

The Geography of Transport Systems

FIFTH EDITION

Jean-Paul Rodrigue

Trade, Logistics and Freight Distribution

CHAPTER 7

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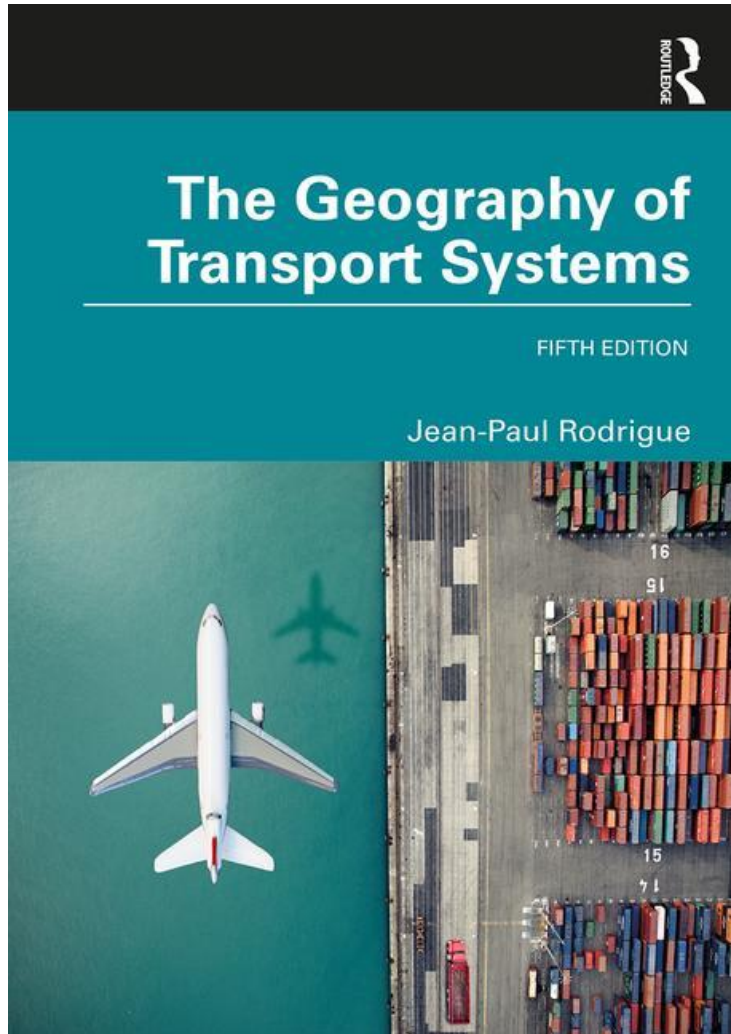


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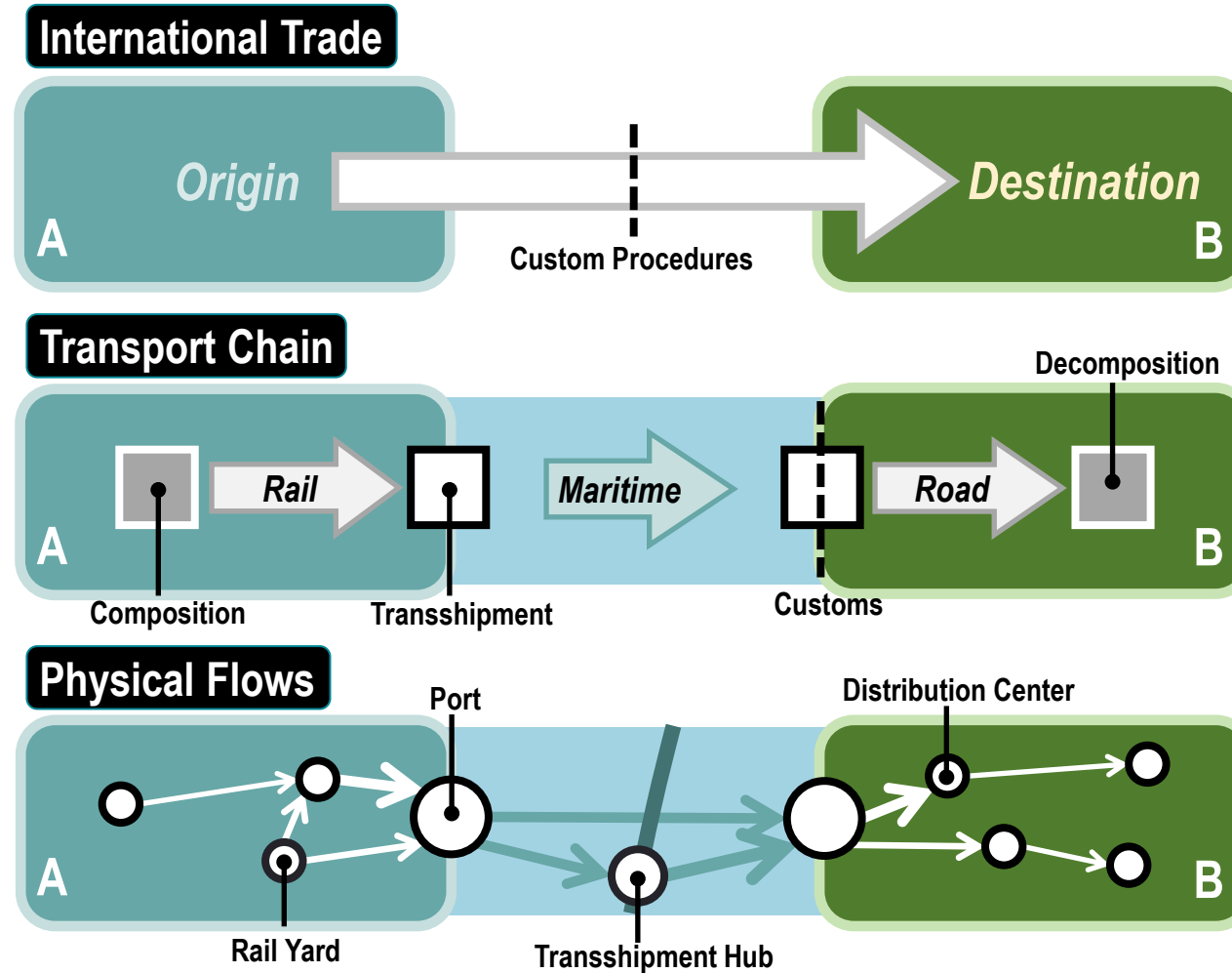
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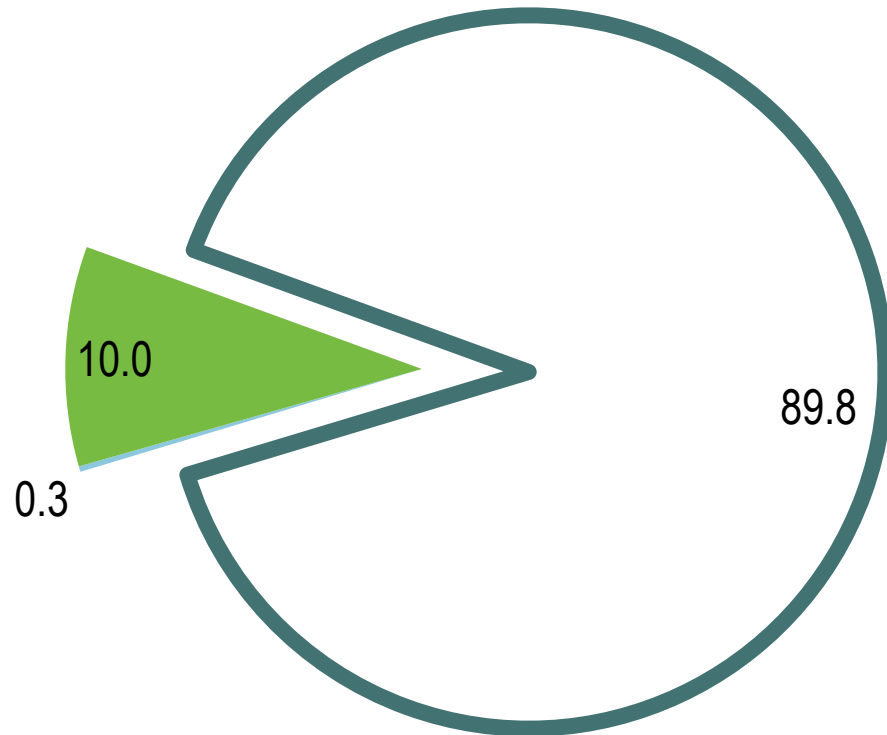
7.1 - Transborder Transportation

International Trade, Transportation Chains and Logistics



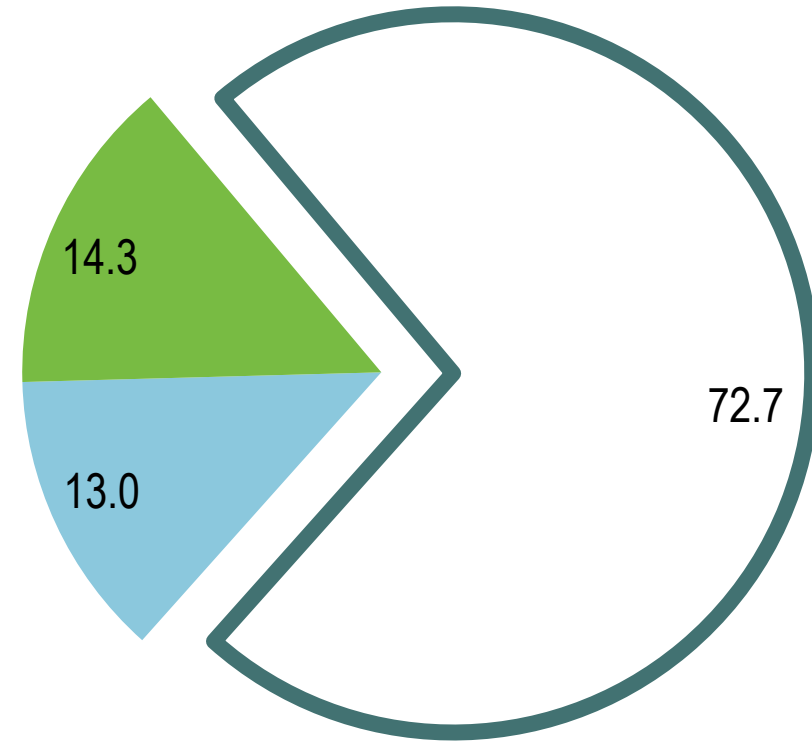
Modal Shares of World Trade by Volume and Value, 2008

Volume of World Trade



■ Seaborne ■ Airborne ■ Overland

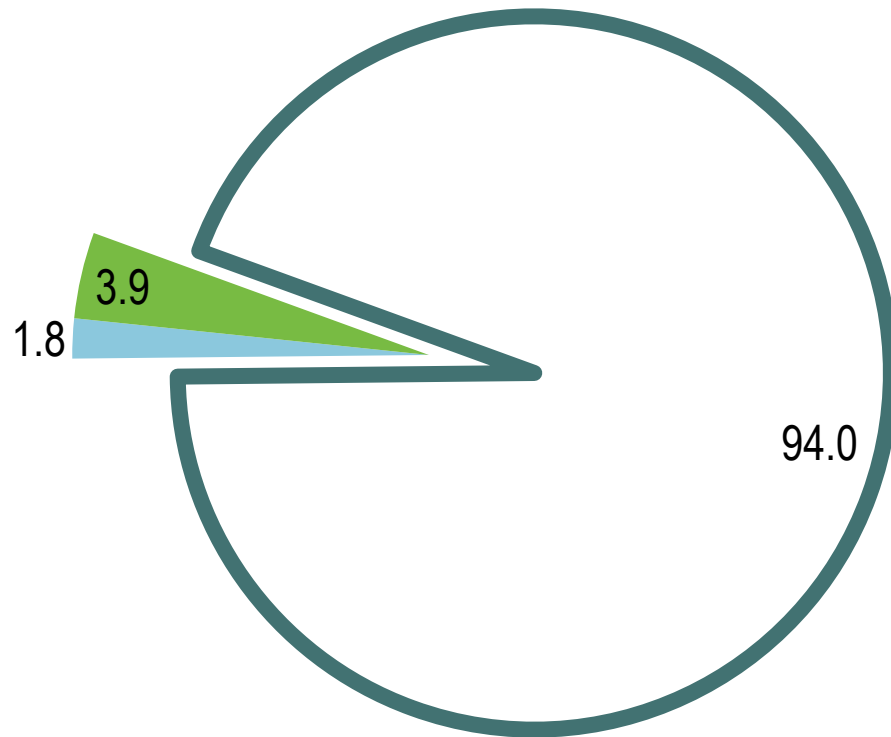
Value of World Trade



■ Seaborne ■ Airborne ■ Overland

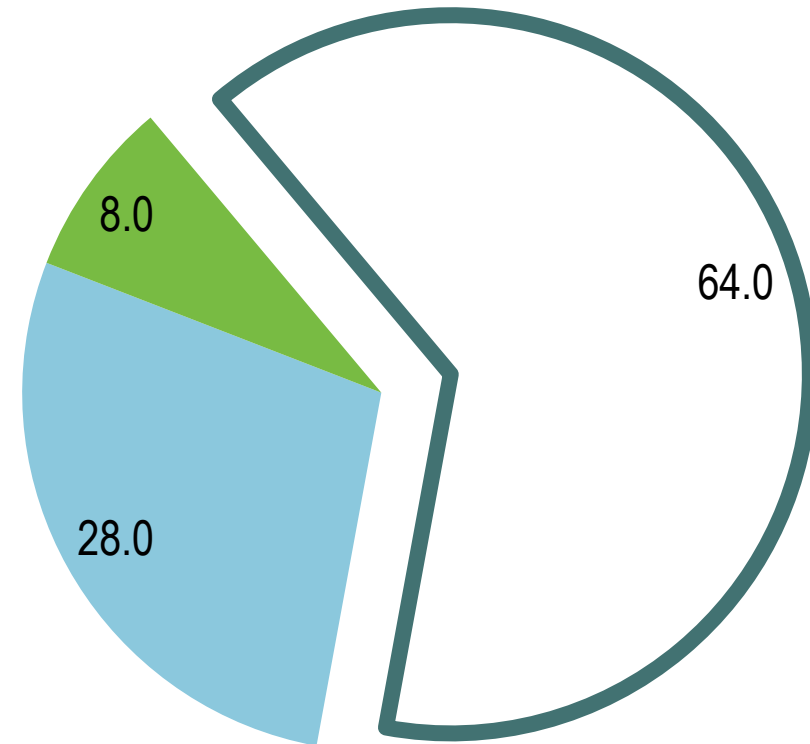
Modal Shares of China Trade with Europe by Volume and Value, 2016

Volume of Trade



■ Seaborne ■ Airborne ■ Overland

Value of Trade

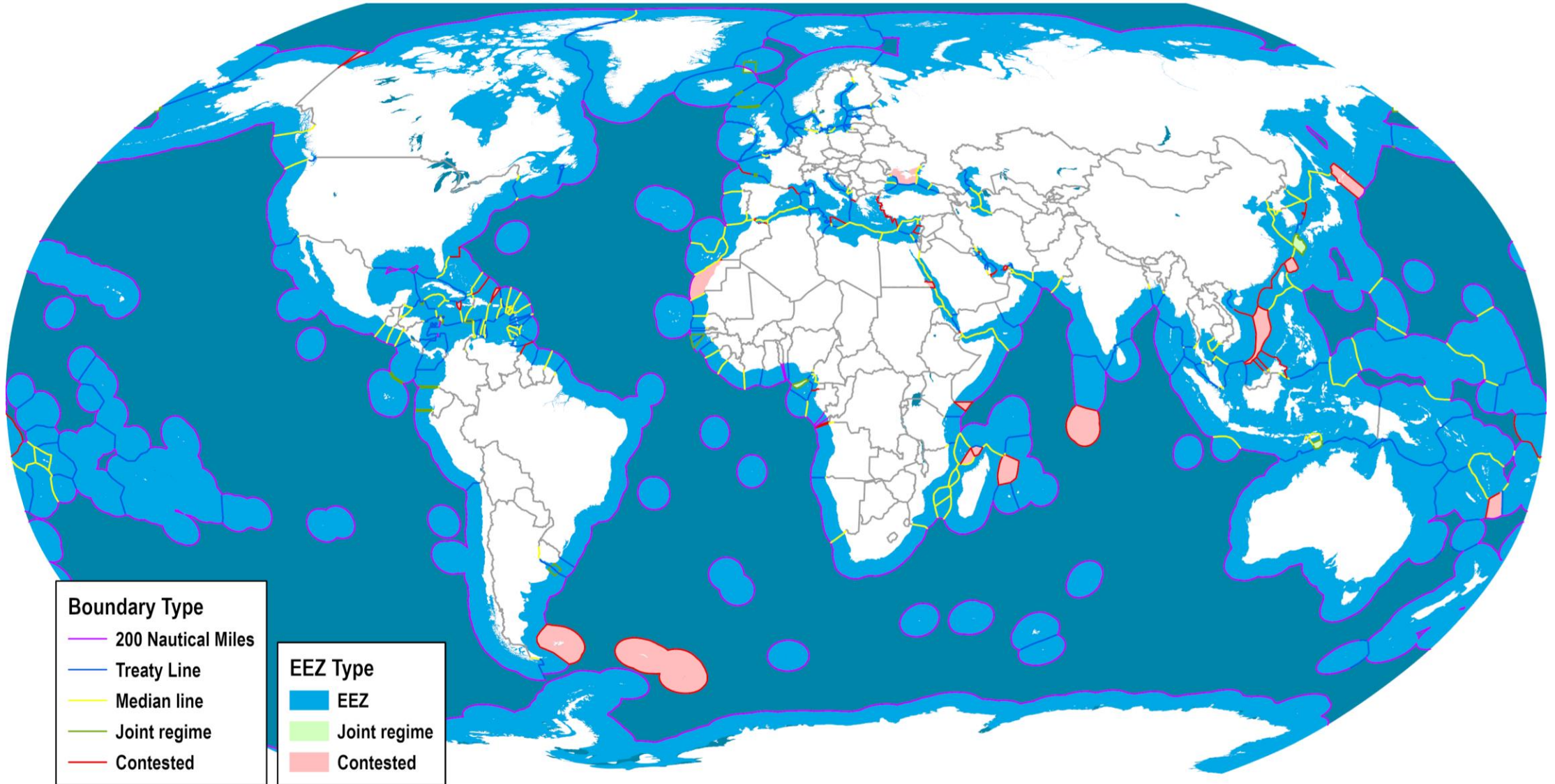


■ Seaborne ■ Airborne ■ Overland

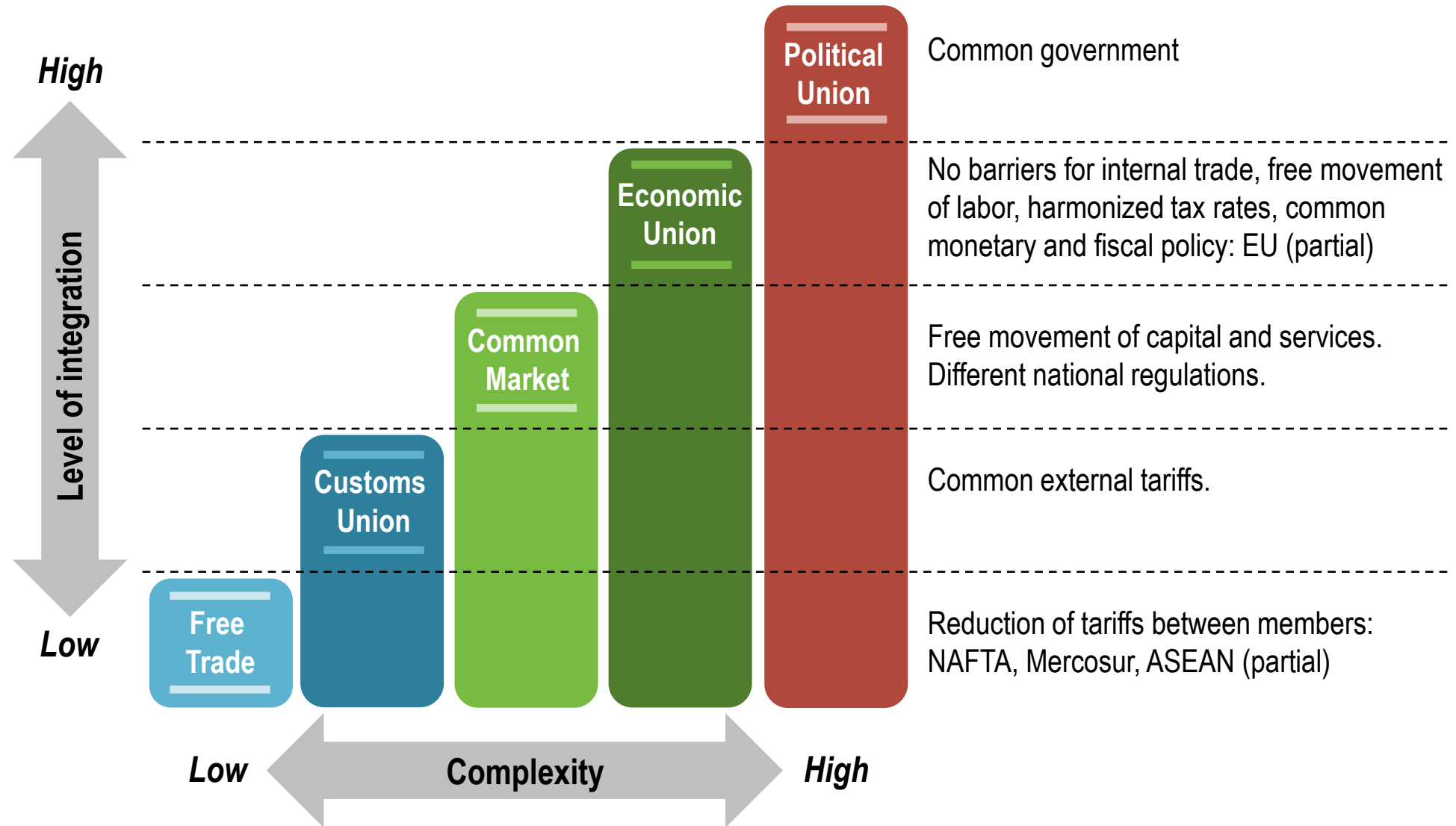
Geostrategy of International Transportation

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.

