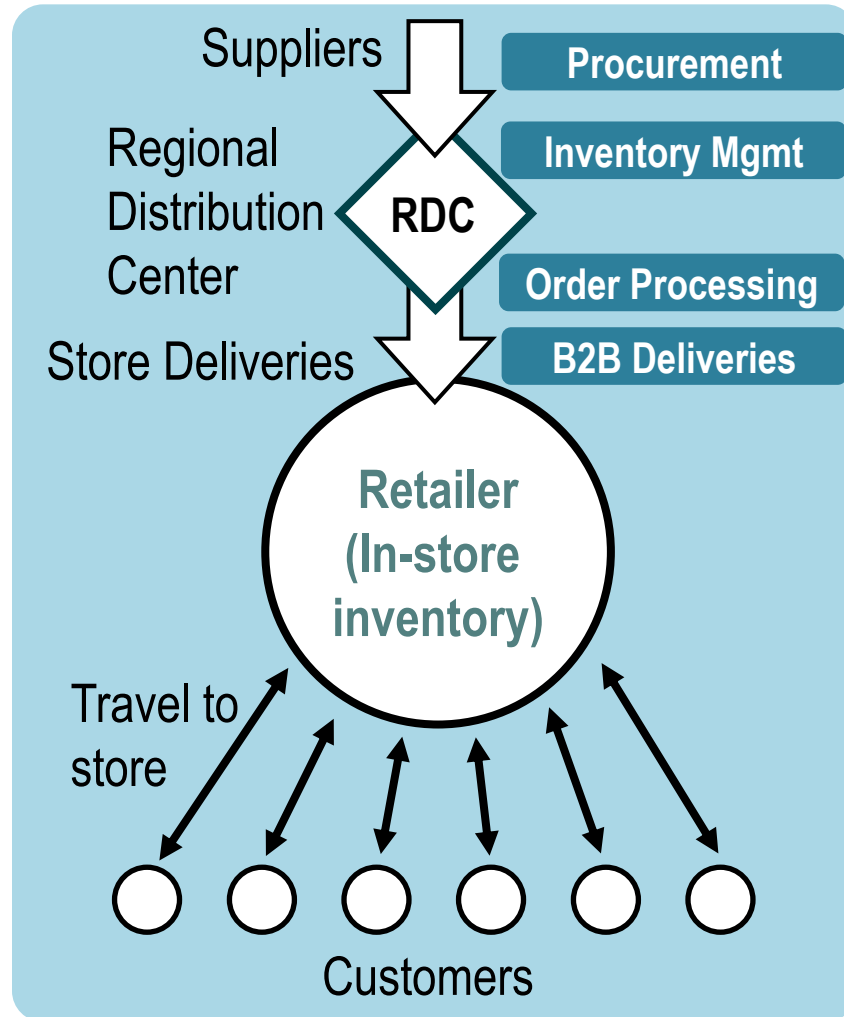


E-Commerce Facilities Operated by Amazon in the United States, 2021

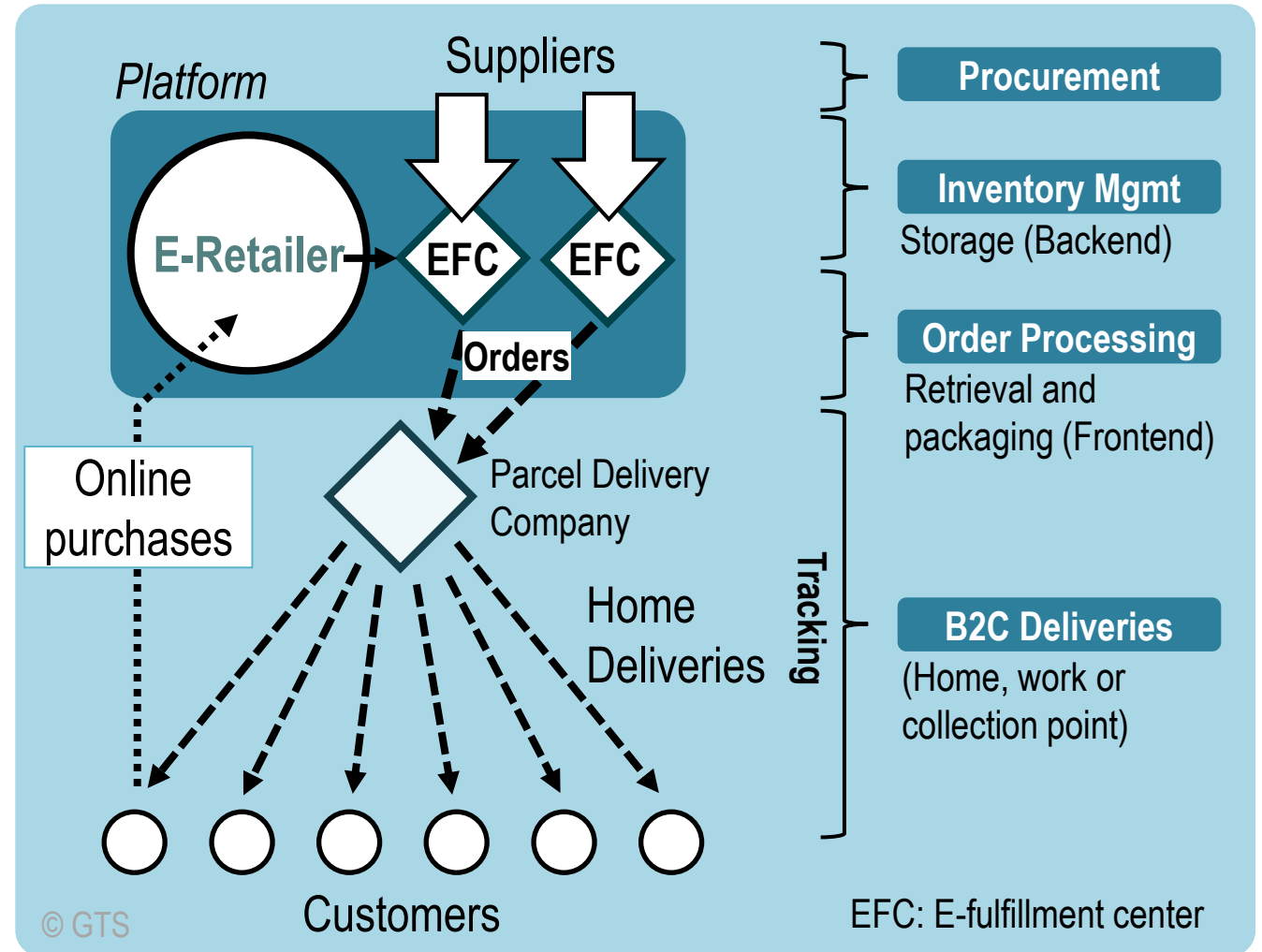


Retail Logistics and E-commerce

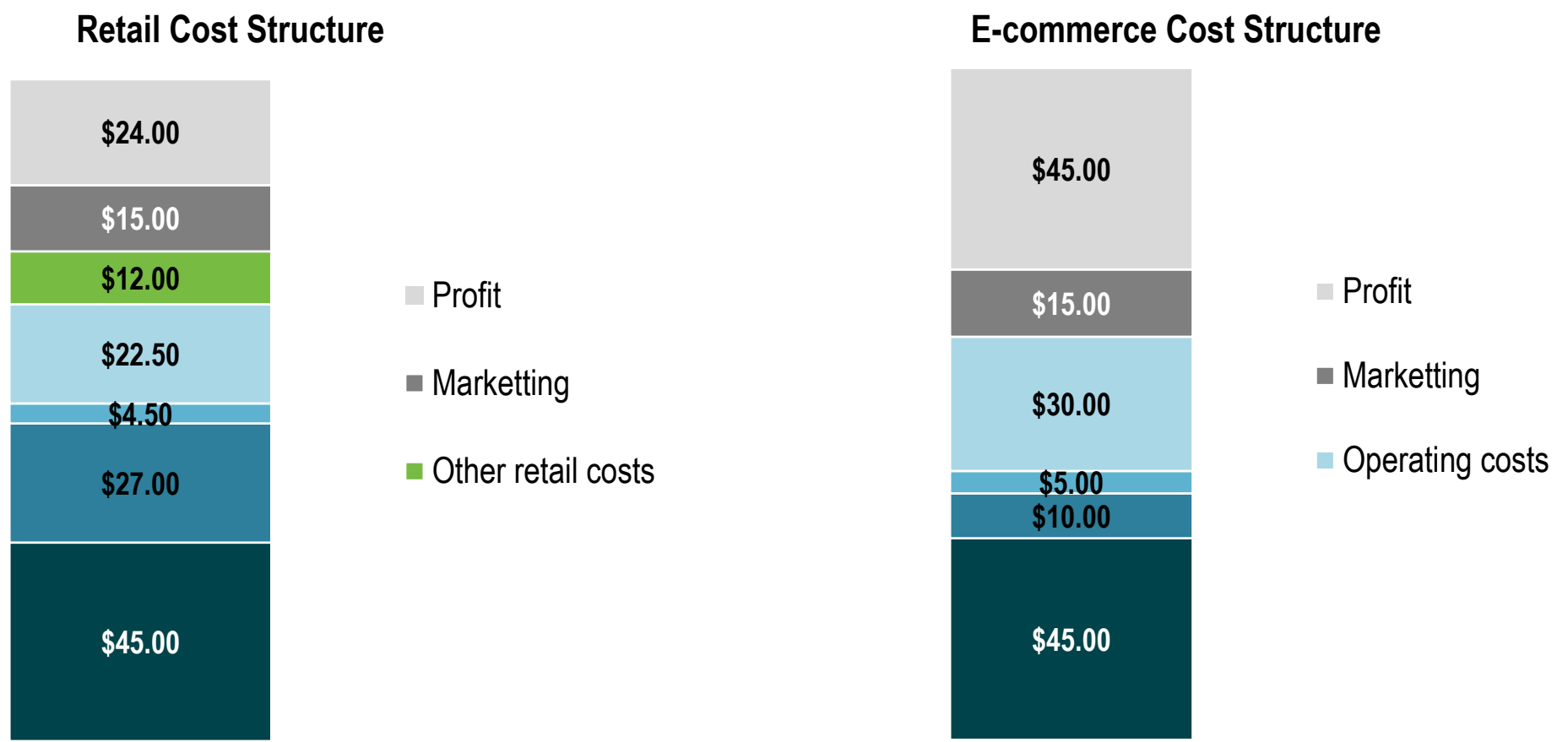
Conventional Retail Logistics



E-commerce Retail Logistics



Comparison Between Retail and E-commerce Cost Structures for a \$150 Apparel Piece



Shifts of Logistical Operations in the Internet Economy

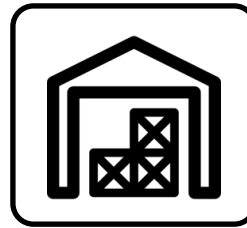
	Traditional logistics	E-logistics
Orders	Predictable	Variable
Order cycle time	Weekly	Daily or hourly
Customer	Strategic	Broader base
Customer service	Reactive, rigid	Responsive, flexible
Replenishment	Scheduled	Real-time
Distribution model	Supply-driven (push)	Demand-driven (pull)
Demand	Stable, consistent	More cyclical
Shipment type	Bulk	Smaller lots
Destinations	Concentrated	More dispersion
Warehouse reconfiguration	Weekly or monthly	Continual, rule-based
International trade compliance	Manual	Automated