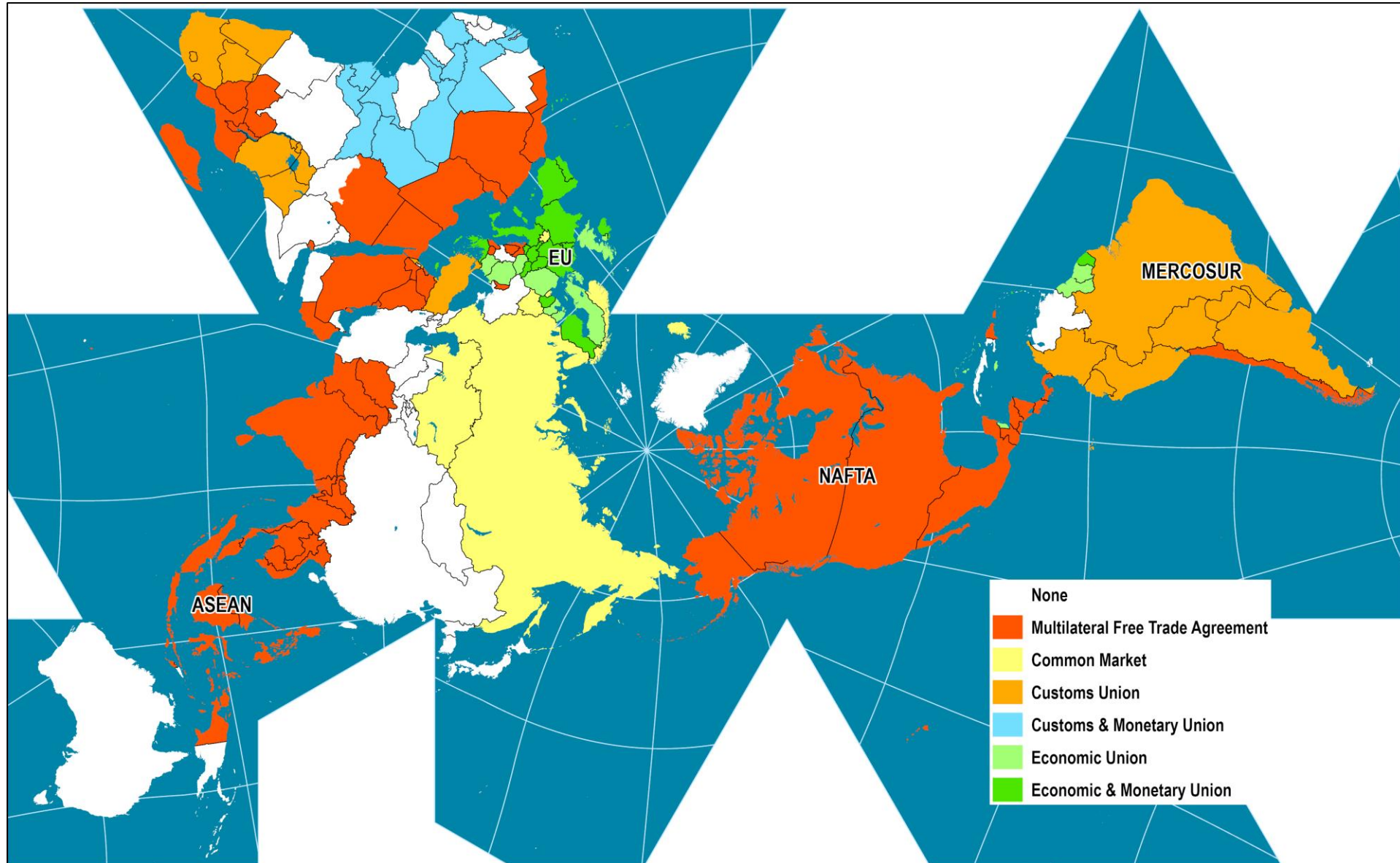
Exclusive Economic Zones



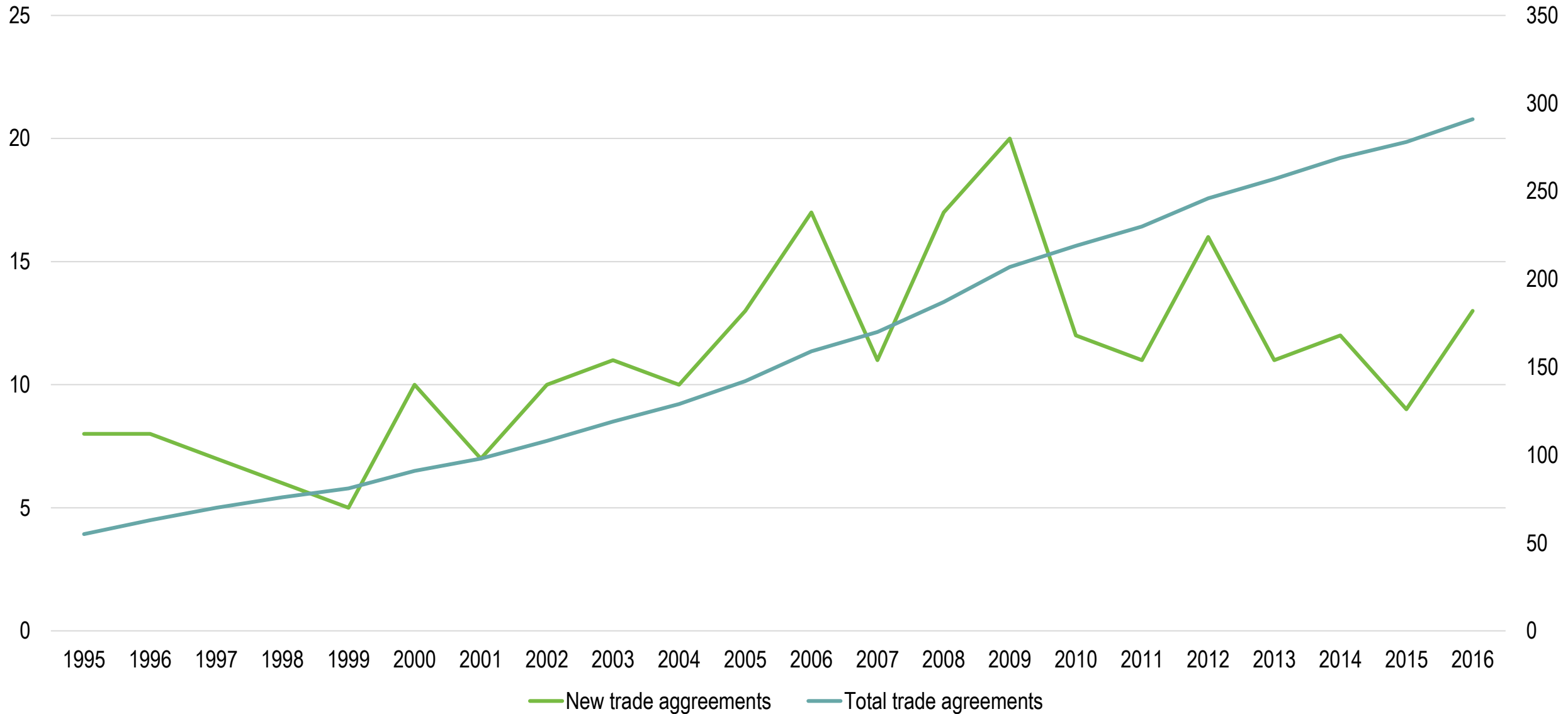
Levels of Economic Integration



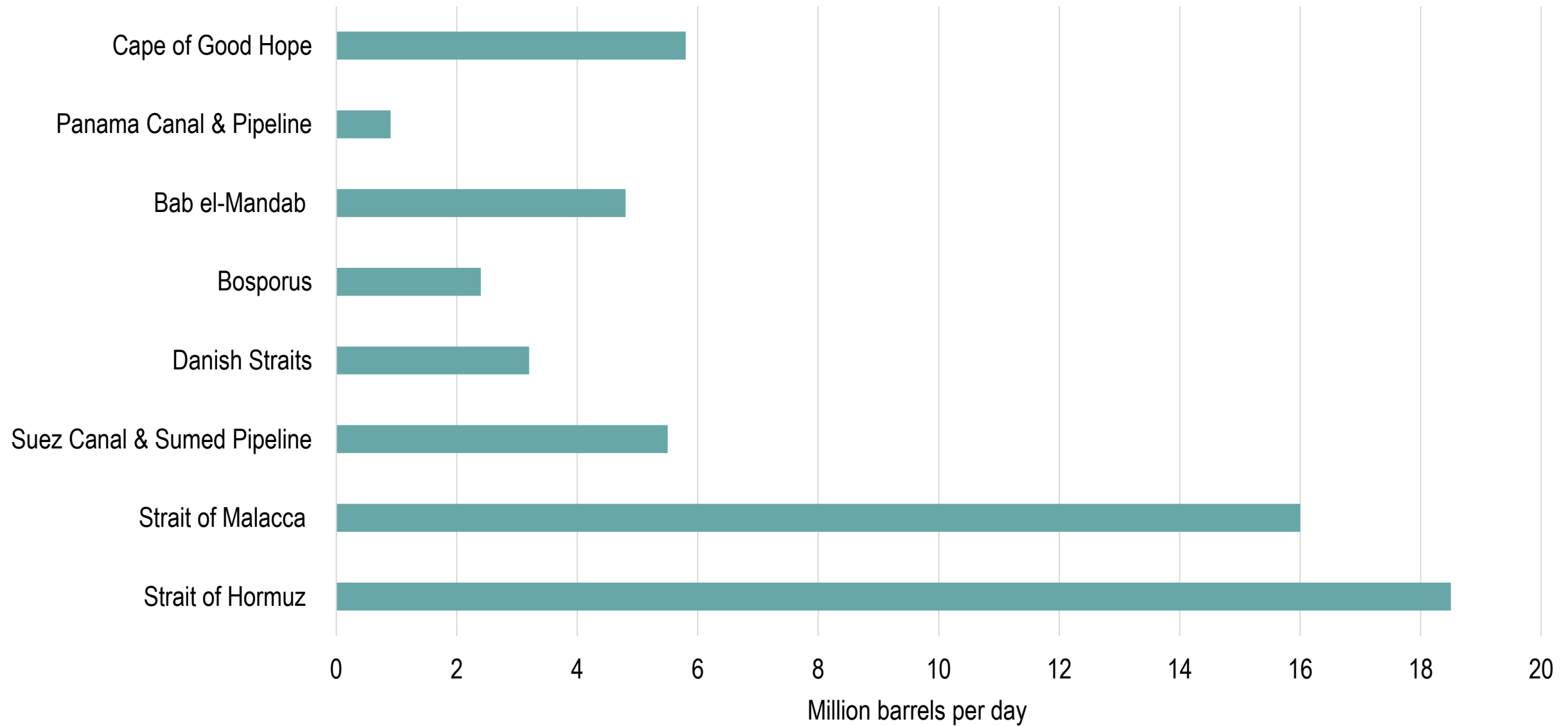
Economic Integration Levels, 2015



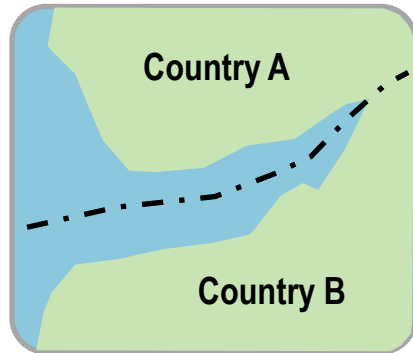
Number of Regional Trade Agreements on Customs and other Trade Facilitation Measures, 1995-2016



Oil Transited at Major Strategic Locations, 2016

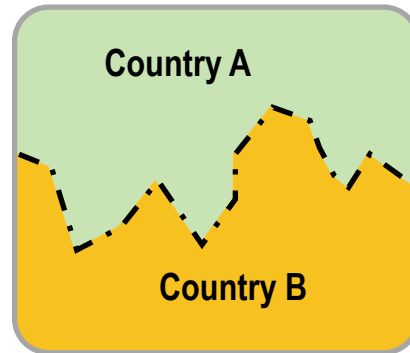


Types of International Boundaries



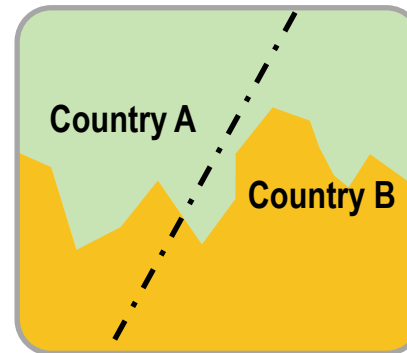
Antecedent

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



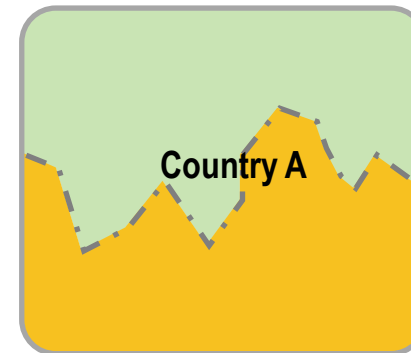
Subsequent

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



Superimposed

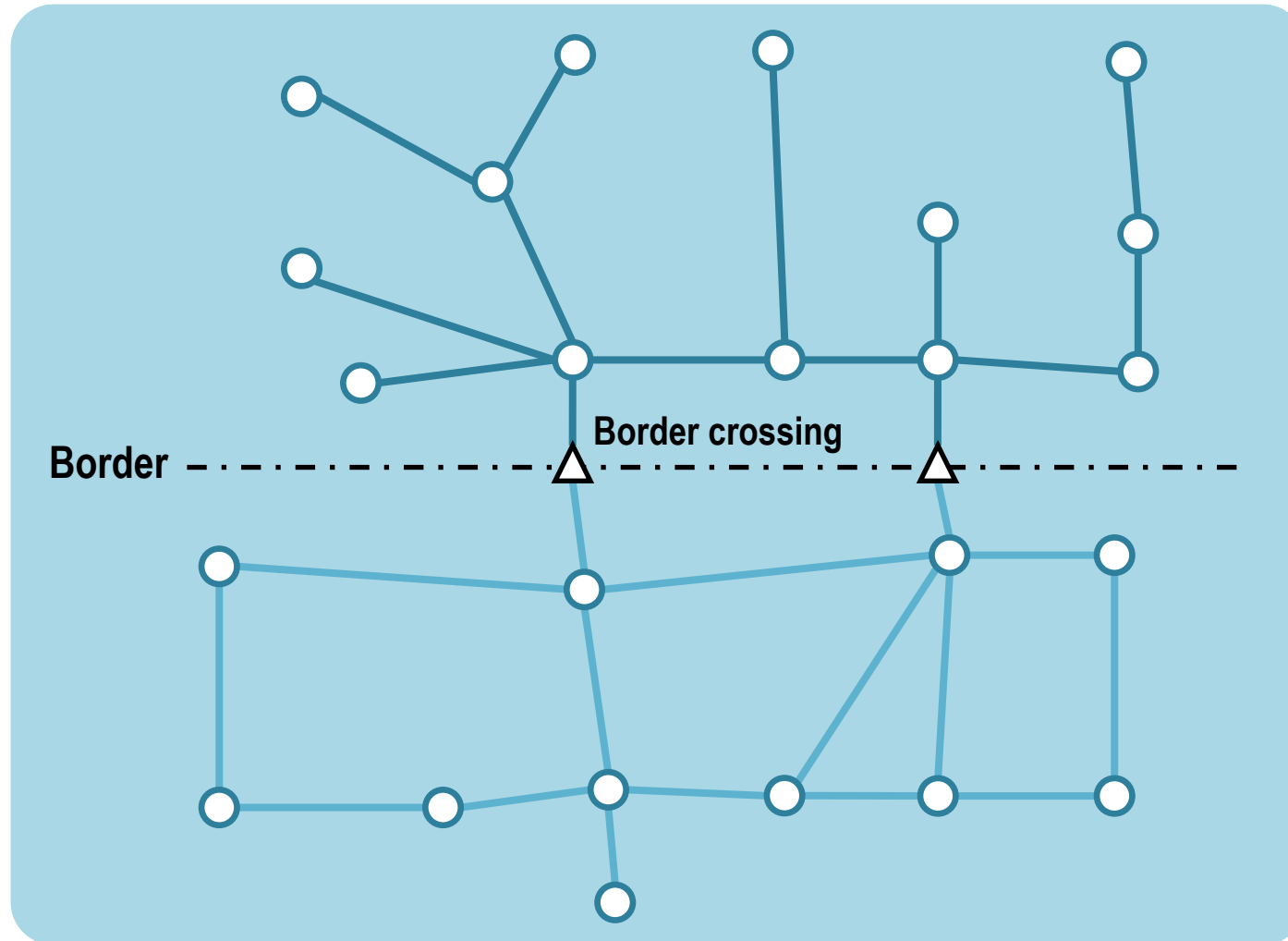
Boundary is imposed by an outside force (treaty). May not reflect existing cultural landscape.



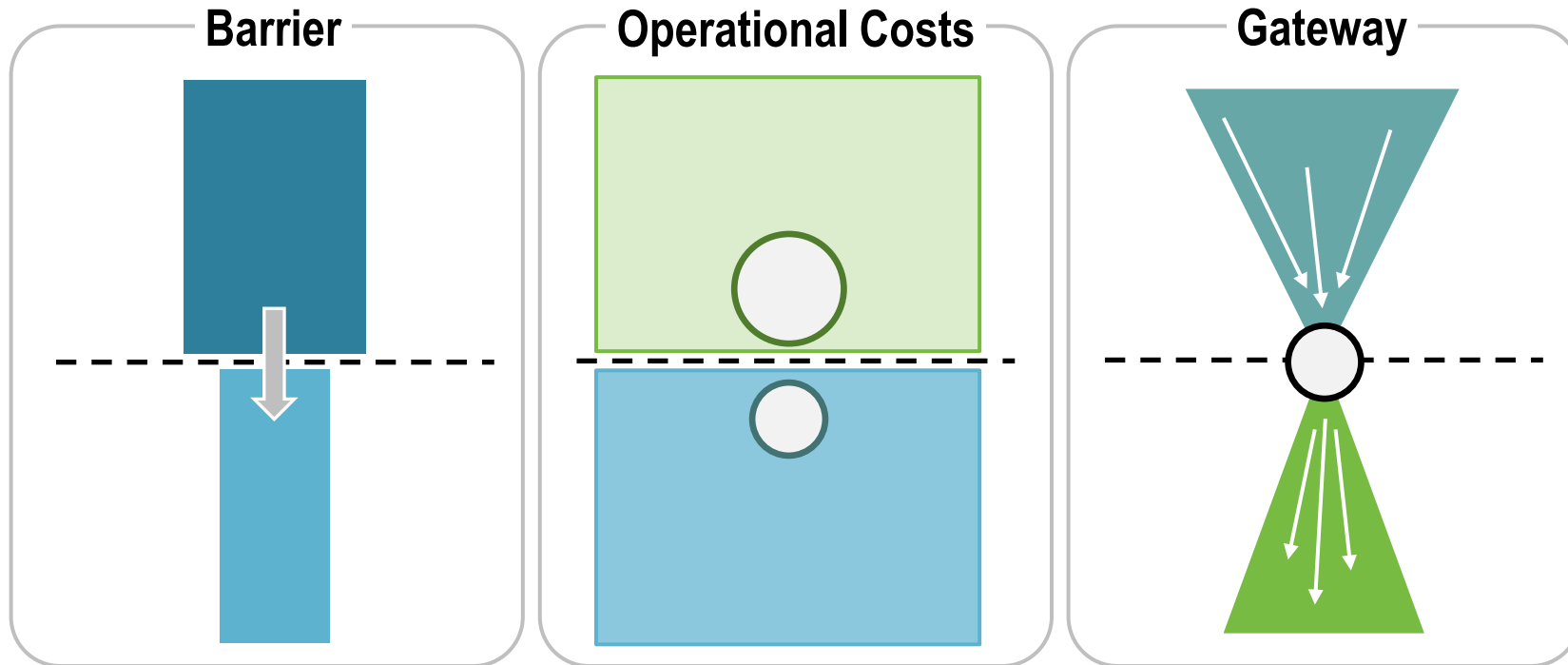
Relic

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

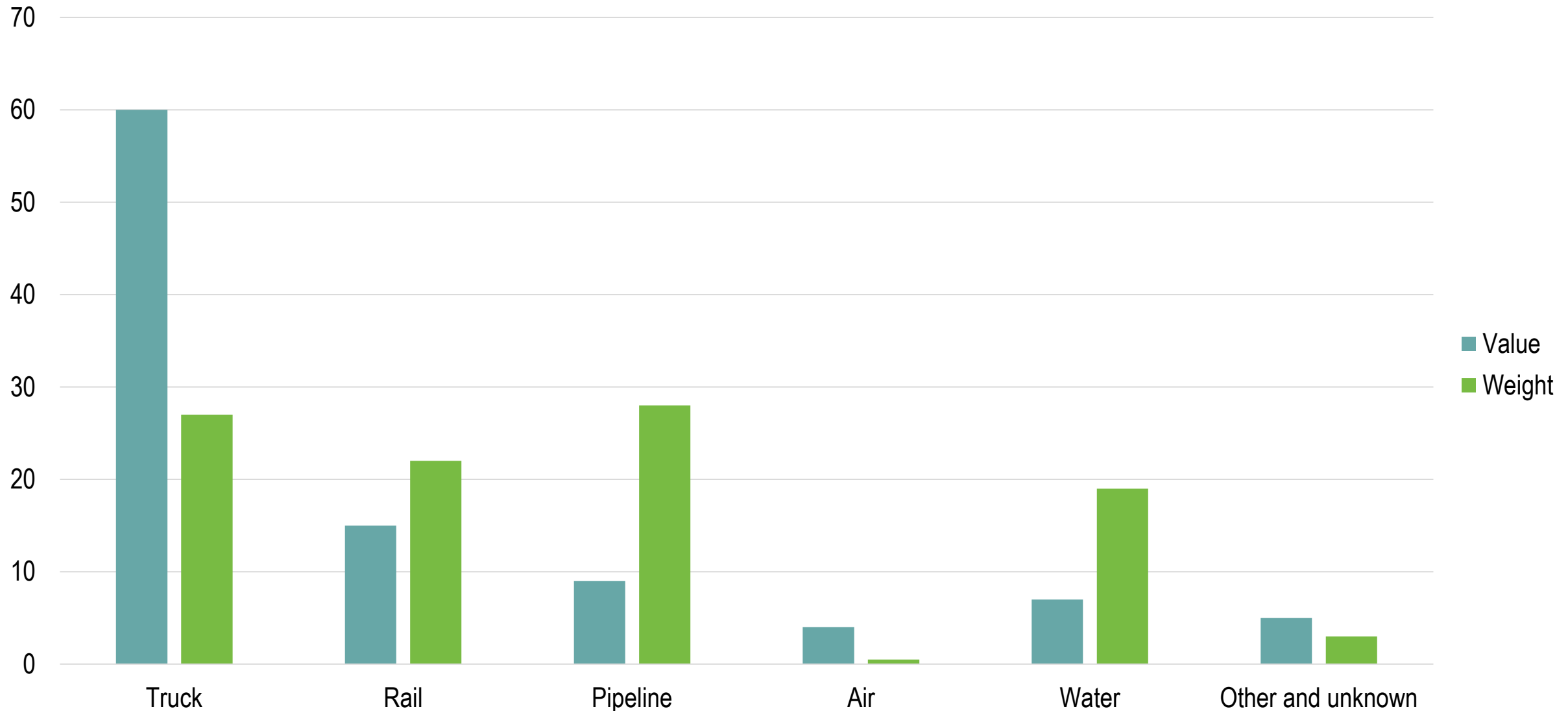
The Effect of a Border on a Transportation Network



The Effect of a Border on Freight Distribution



Modal Shares of U.S.-NAFTA Merchandise Trade by Value and Weight, 2013



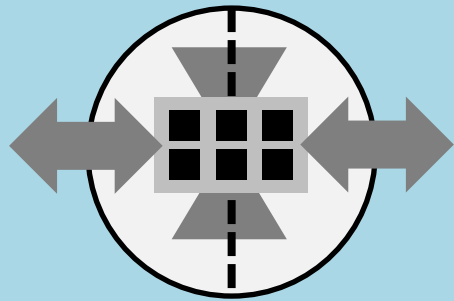
Types of Free Zones

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

Free Port

International Domestic



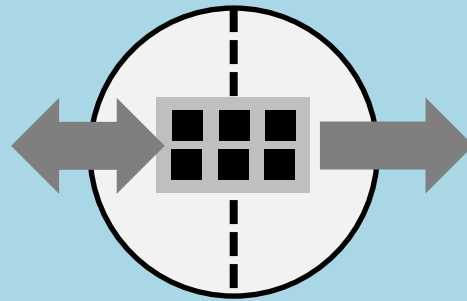
Trade and logistics platform

Port cities or connected locations

Domestic, internal and export markets

Free Trade Zone

International Domestic



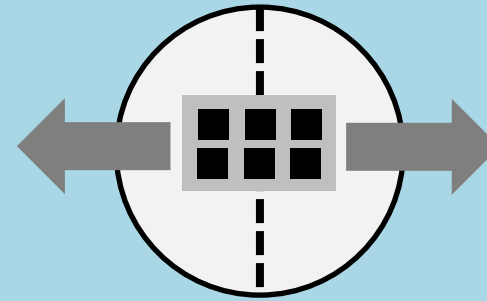
Trade support with entrepots and trade-related activities