Elements of Last Mile Logistics



TERMINAL

Capacity; turnover; gate access



WAREHOUSING

Inventory level; lead time;
transloading



DRAYAGE

Congestion; chassis management

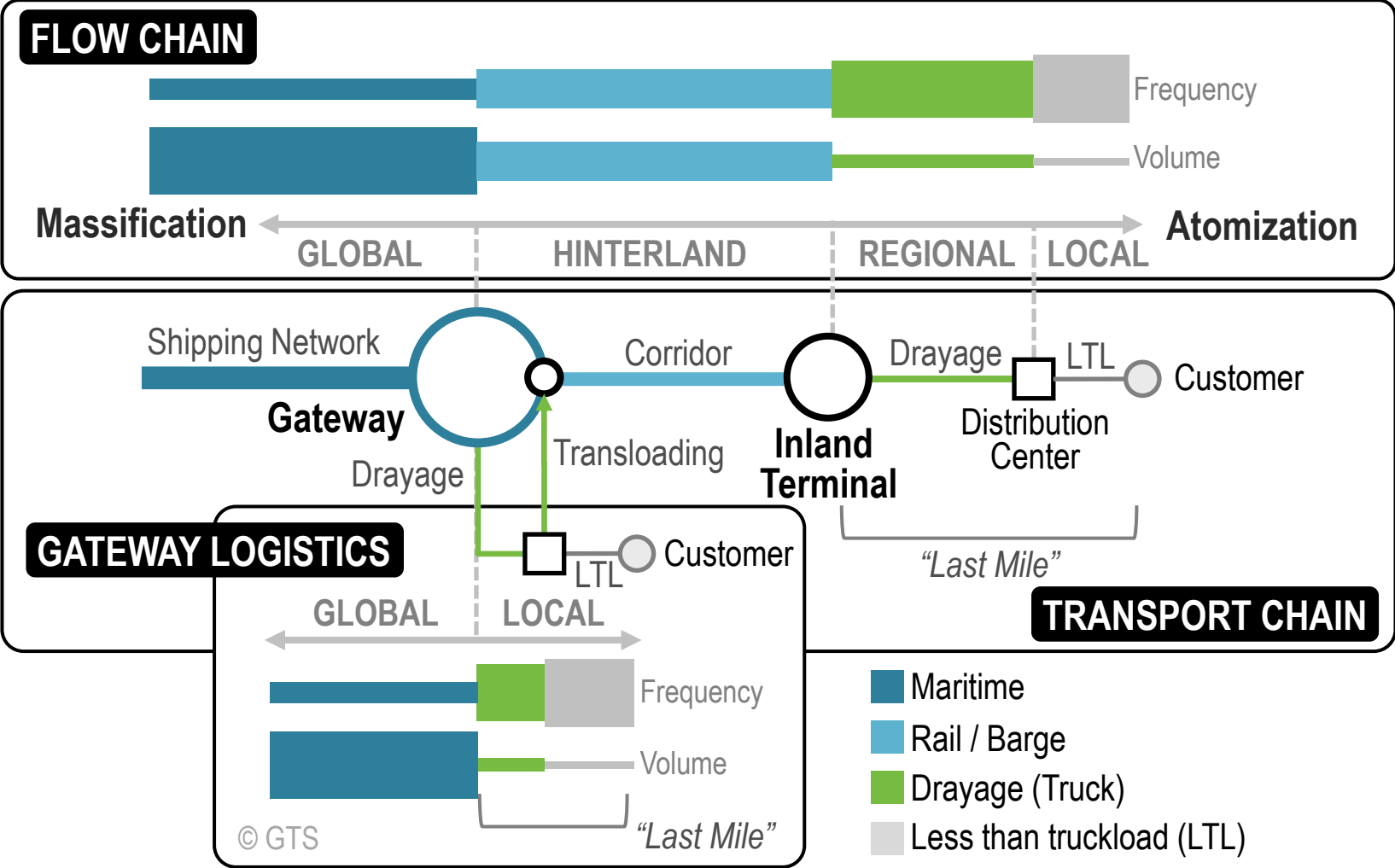


DELIVERIES

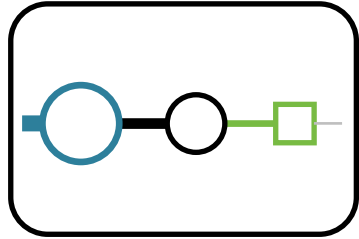
Congestion; parking

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The Last Mile in Inland Freight Distribution

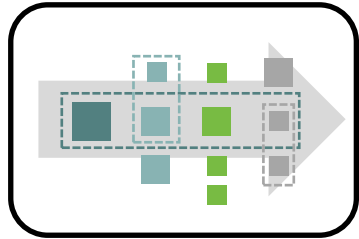


Elements of Supply Chain Connectivity and Integration



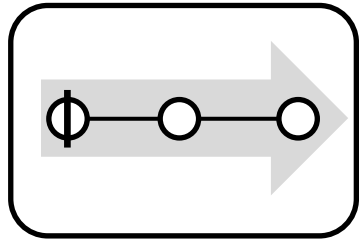
Transport Connectivity

Improving connectivity and interoperability of modes (intermodalism).
Infrastructure and superstructure improvements (capacity and throughput).
Synchronizing terminals and hinterland flows.



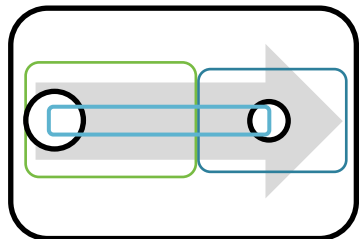
Commercial Integration

Trade and commercial agreements. Mergers and acquisitions along the supply chain.
Cost, time and reliability of transport and distribution services.
Vertical and horizontal integration (e.g. bill of lading).



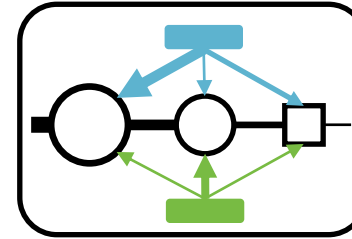
Customs and Security Integration

Moving cargo more efficiently across borders.
Harmonization of customs and security procedures.
Assessments of cargo contents, cargo integrity, route integrity and information integrity.



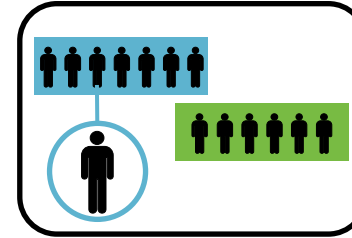
Regulatory Integration

Promote modal choice and avoid subsidized modal preference.
Harmonization of regulations across jurisdictions such as for vehicles, goods handling and transport, land use, labor and finance. Promotion of standards and certification.



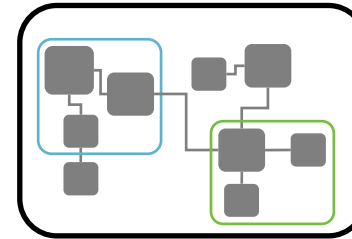
Planning and Funding Integration

Planning and funding of infrastructure provision from an integrated multi-modal and logistics chain perspective.
Respective roles and competencies of the public and private actors.



Work Practices Integration

Organizational (managing labor as a group) and skills (managing individual workers) competencies to move cargo efficiently.
Operational window (working hours), minimal service levels and essential services.
Automation of repetitive tasks.