Ports of entry

Domestic and re-exports

Export Processing Zone

International Domestic



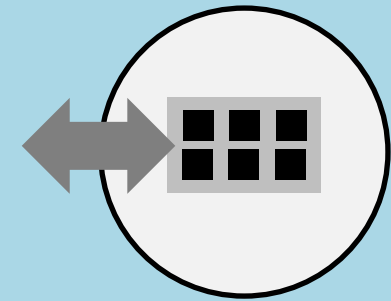
Develop manufacturing and processing

Usually close to a major transport node

Exports and domestic

Special Economic Zone

International



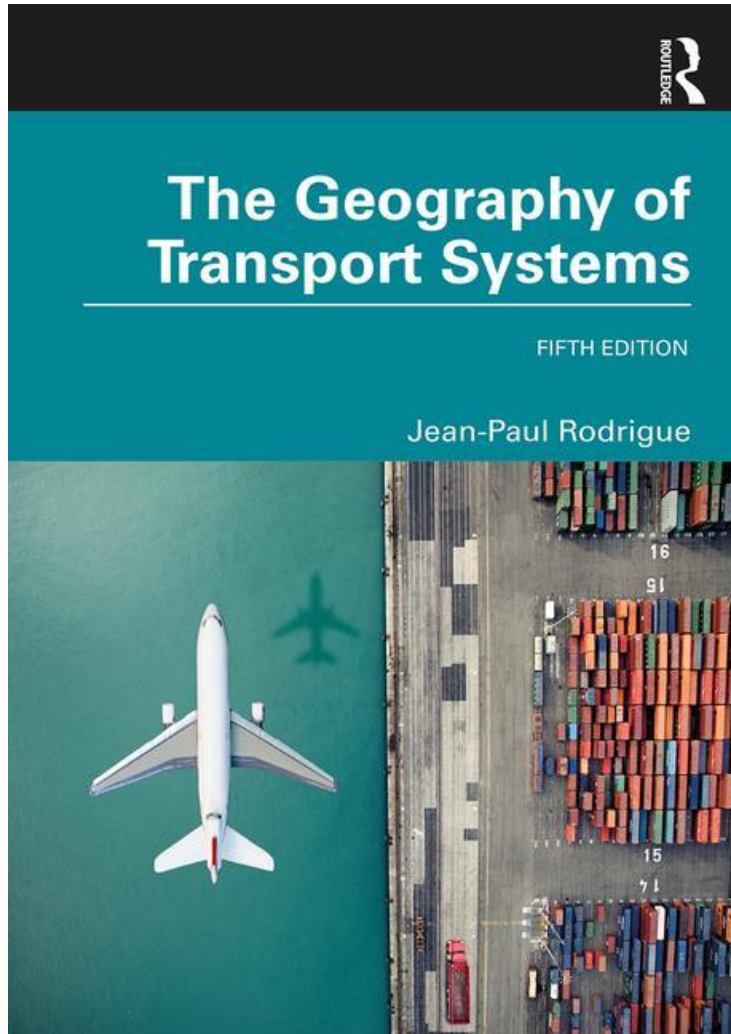
Attract foreign direct investments

Commercial gateways

Exports and re-exports

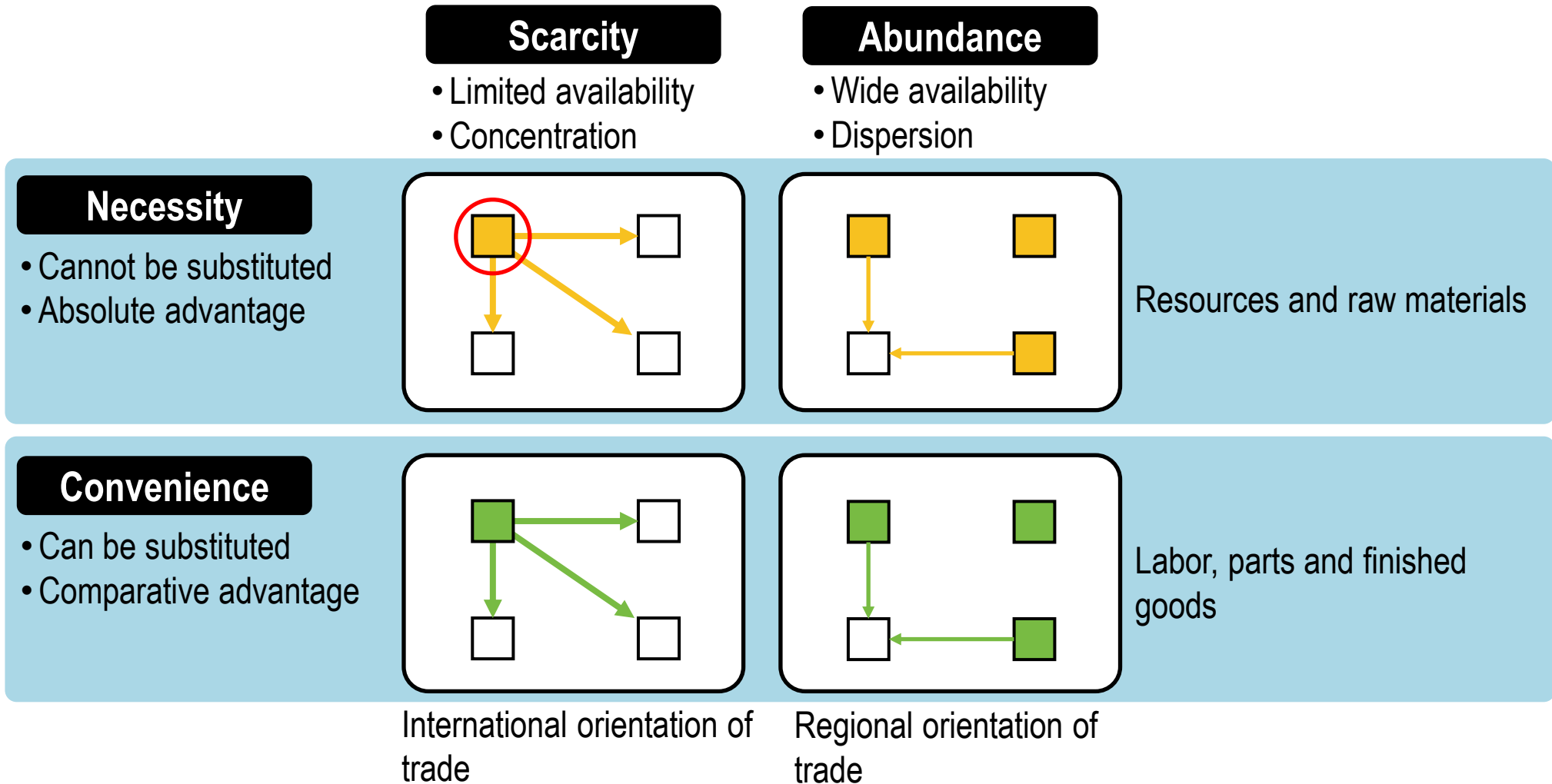
Specialized Free Zones

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

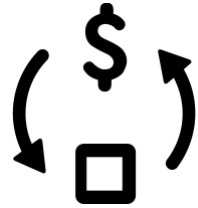


7.2 - Globalization and International Trade

The Rationale for Trade



The Flows of Globalization



Trade

Flows of physical goods
(mainly asymmetrical)

Raw materials, energy, food,
parts and consumption
goods

Freight transport modes
(maritime, rail, trucking)

Interconnected hub-and-
spoke networks

Ports as main hubs



Migration

Flows of people (mainly
symmetrical)

Permanent, temporary
(migrant workers), tourism,
business transactions

Passengers transport
modes (vehicles, air, rail)

Interconnected hub-and-
spoke networks

Airports as main hubs



Telecommunications

Flows of information (mainly
asymmetrical)


Communication, power
exchanges, symbolic exchanges

Telecommunication
systems (postal, internet,
telephone, radio)

Interconnected and redundant
hub-and-spoke networks

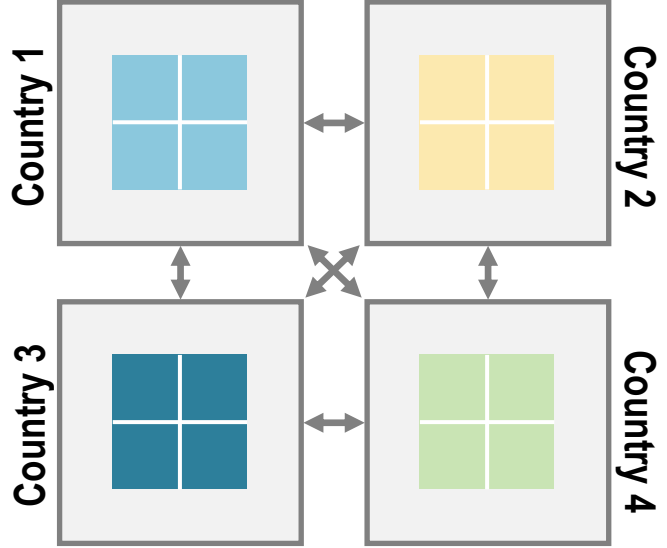
Global cities as main hubs

Economic Rationale of Trade



Without Trade

- Small national markets.
- Limited economies of scale.
- High prices and near monopoly.
- Limited product diversity.
- Different standards.

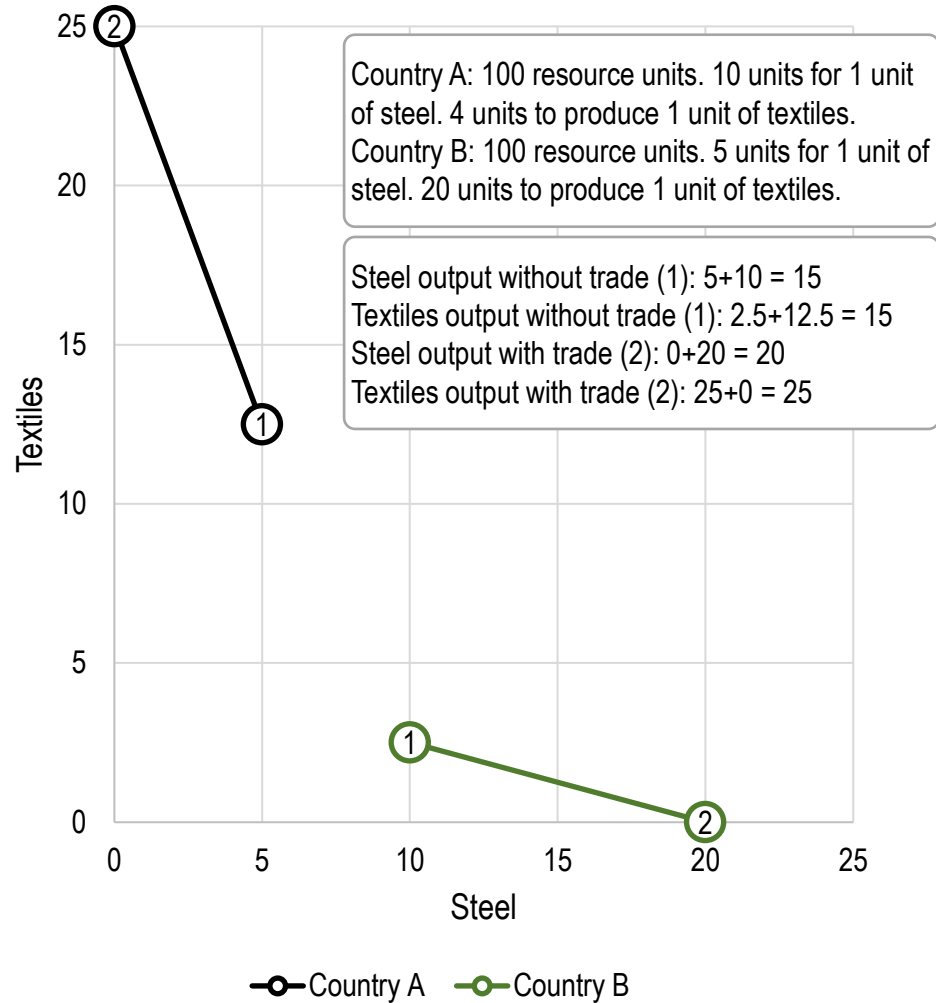


With Trade

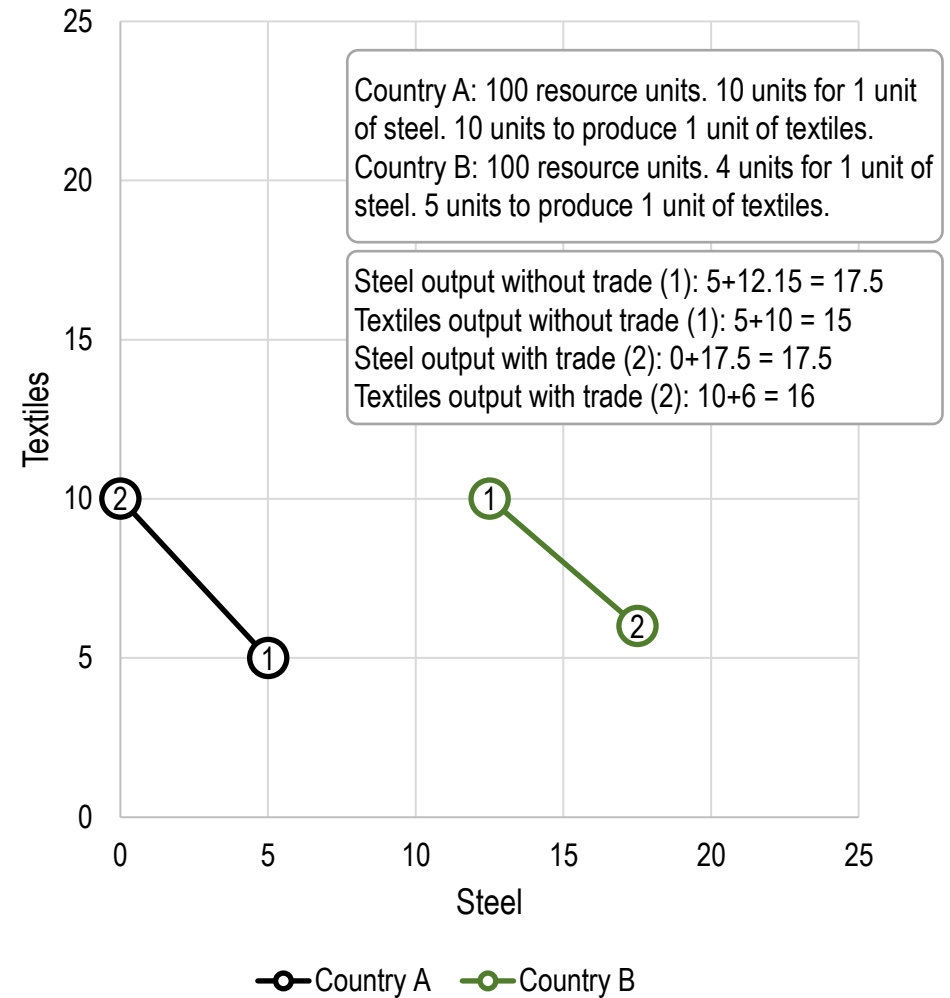
- Increased competition.
- Economies of scale.
- Specialization.
- Lower prices and more output.
- Interdependencies.

Absolute and Comparative Advantages

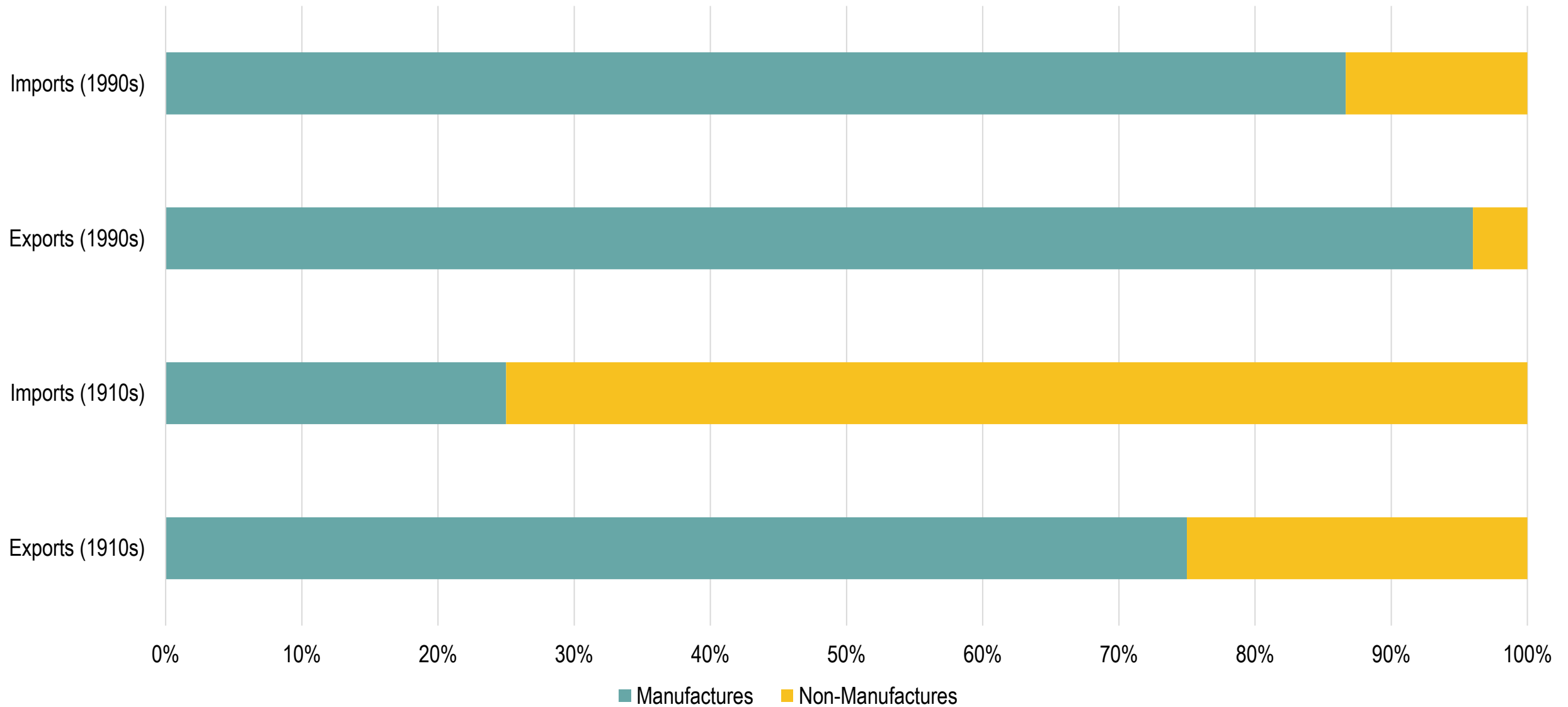
Absolute Advantages



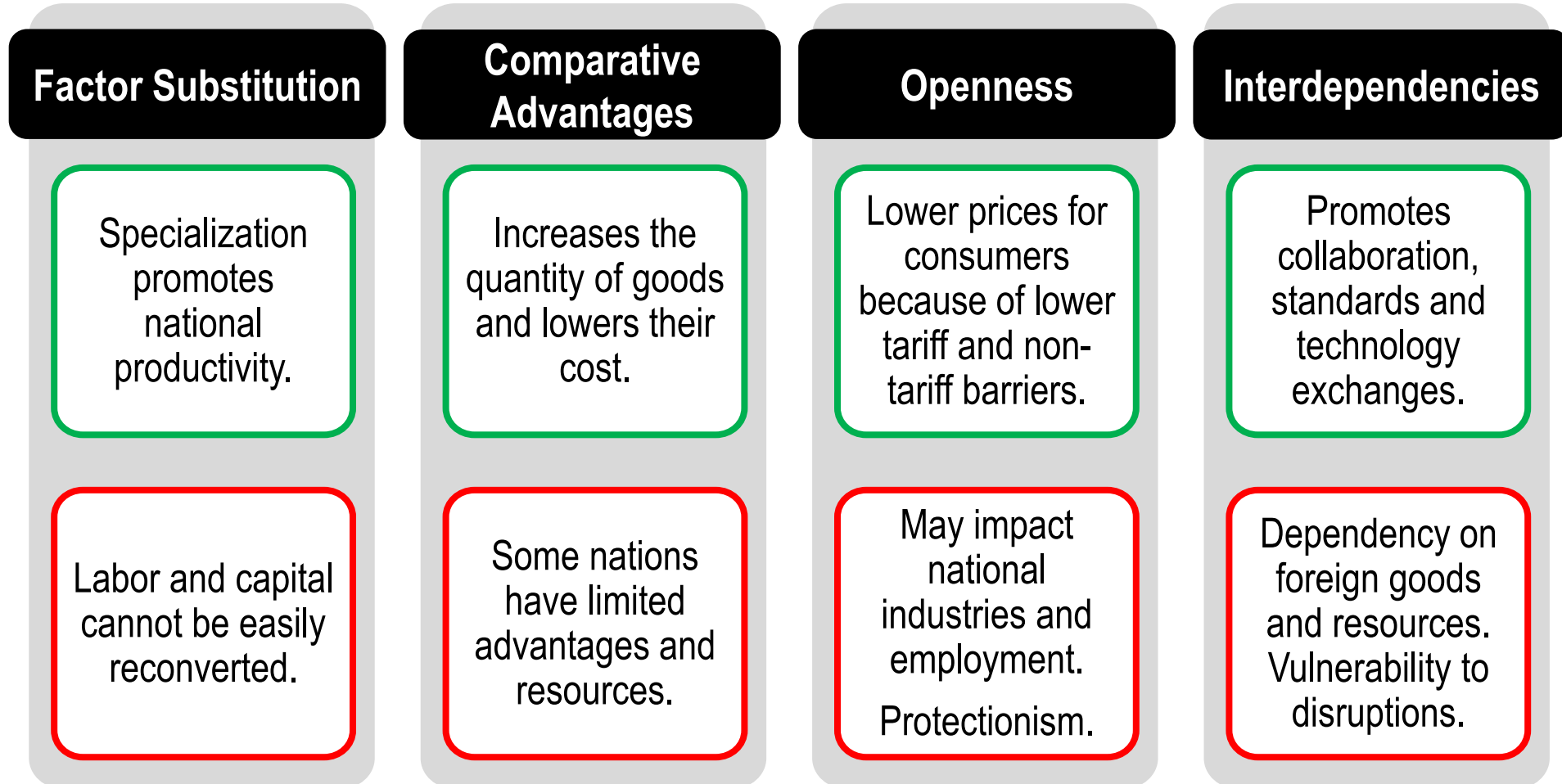
Comparative Advantages



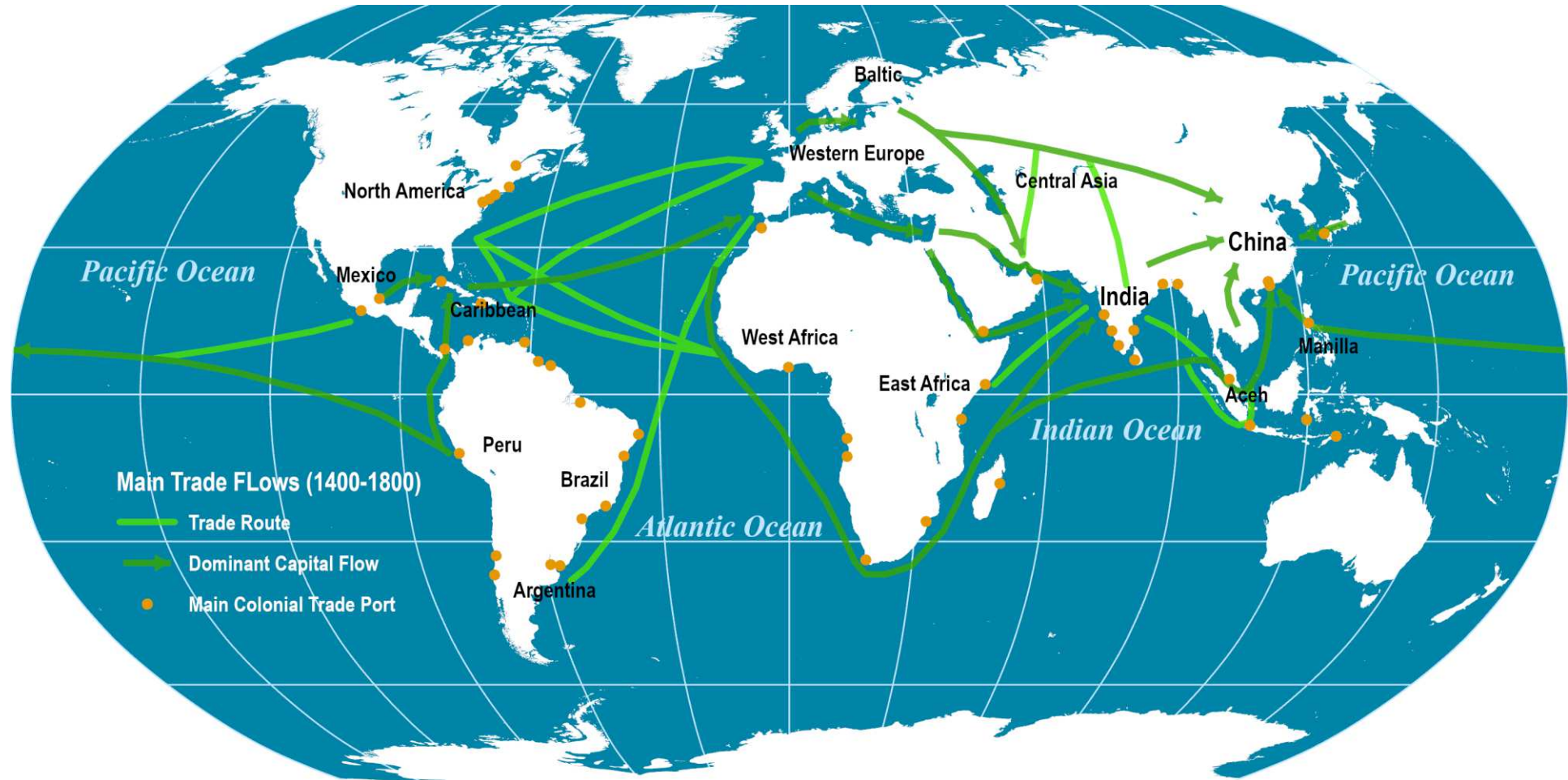
Composition of British Trade, 1910s and 1990s



Favorable and Contentious Factors in International Trade



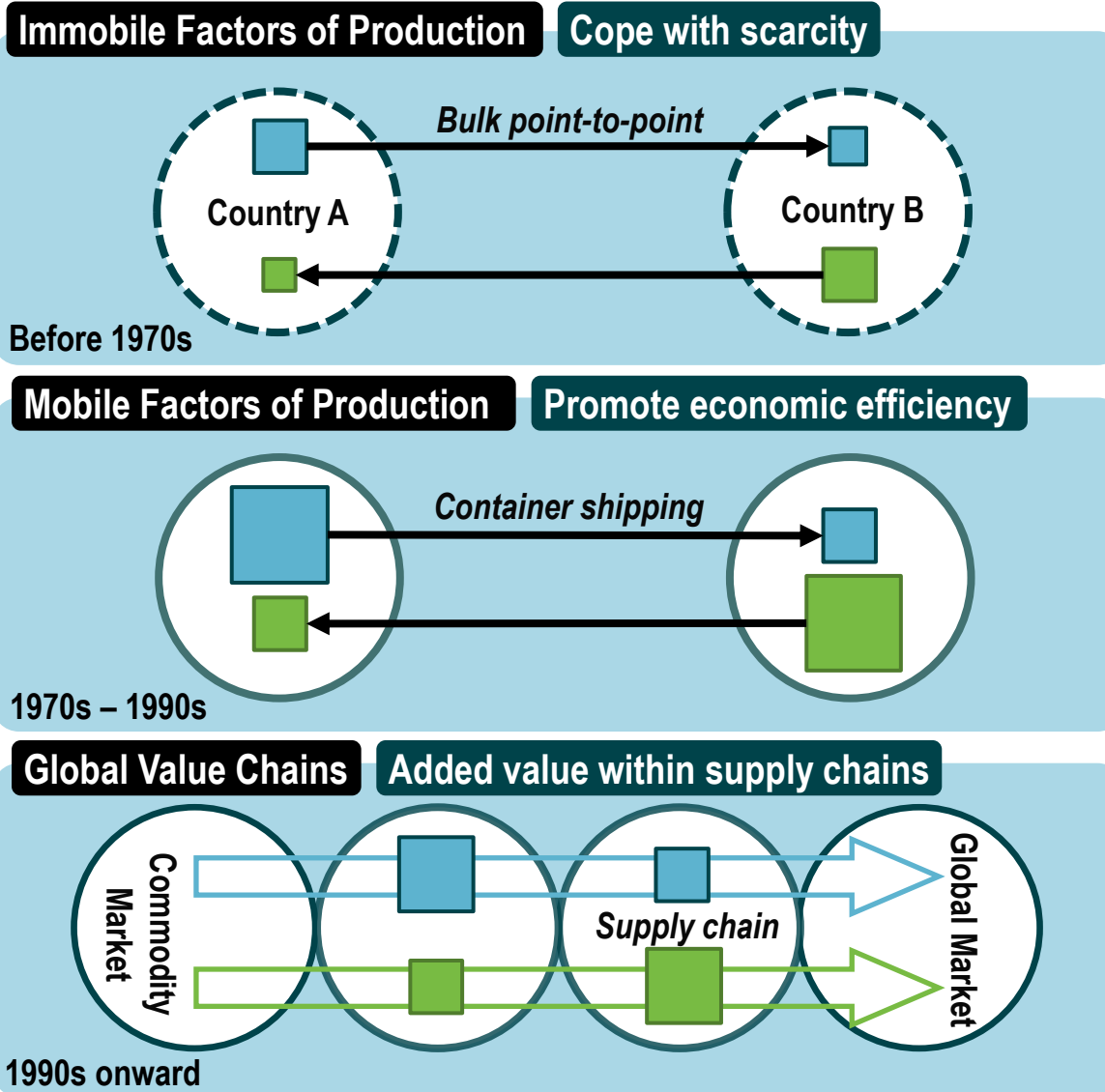
Major Global Trade Routes, 1400-1800



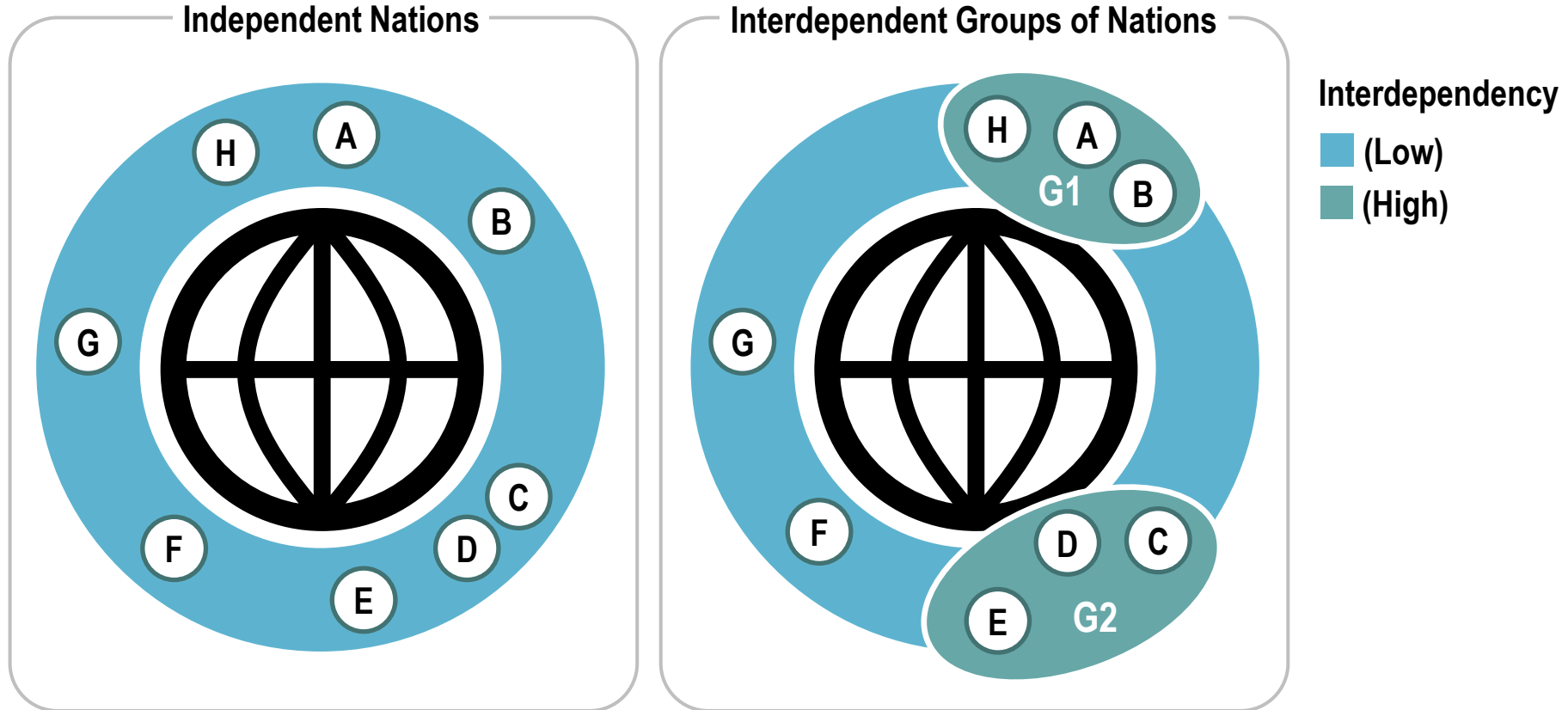
Standard International Trade Classification (SITC)

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)

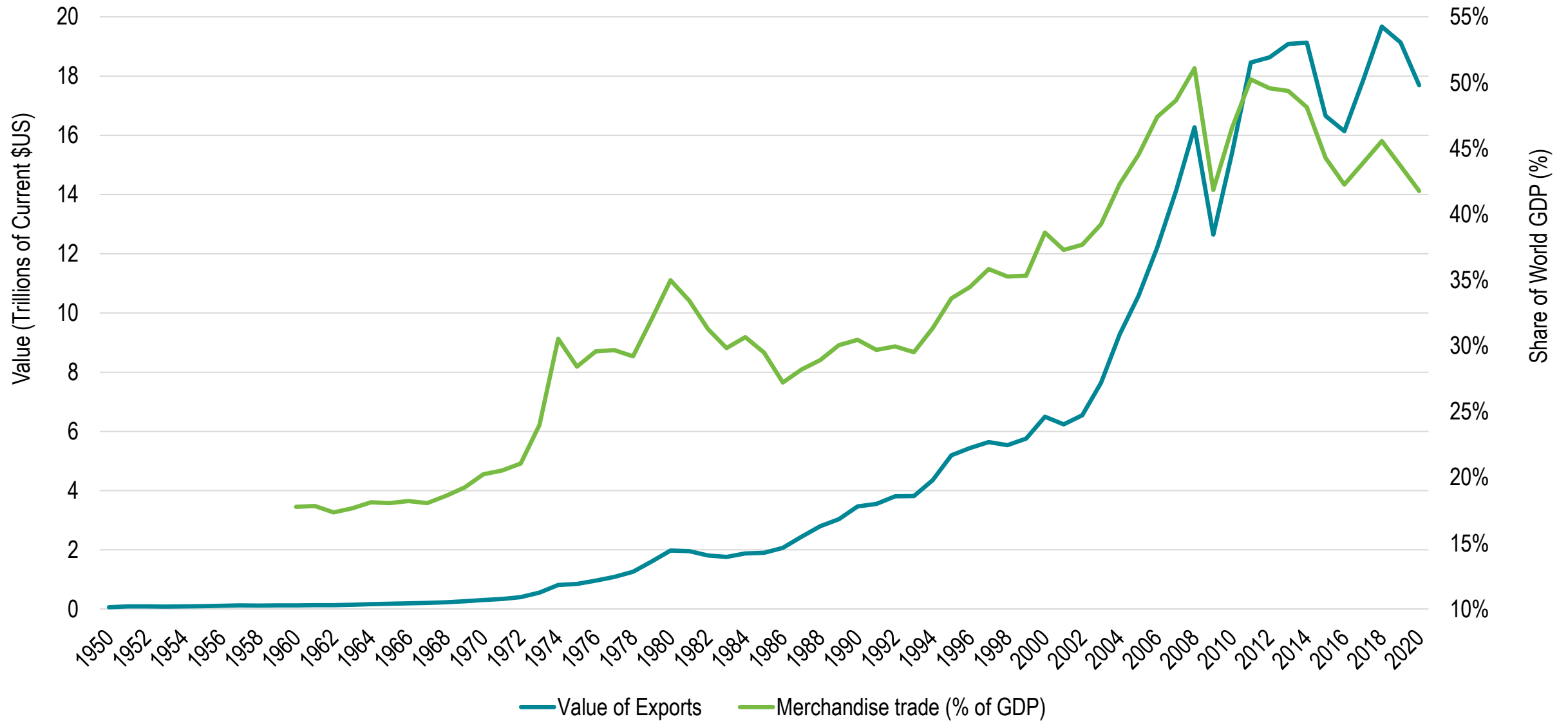
Changes in the Global Trade Environment



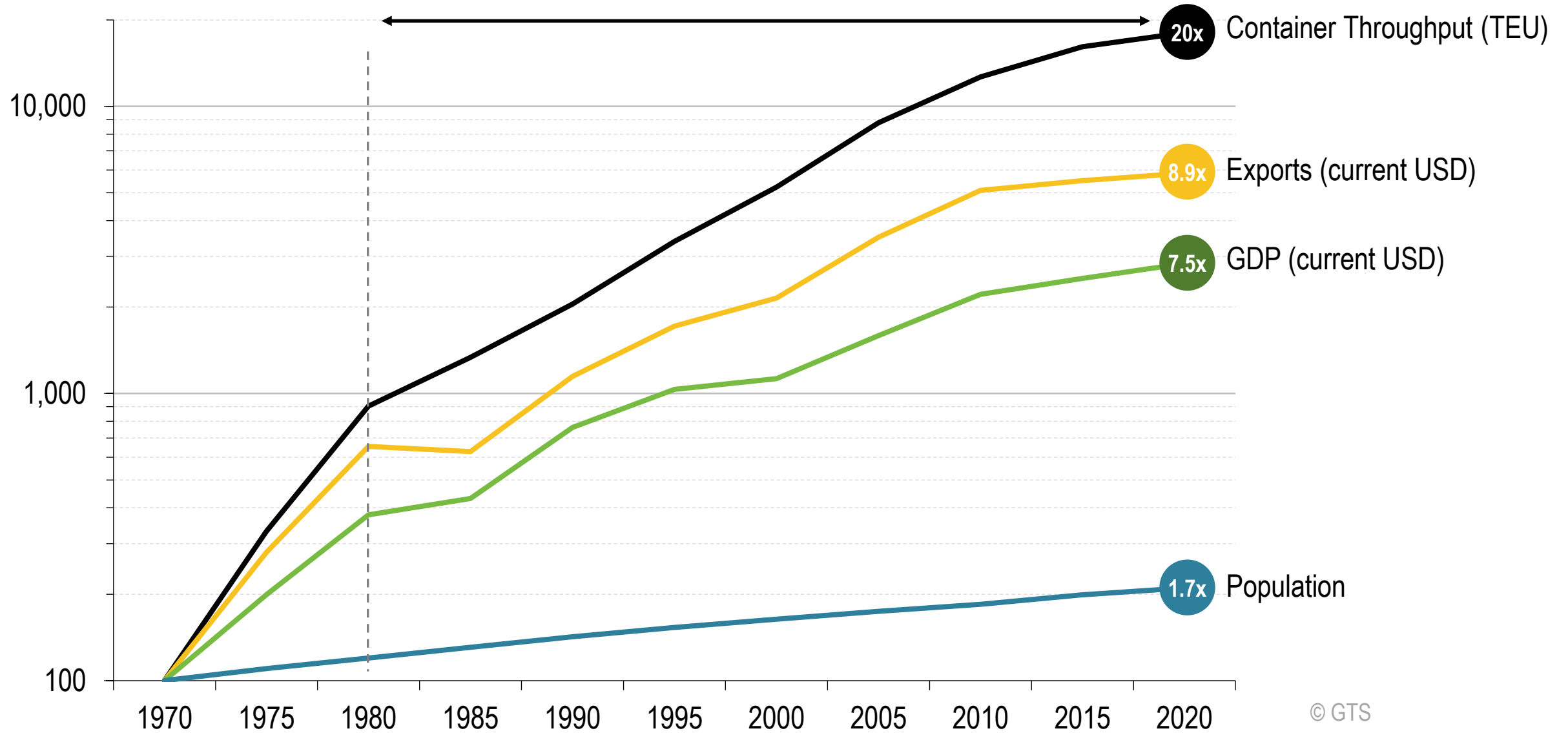
Economic Integration and Interdependencies



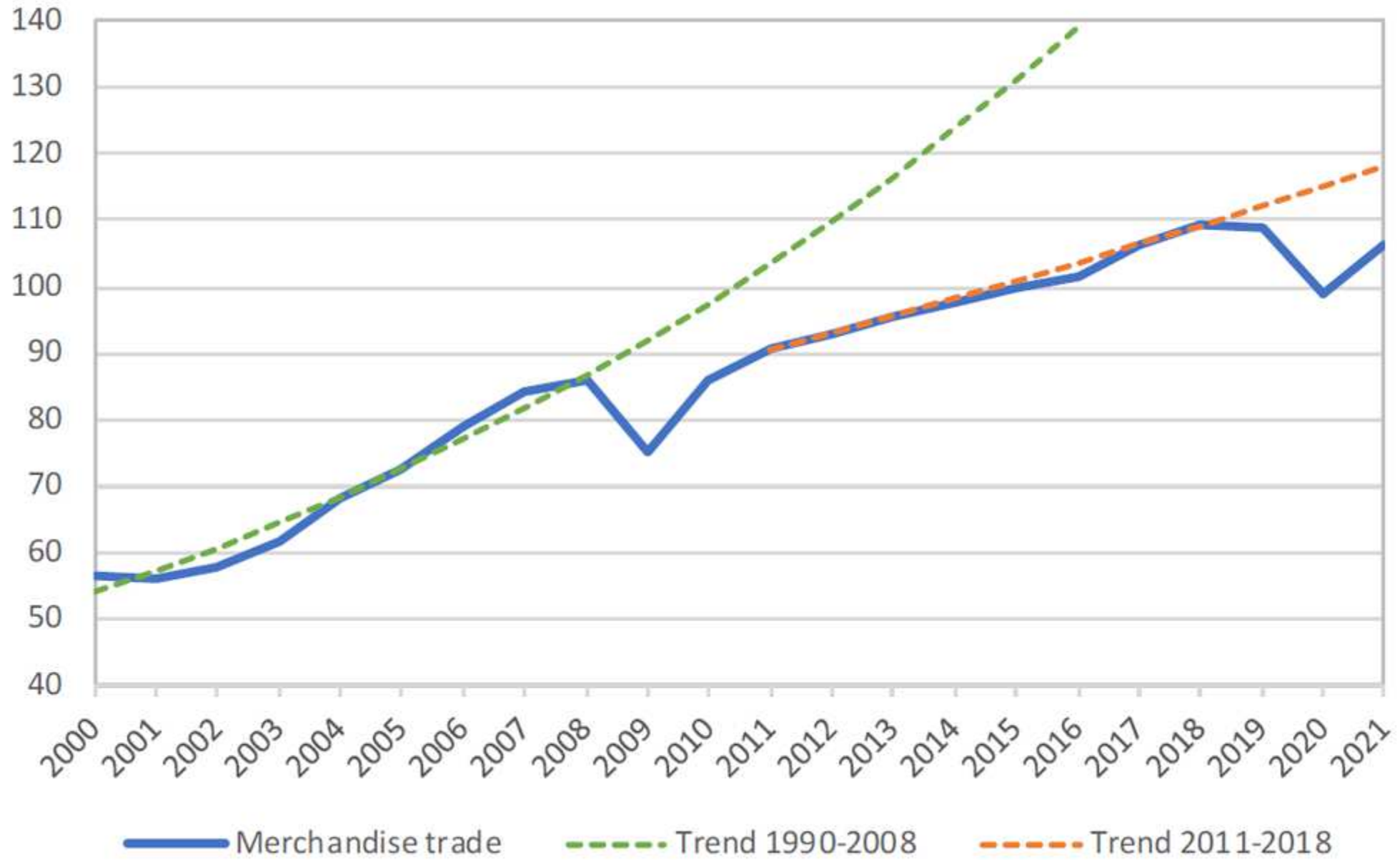
World Merchandise Trade, 1960-2020



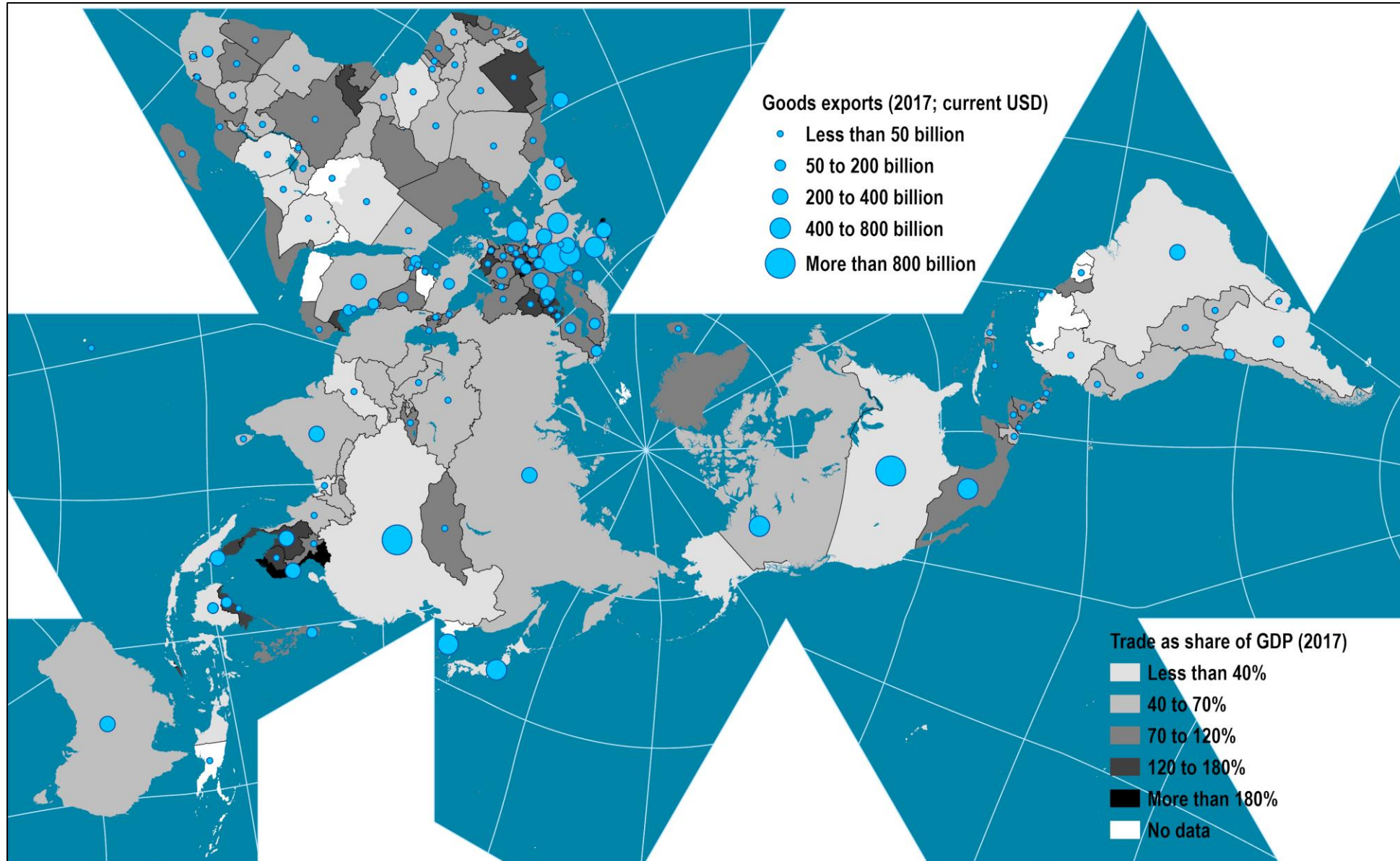
Global Trade and Container Throughput (1970=100)