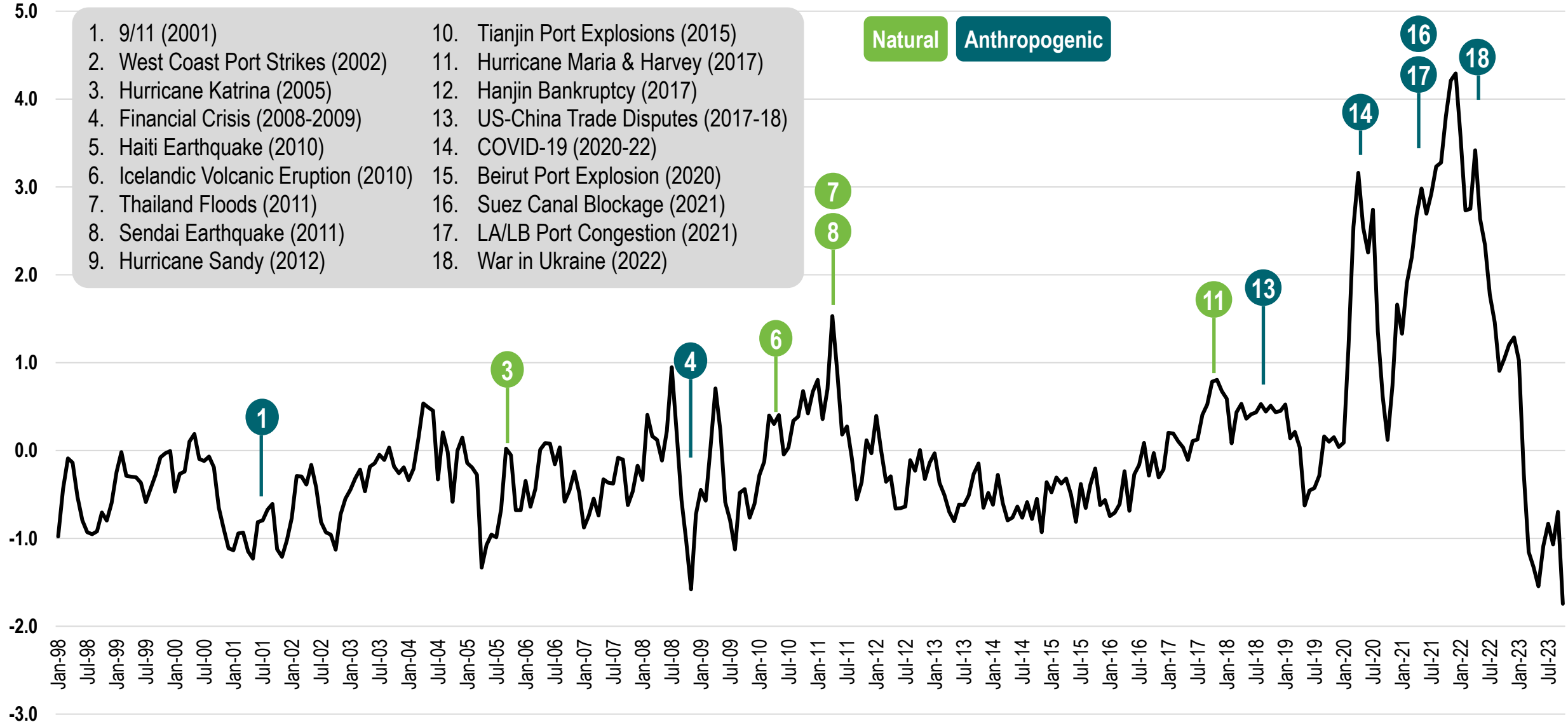
Information Systems Integration

Interconnectivity of information systems with blockchains.
Asset tracking, status monitoring, customs facilitation, freight status information and transport network status information.

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Main Elements in Supply Chain Integration and Connectivity

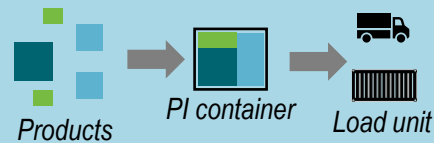
Global Supply Chain Pressure Index (GSCPI) and Major Supply Chain Disruptions



Fundamentals of the Physical Internet

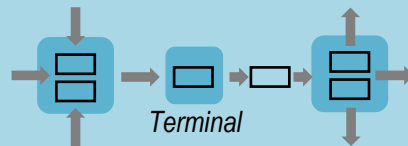
PHYSICAL INTERNET

Encapsulation



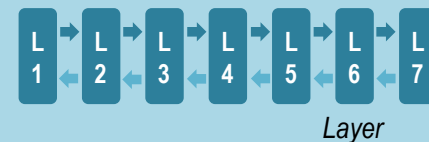
- Encapsulation (consolidation) of products into a modular unit (PI container).
- PI containers to be reconciled with existing load units (e.g. boxes, pallets, ISO containers).

Interfaces



- Consolidation, deconsolidation and storage of PI containers at distribution facilities.
- Transport and relay PI containers at terminal facilities.
- Physical and digital interfaces.

Protocols



- Protocols regulating the layers of logistics services (L) along supply chains.
- Layers: Physical (L1), Link (L2), Network (L3), Routing (L4), Shipping (L5), Encapsulation (L6), Logistics (L7).

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