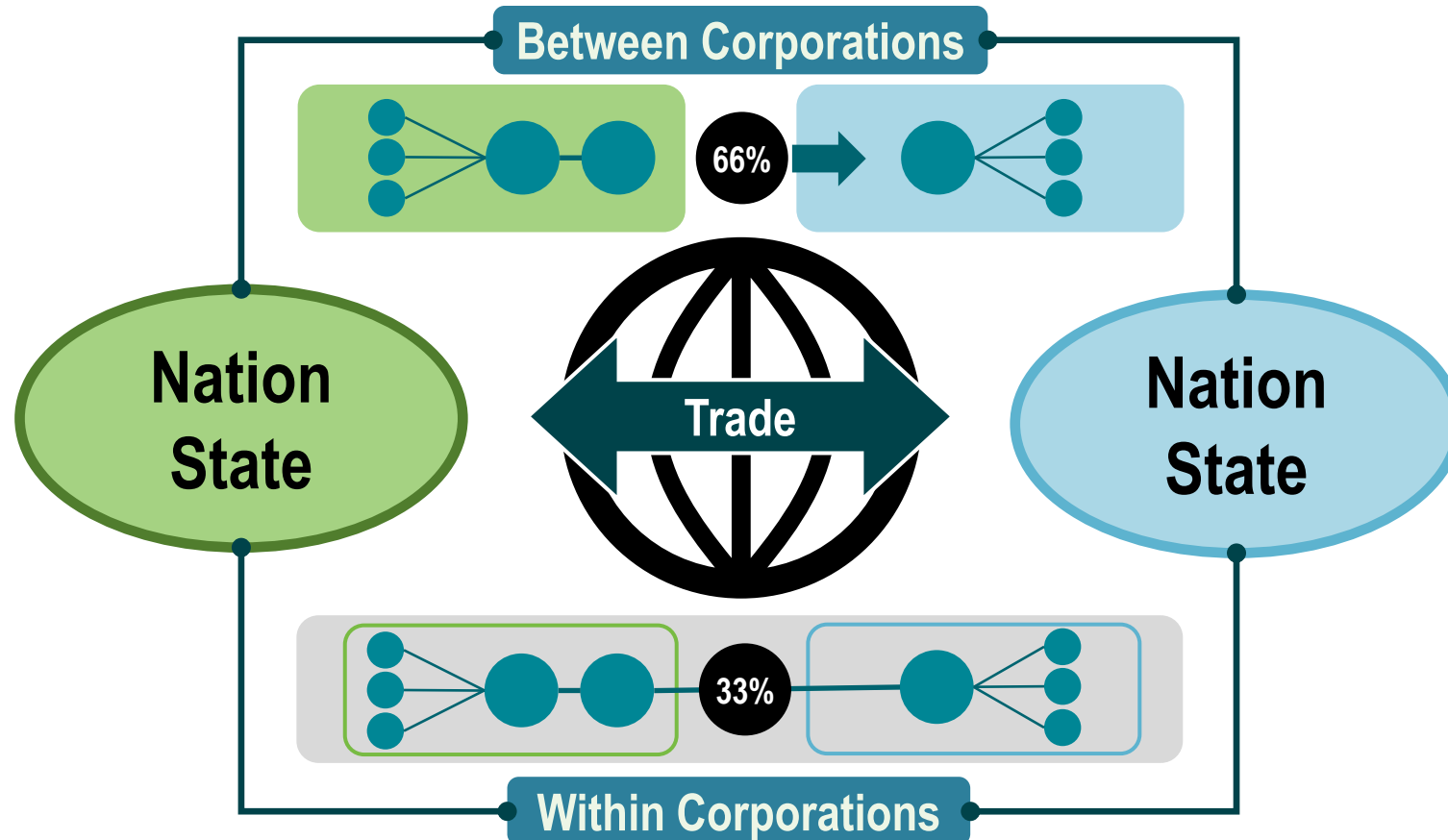
© GTS



Global Trade, 2017



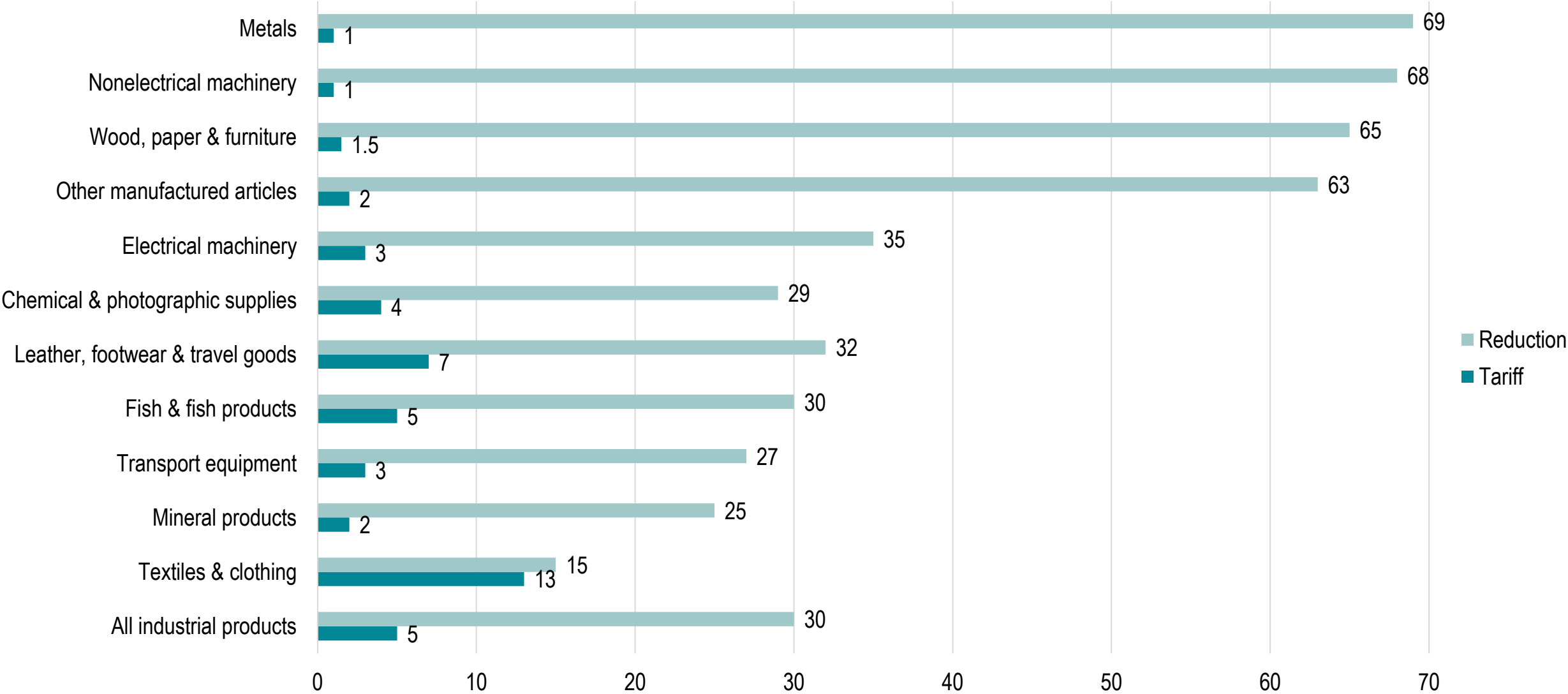
Trade Within and Between Corporations



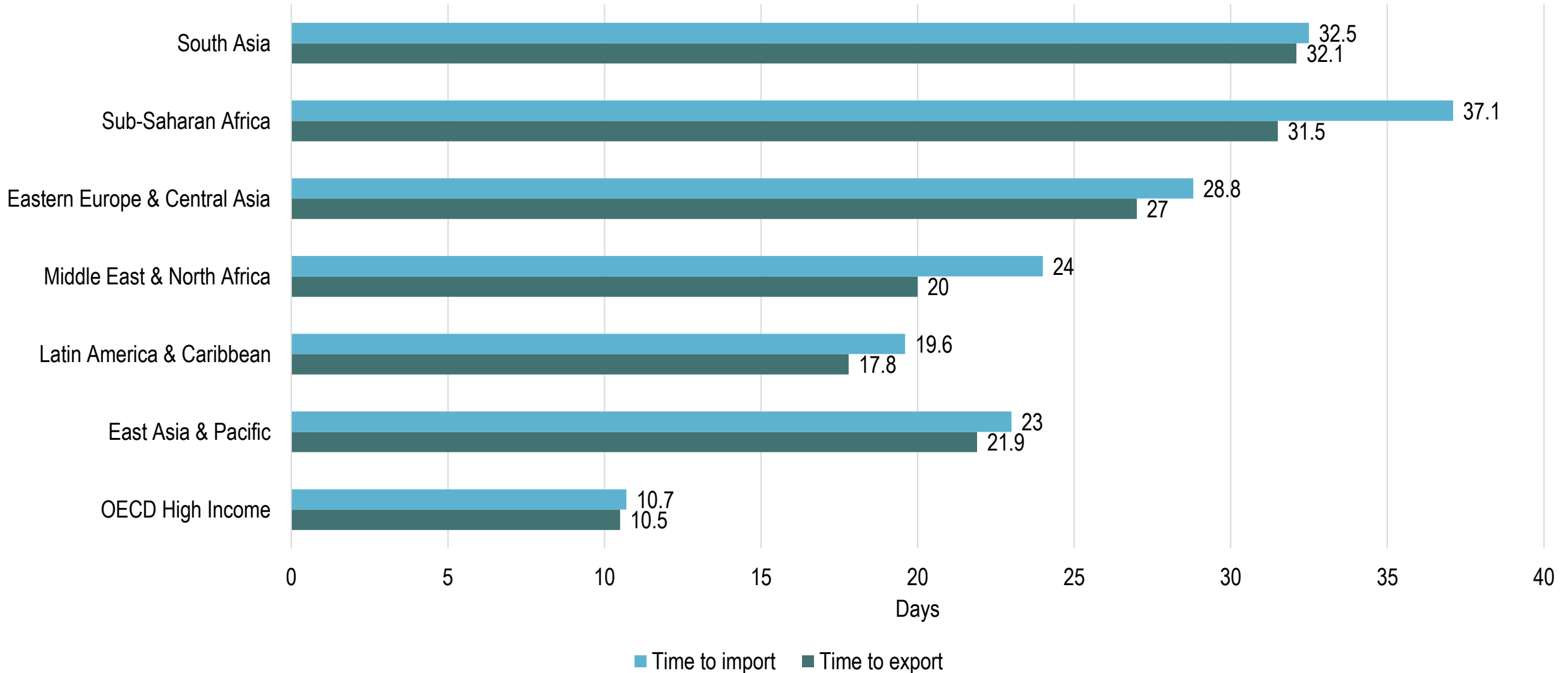
GATT Rounds

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.

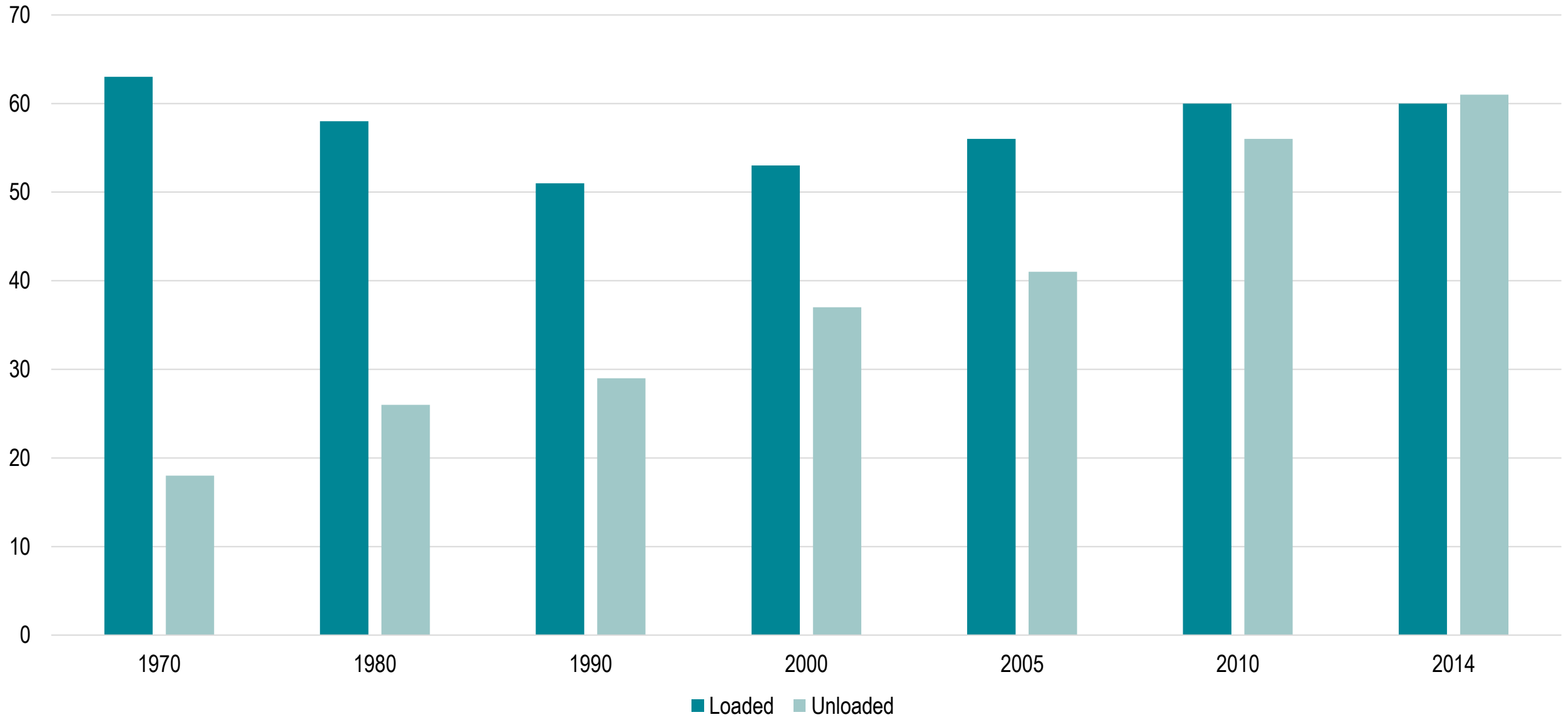
Average Tariffs after the Uruguay Round (%)



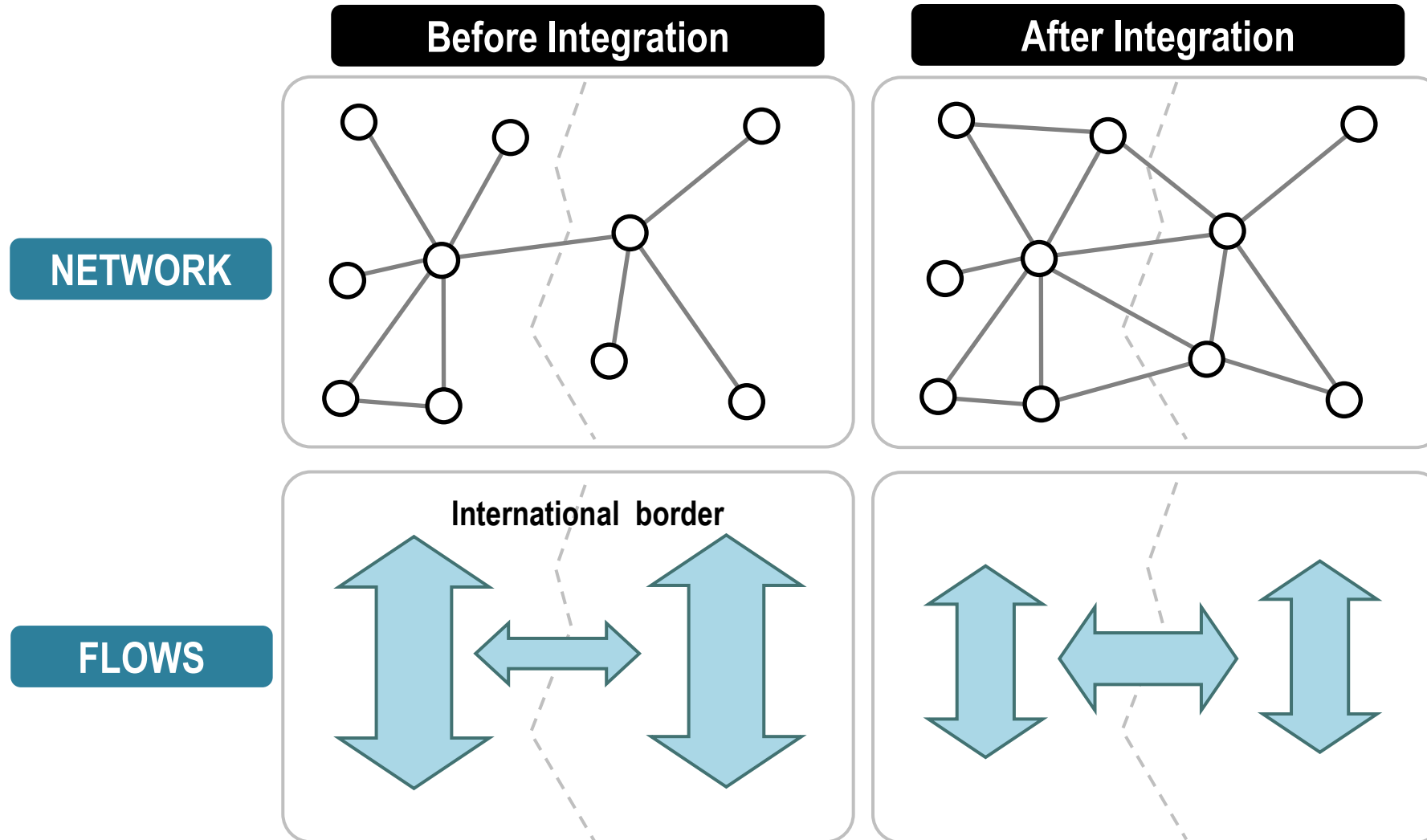
Regional Averages in Trading Across Borders, 2012



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.

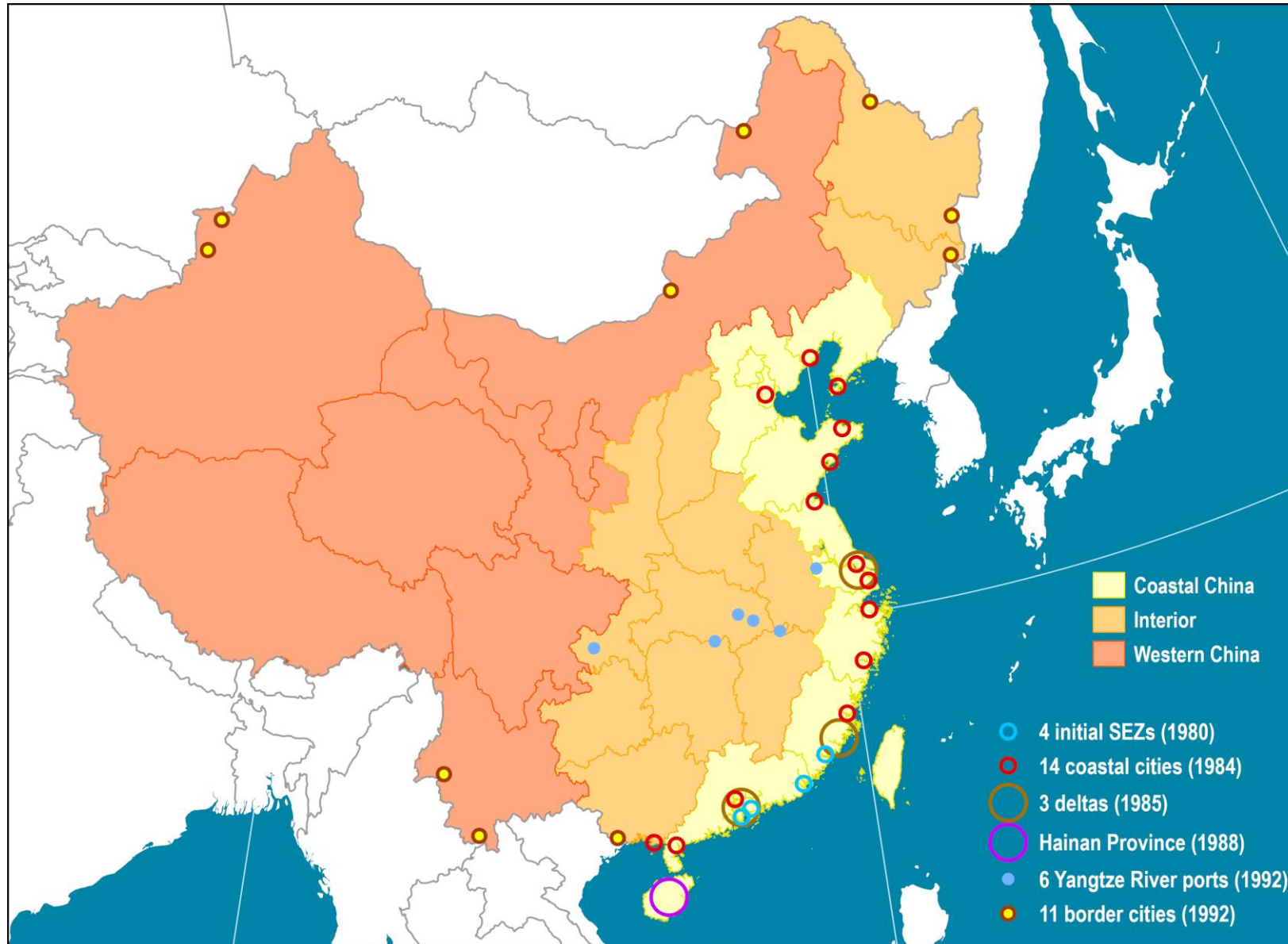
Export-oriented

Activities operating within the zone produce mainly or exclusively for foreign markets.

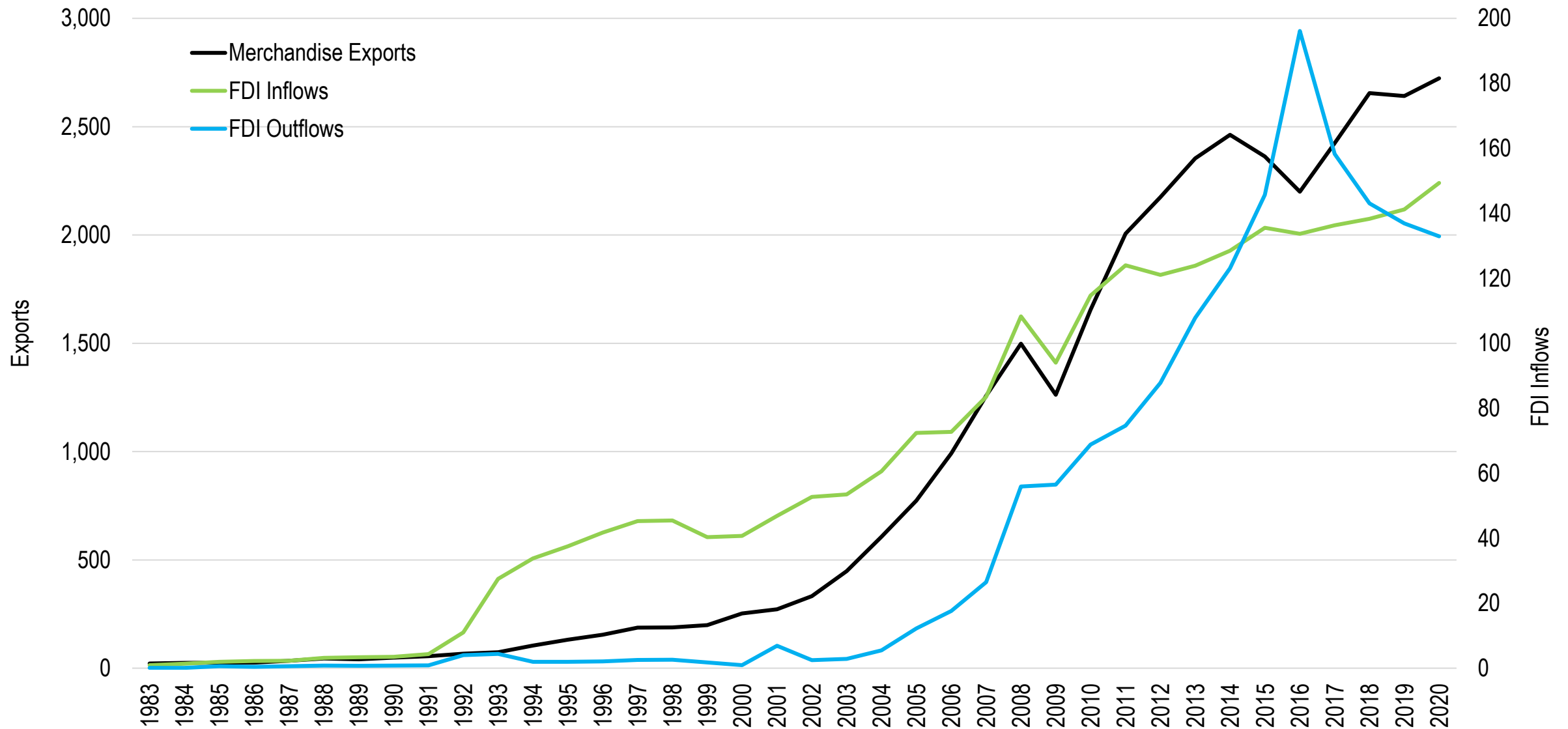
Incentives

Variety of incentives, including low cost land, infrastructures, tax and duty exemptions or various subsidies.

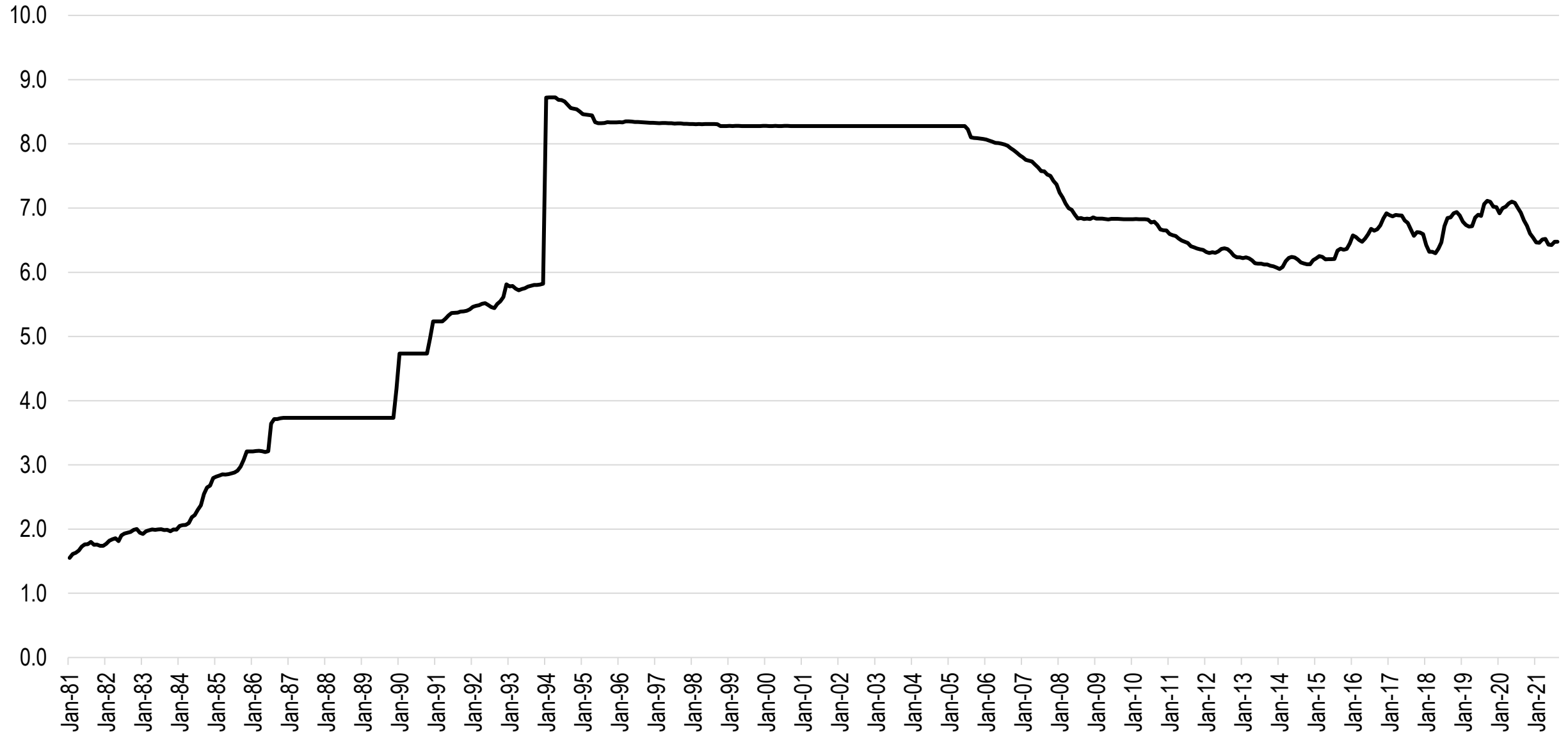
China's Special Economic Zones



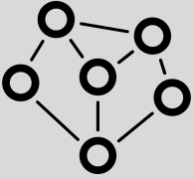

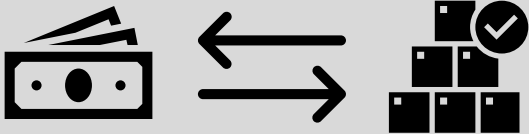
Value of Chinese Exports and FDI, 1983-2020 (Billions of \$US)



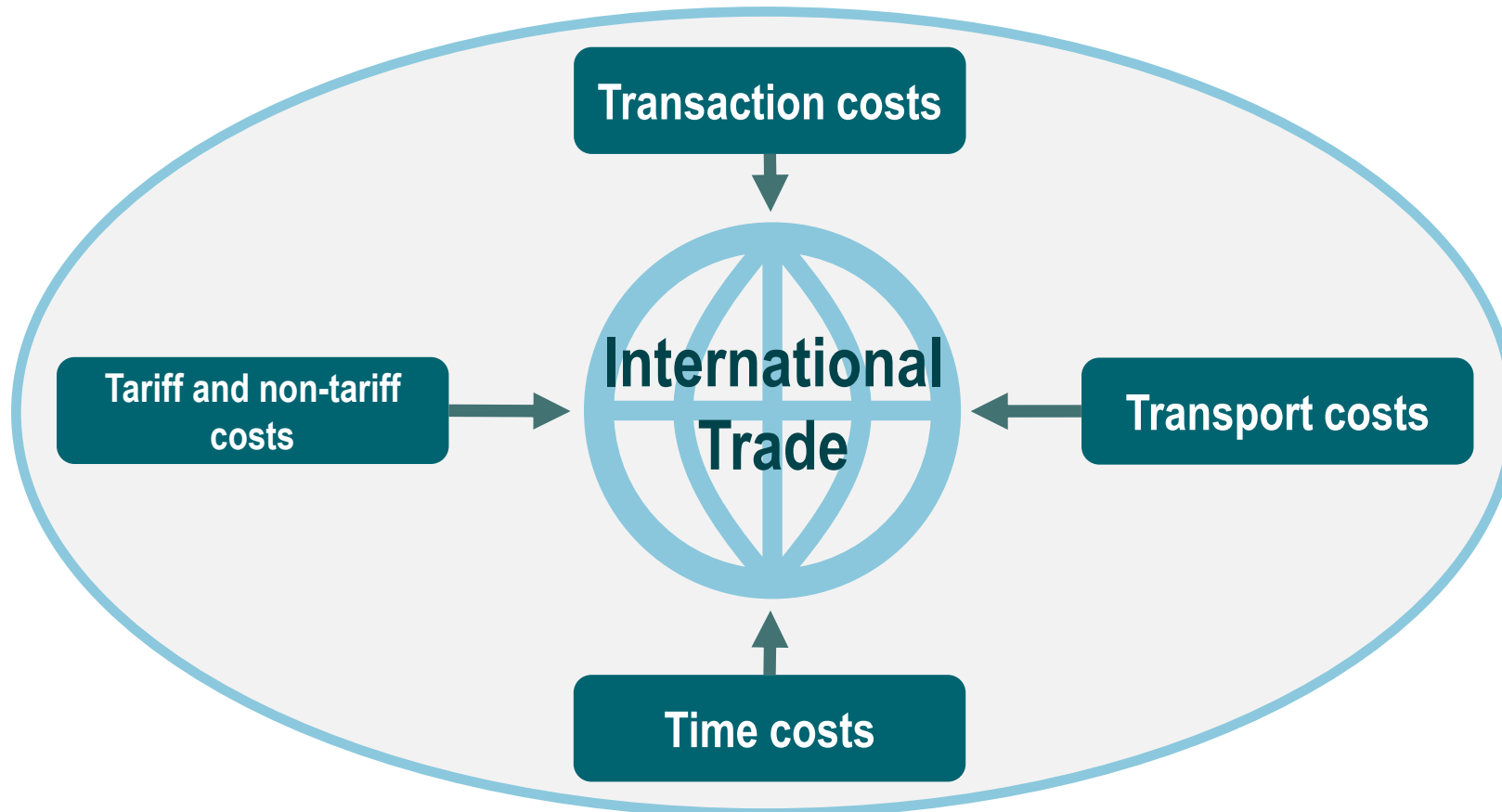
Yuan Exchange Rate (per USD), 1981-2021 (Monthly)



The Main Dimensions of Trade Facilitation

	Integration-Based	Distribution-Based	Transactions-Based
Nature	 <p>Compliance to rules and regulations.</p>	 <p>Physical capacity to support trade.</p>	 <p>Setting transactions and receiving compensation.</p>
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.

The “Four Ts” in International Trade



Separation Factors

Exogenous

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

Country Specific Factors

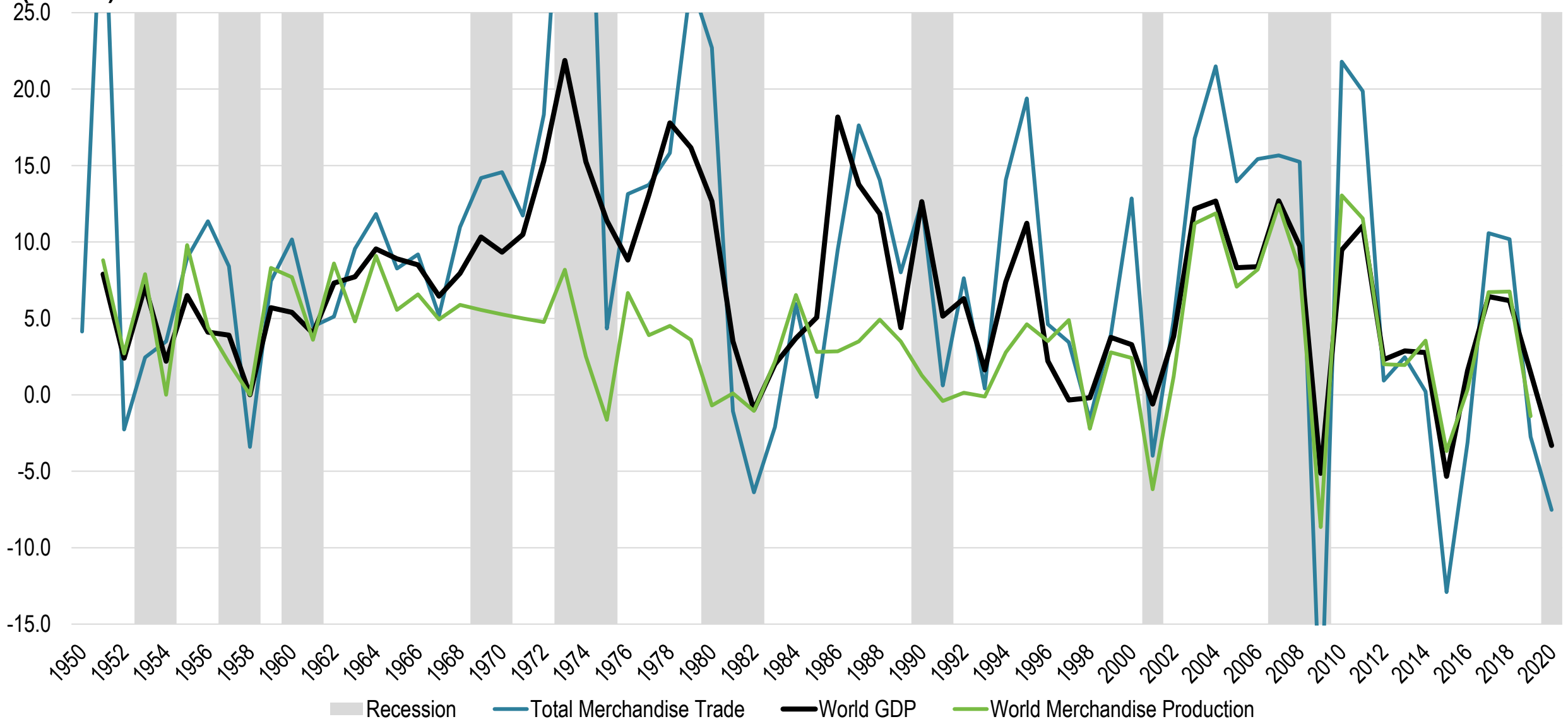
Endogenous

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

Phases of the Export-Oriented Paradigm

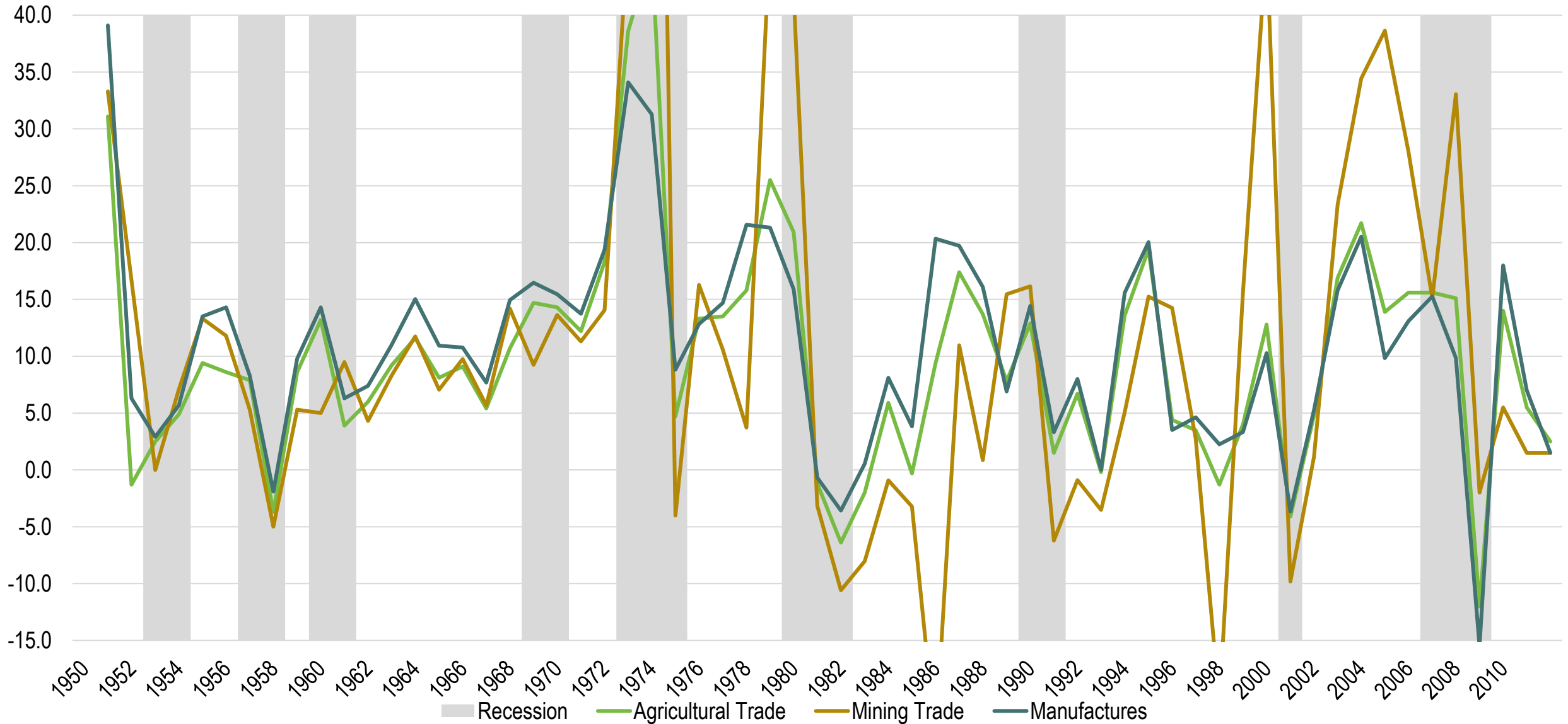
	Phase I	Phase II	Phase III
Capital	Currency devaluation. Mostly Foreign Direct Investments (FDI).	Surge in FDI, but growing share of national capital.	Pressures to revalue currency. Drop in FDI. National capital dominant. Providing FDI to other markets.
Production	Numerous comparative advantage. Focusing 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, 1950-2020 (in %)

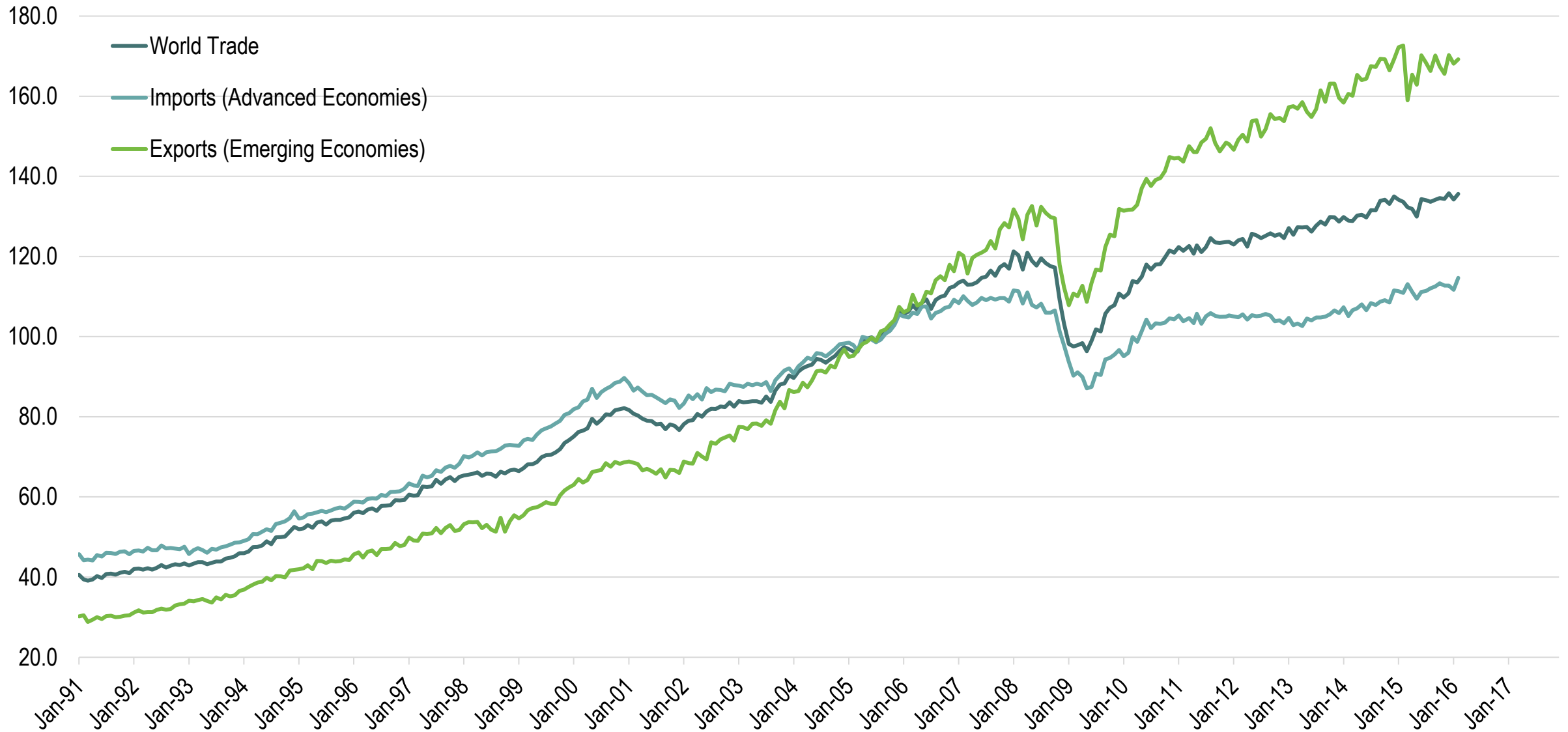


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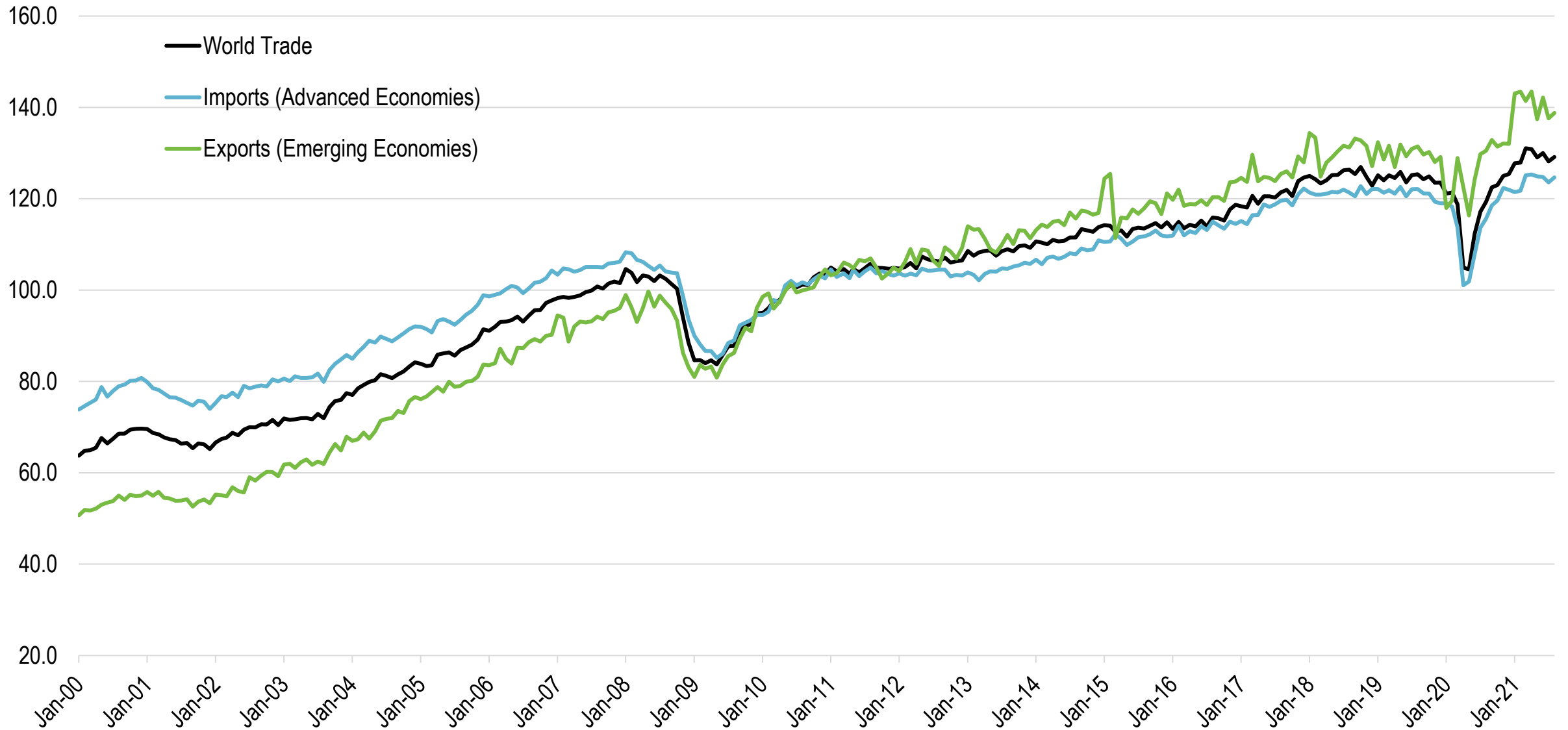
Changes in the Value of World Trade per Type of Merchandise, 1950-2012 (in %)



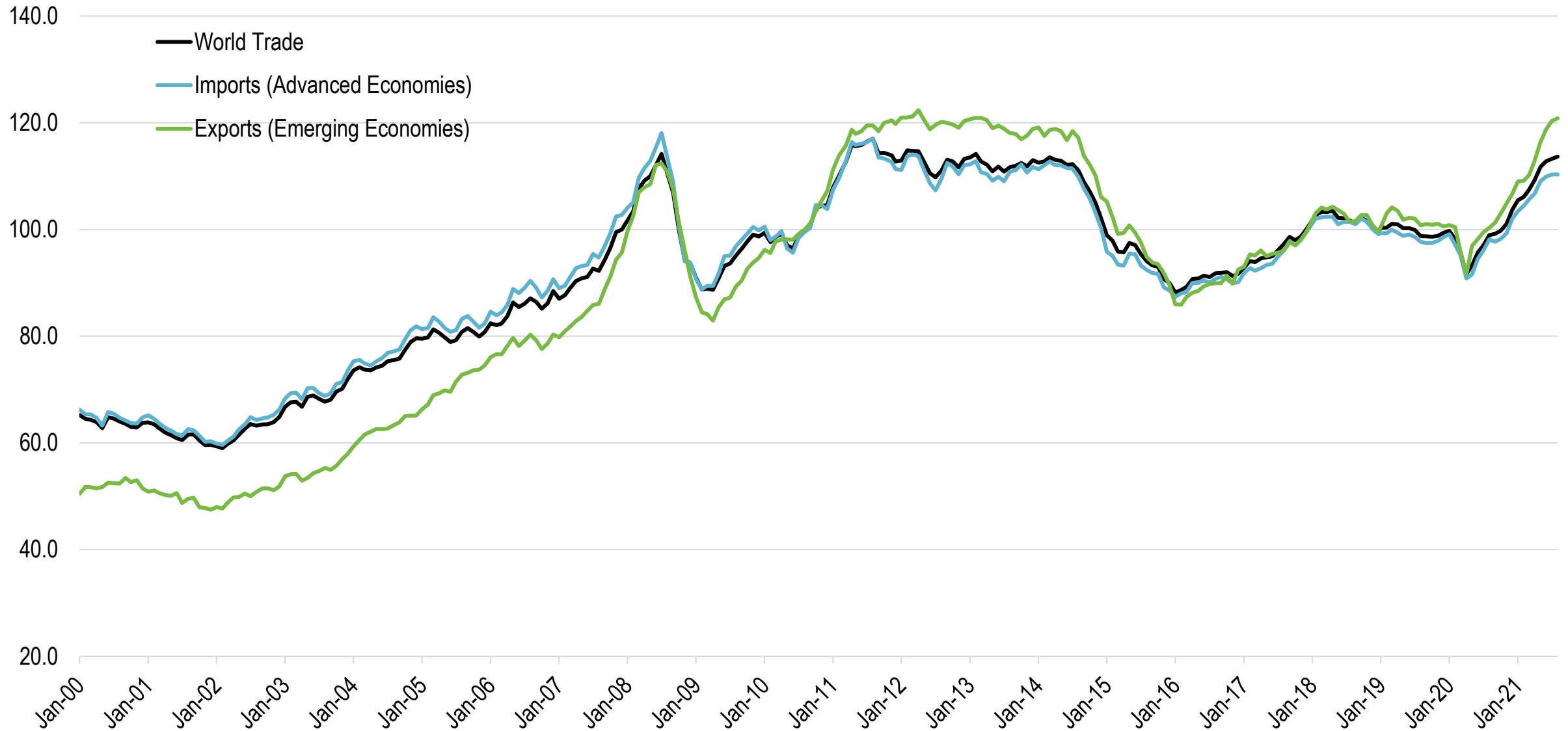
CPB World Trade Index by Volume, 1991-2017 (2005=100)



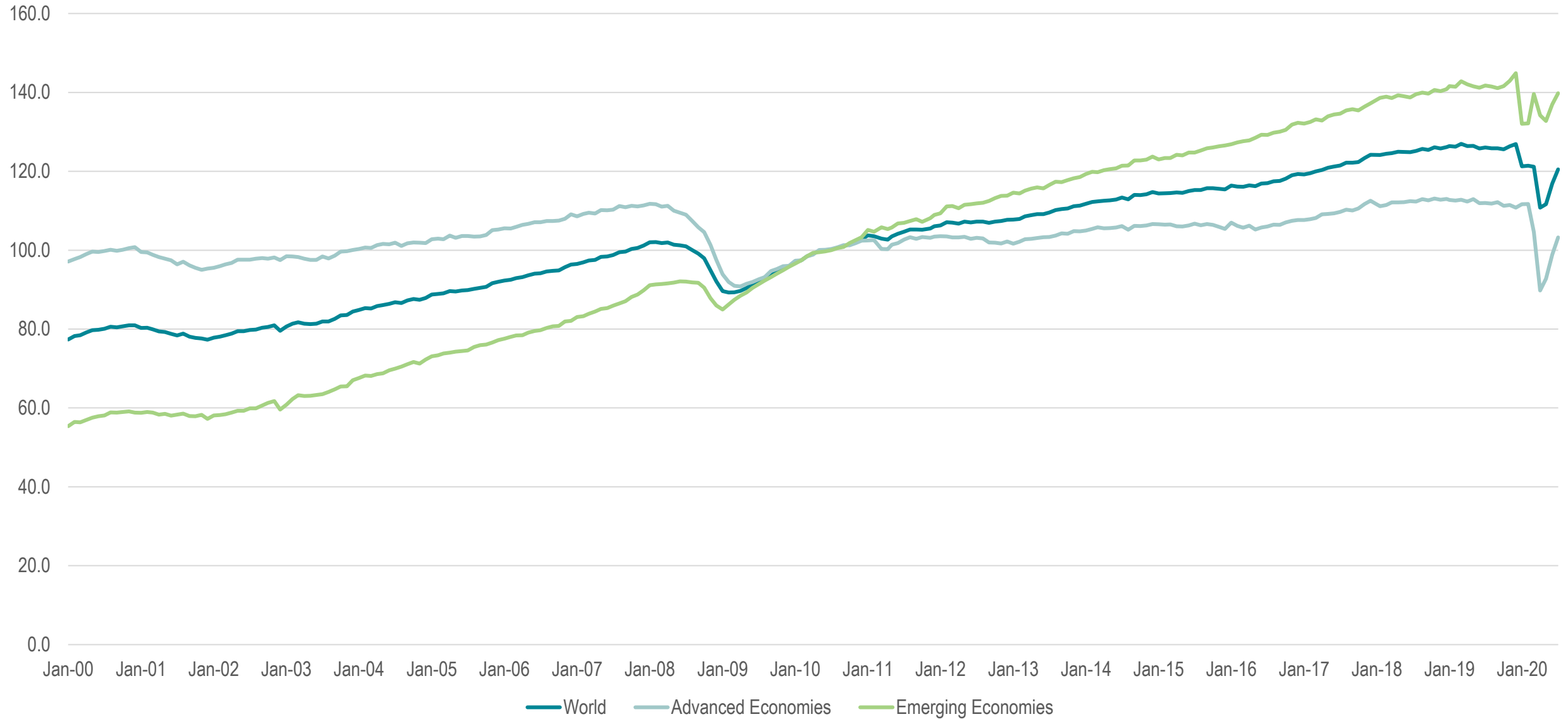
CPB World Trade Index by Volume, 2000-2021 (2010=100)



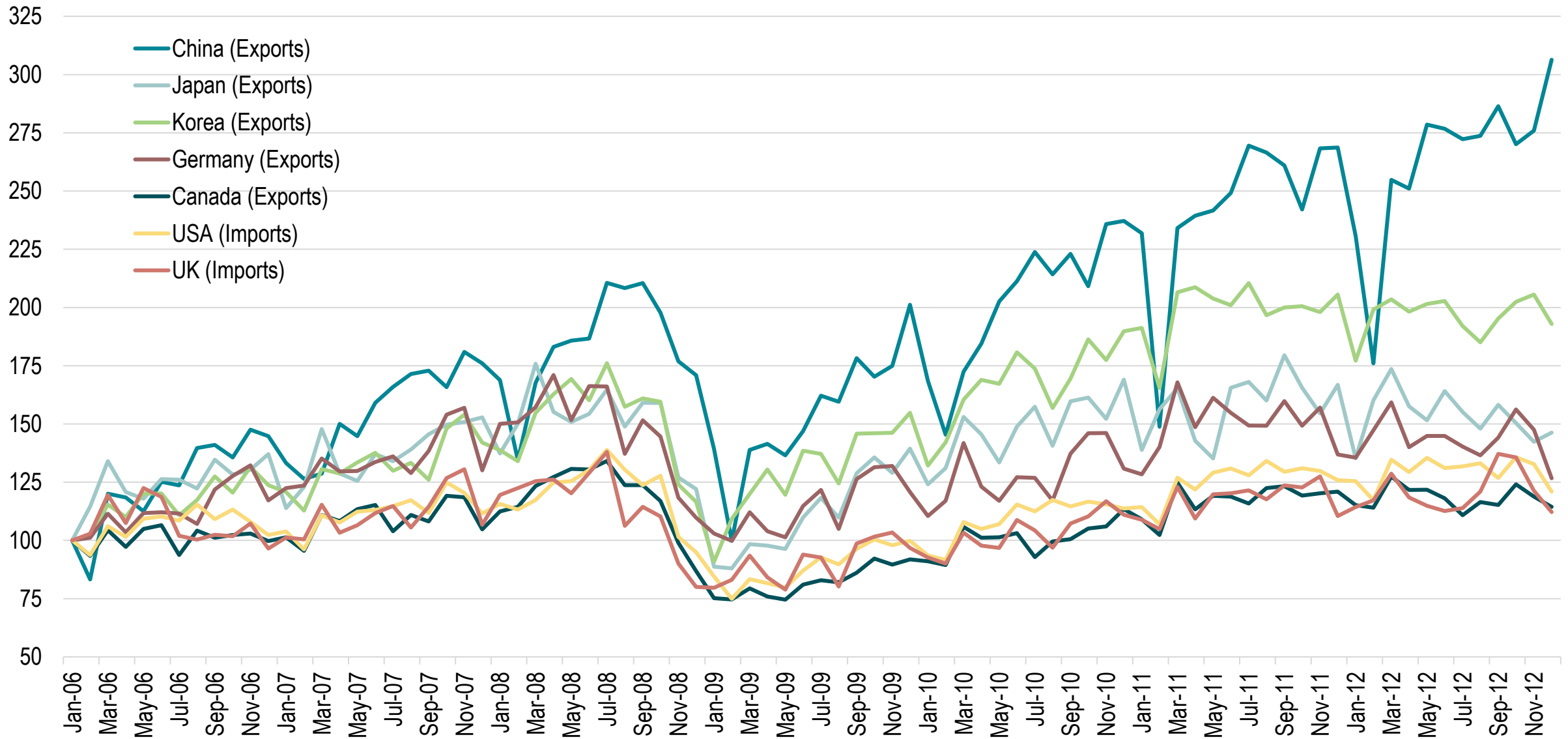
CPB World Trade Index by Value, 2000-2021 (2010=100)



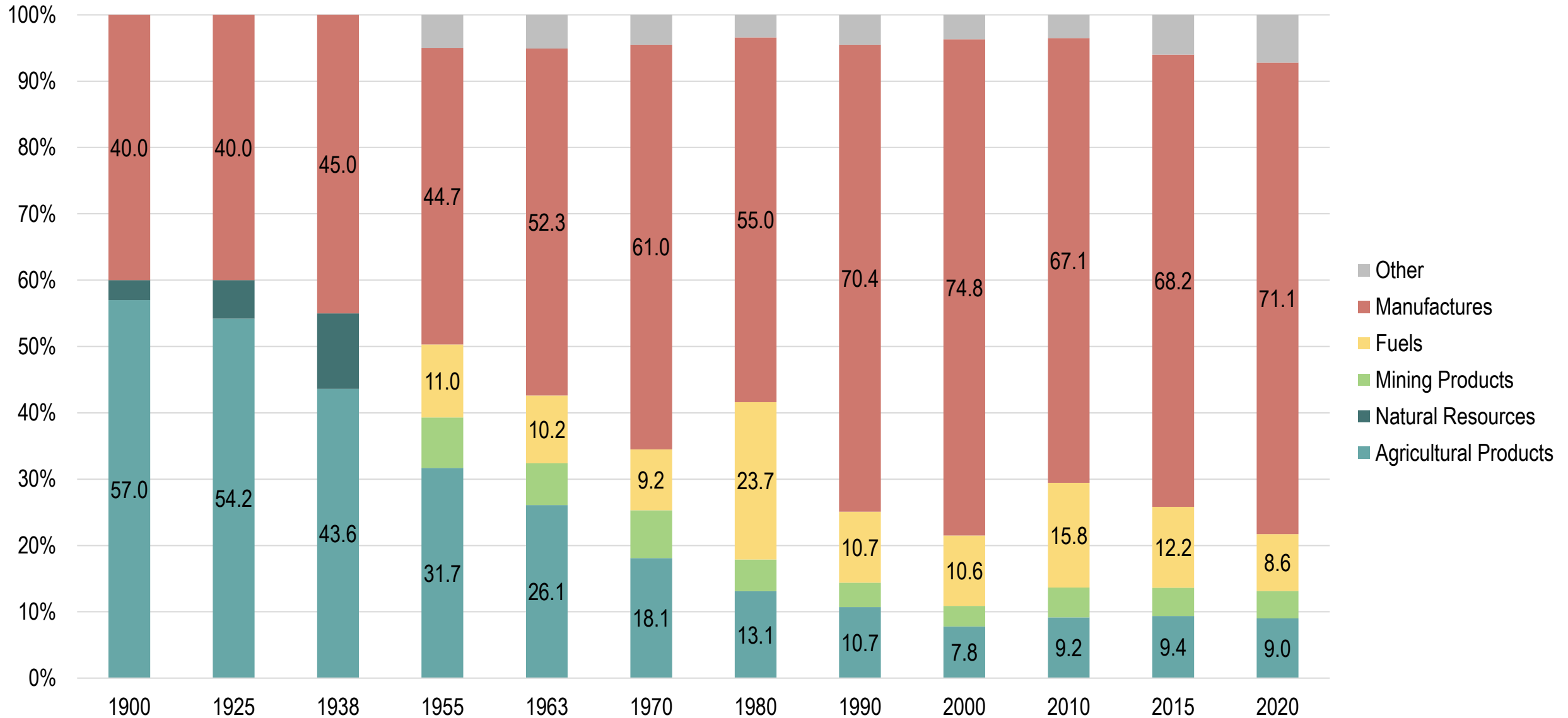
CPB World Production Index, 2000-2020 (2010=100)



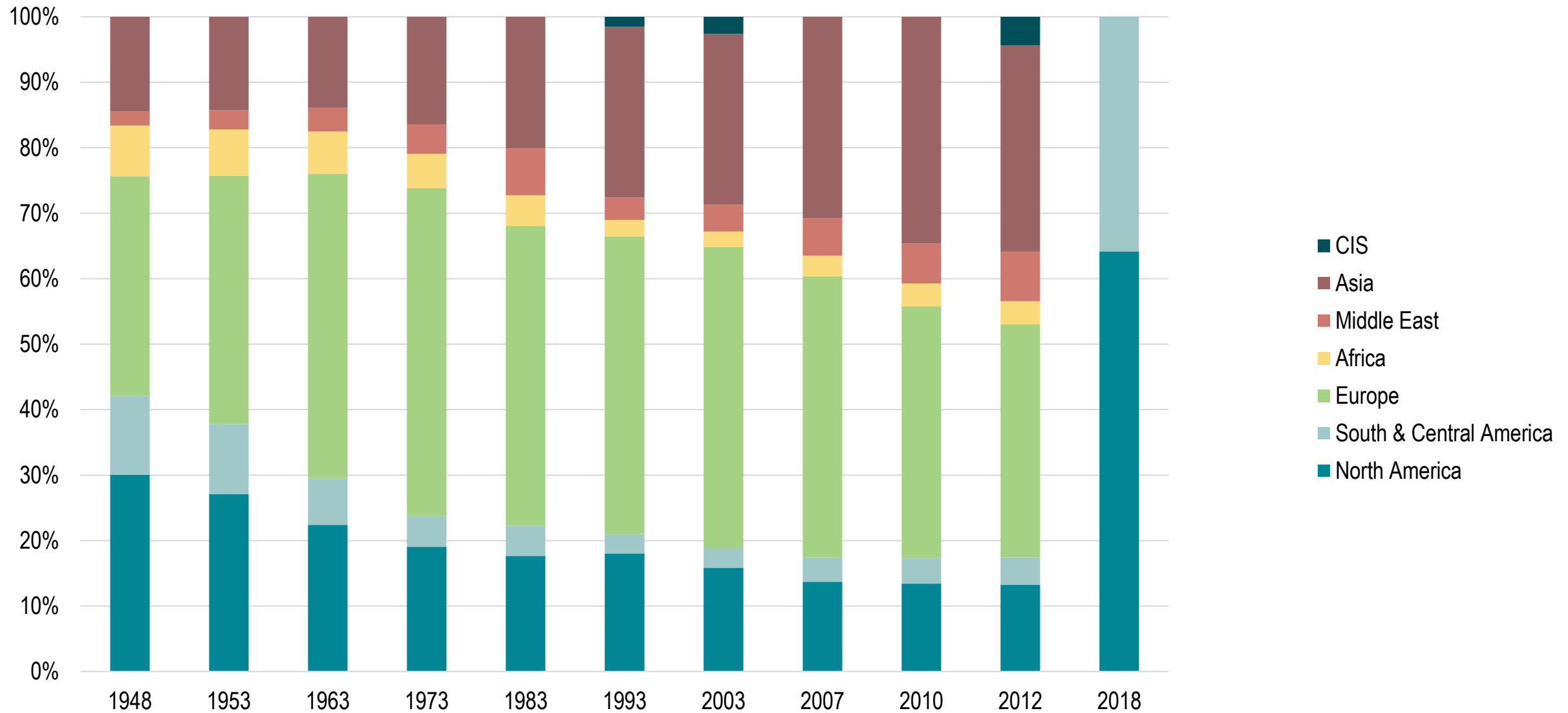
Monthly Value of Exports or Imports, Selected Traders, 2006-2012 (Jan 2006=100)



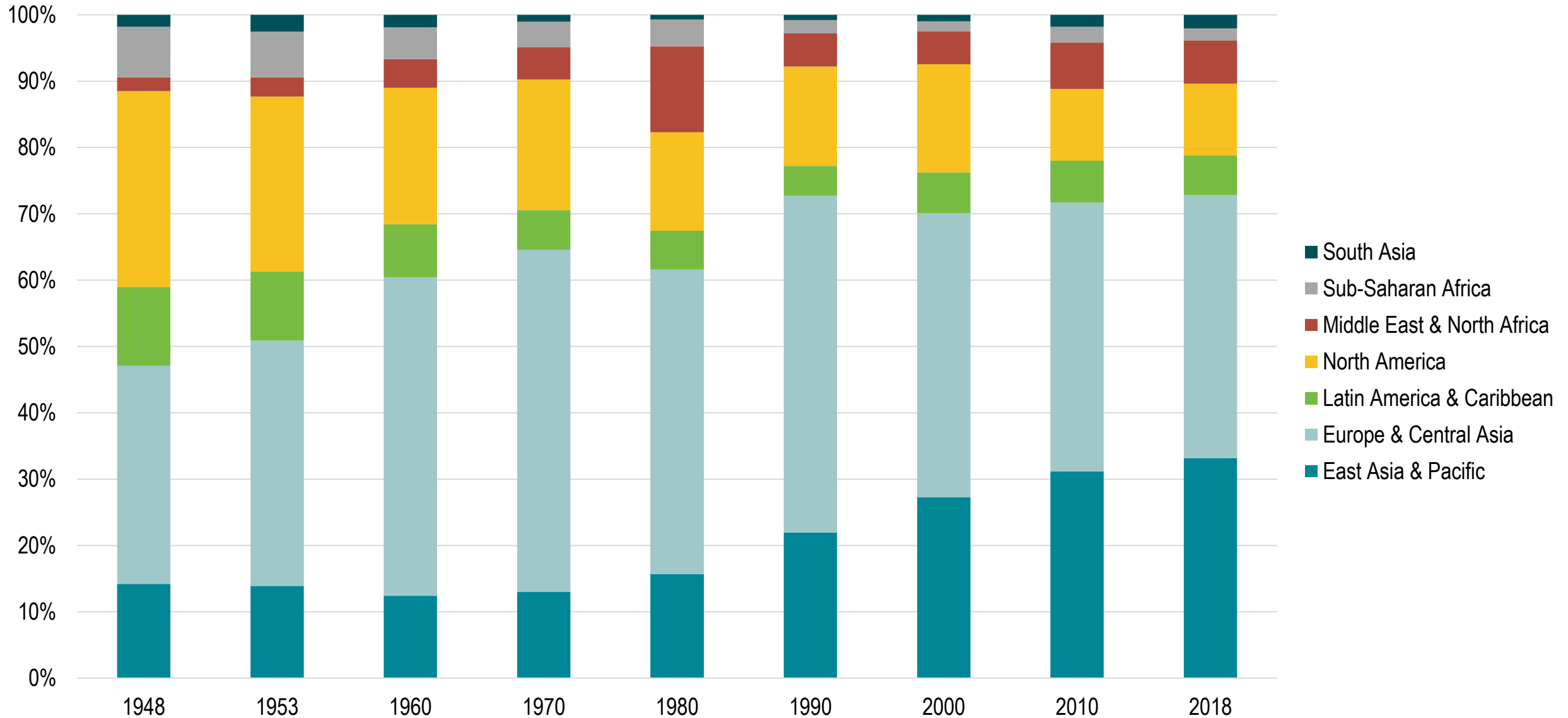
Share of Product Groups in World Merchandise Trade, 1900-2020



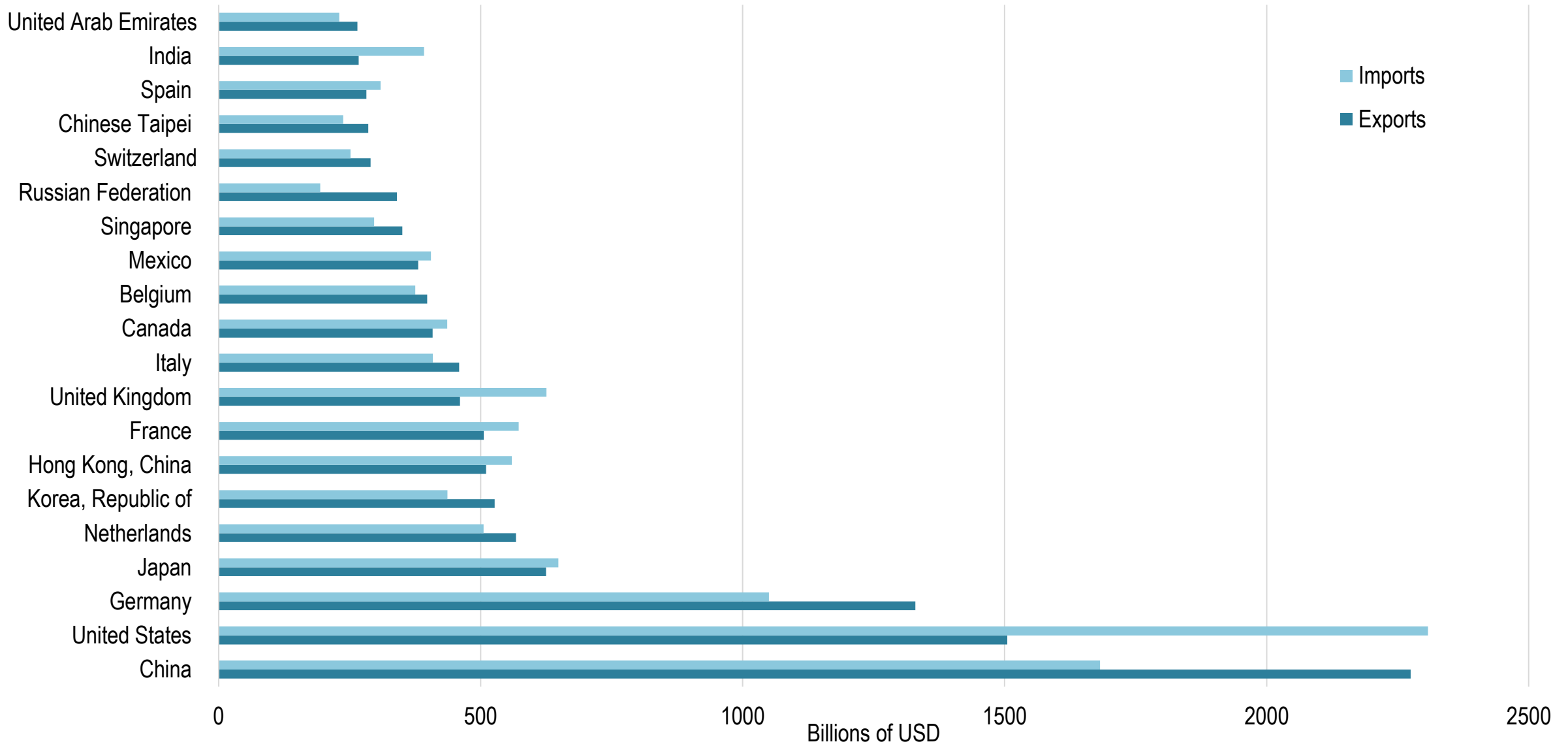
Share of Merchandise Exports by Region, 1948-2012



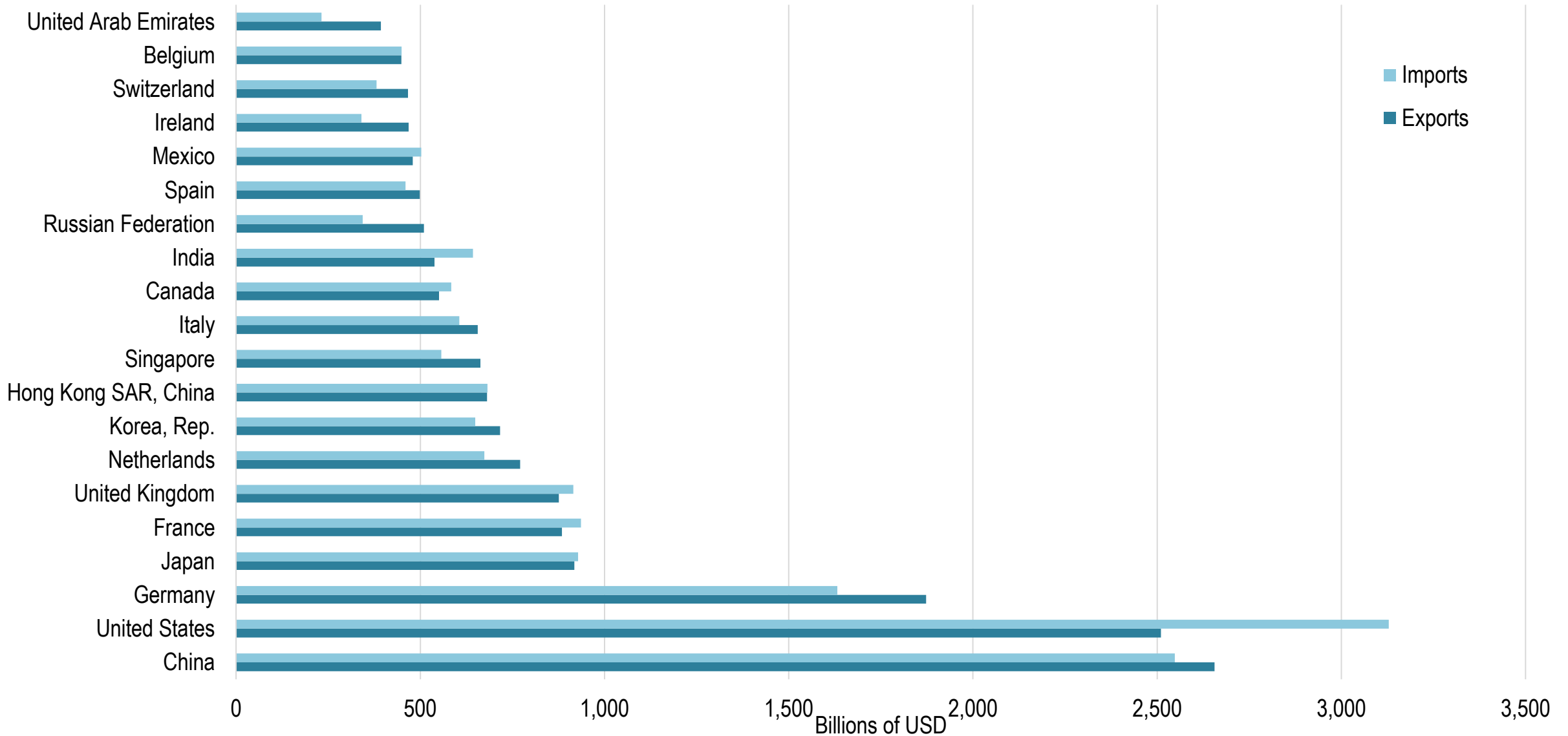
Share of Merchandise Exports by Region, 1948-2018



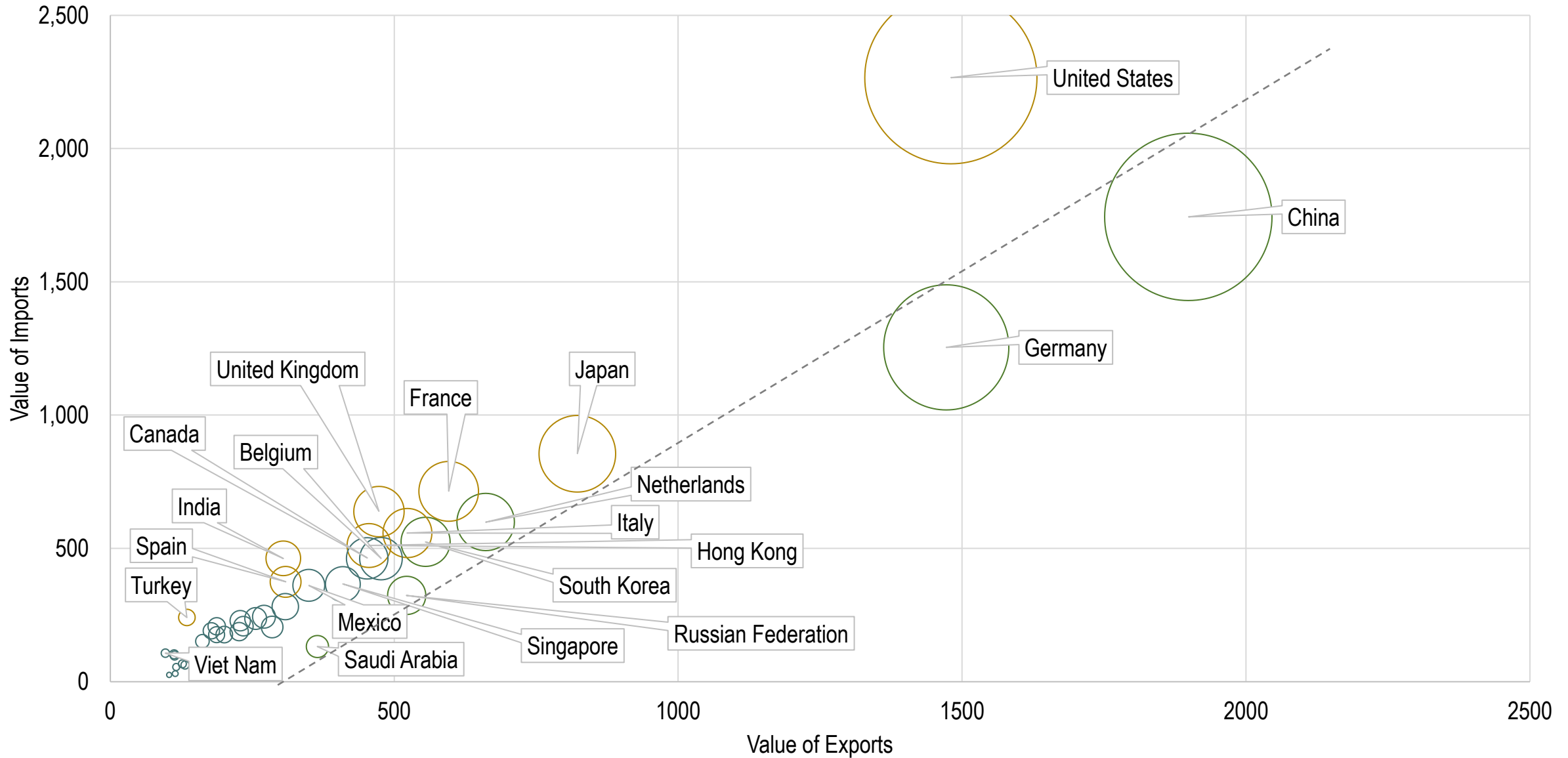
World's 20 Largest Exporters and Importers, 2015



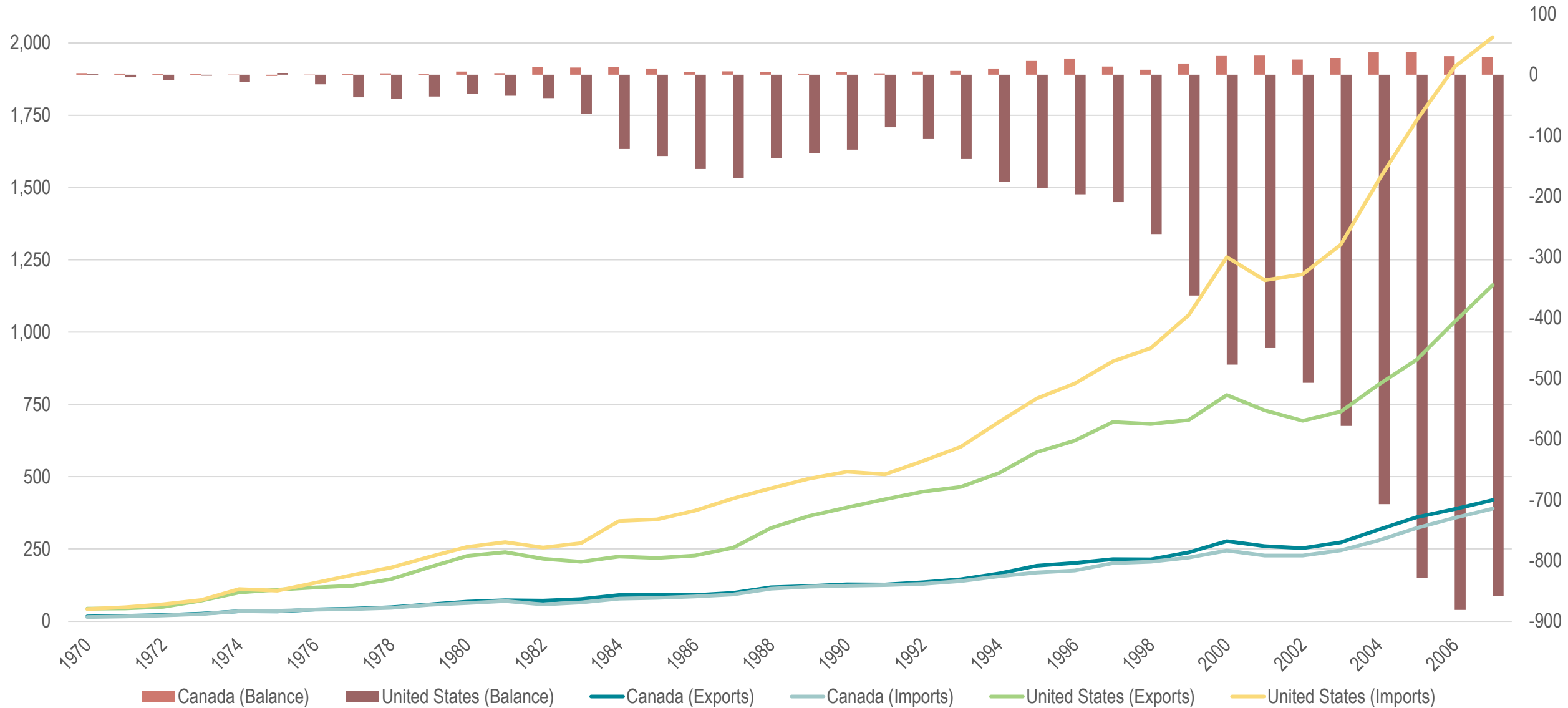
World's 20 Largest Exporters and Importers of Goods and Services, 2018



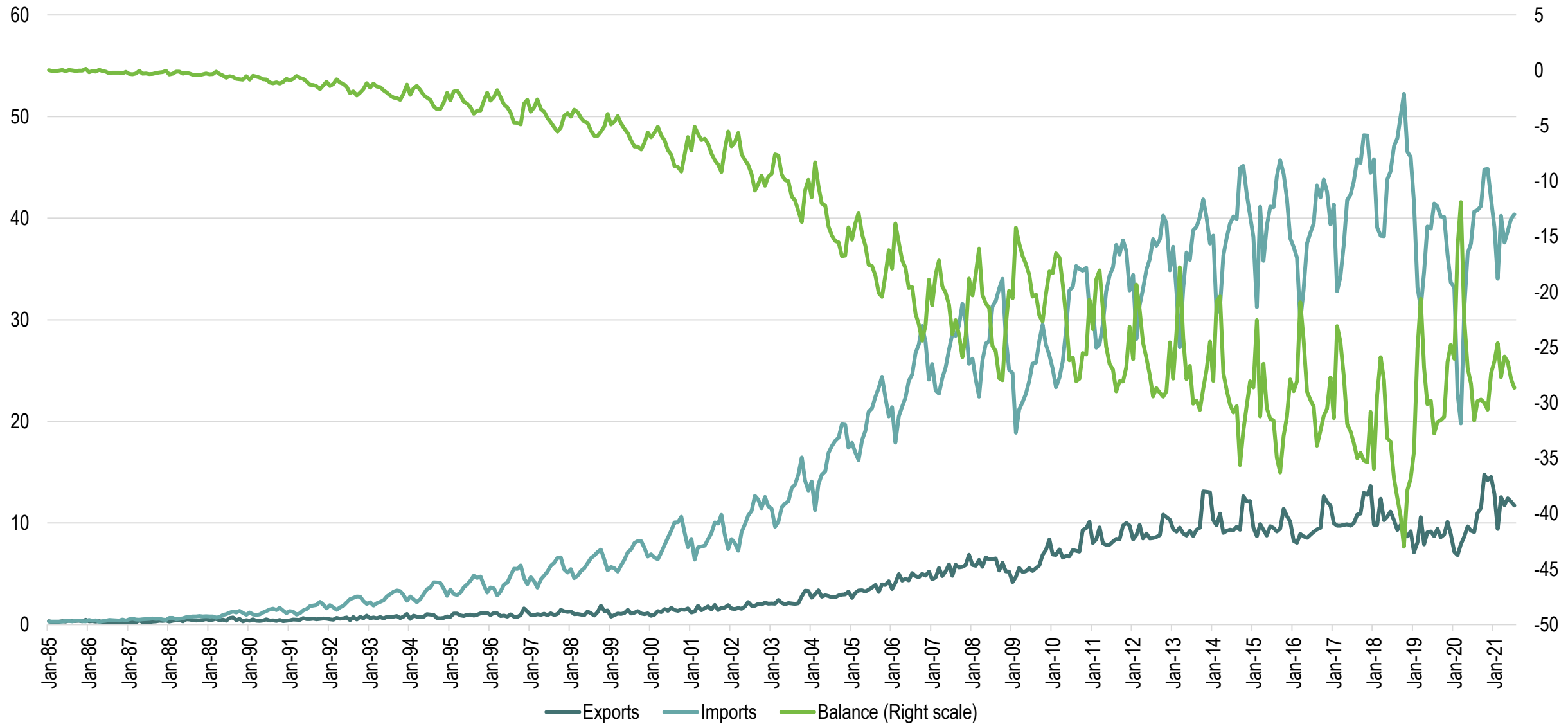
World's Largest Exporters and Importers, 2011



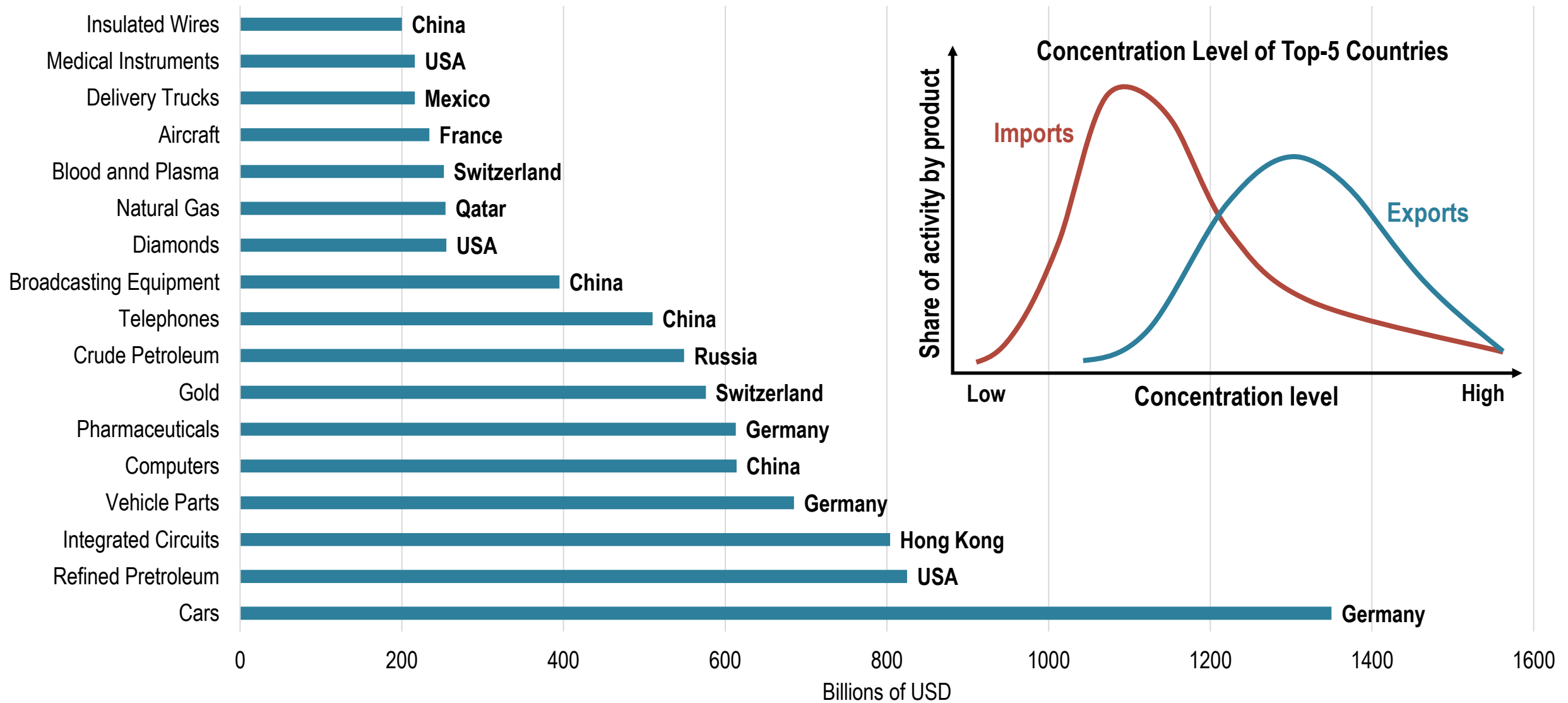
American and Canadian Trade, 1970-2007 (Current USD)



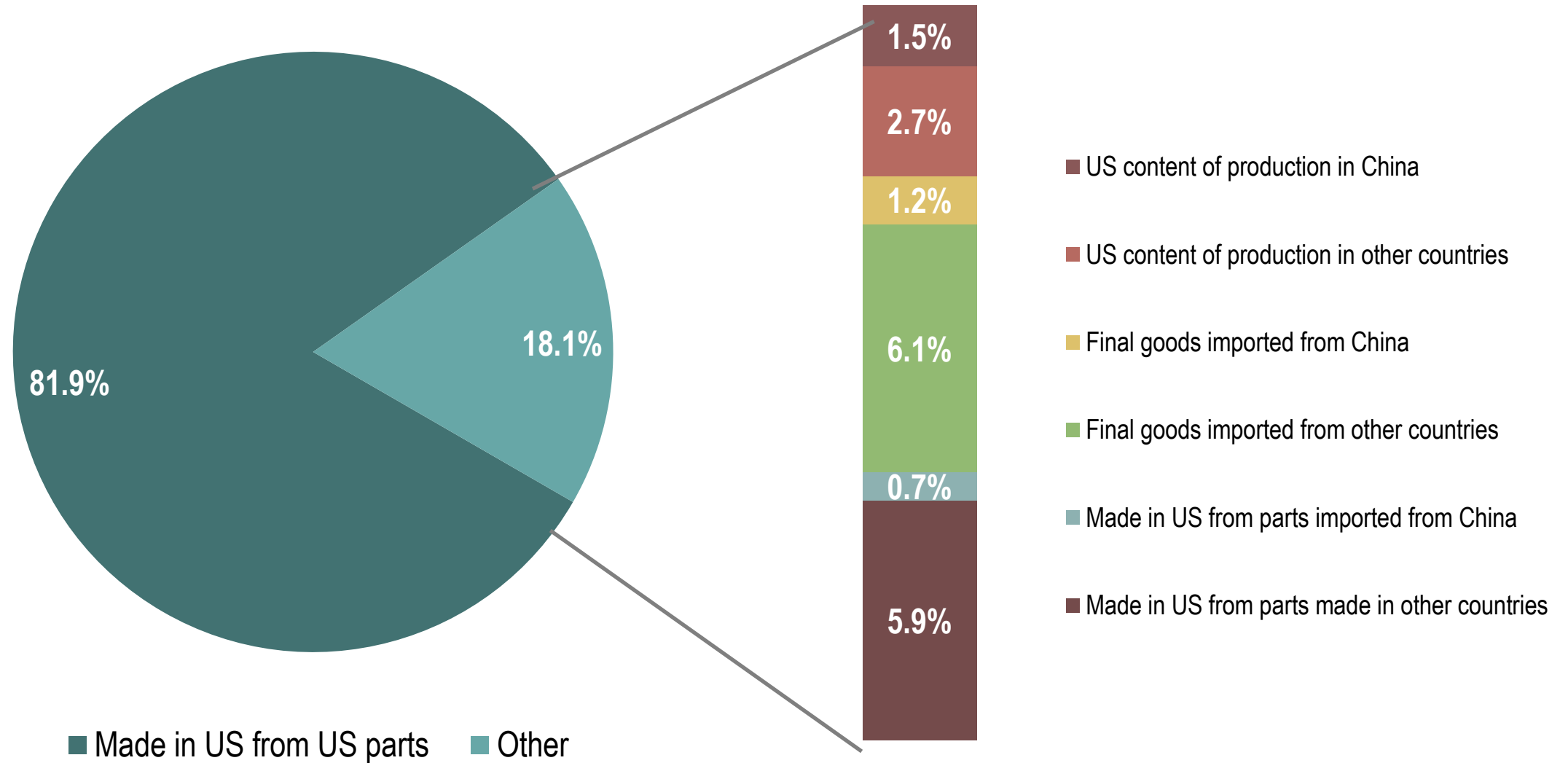
Monthly Trade between China and the United States, Billions of USD (1985-2021)



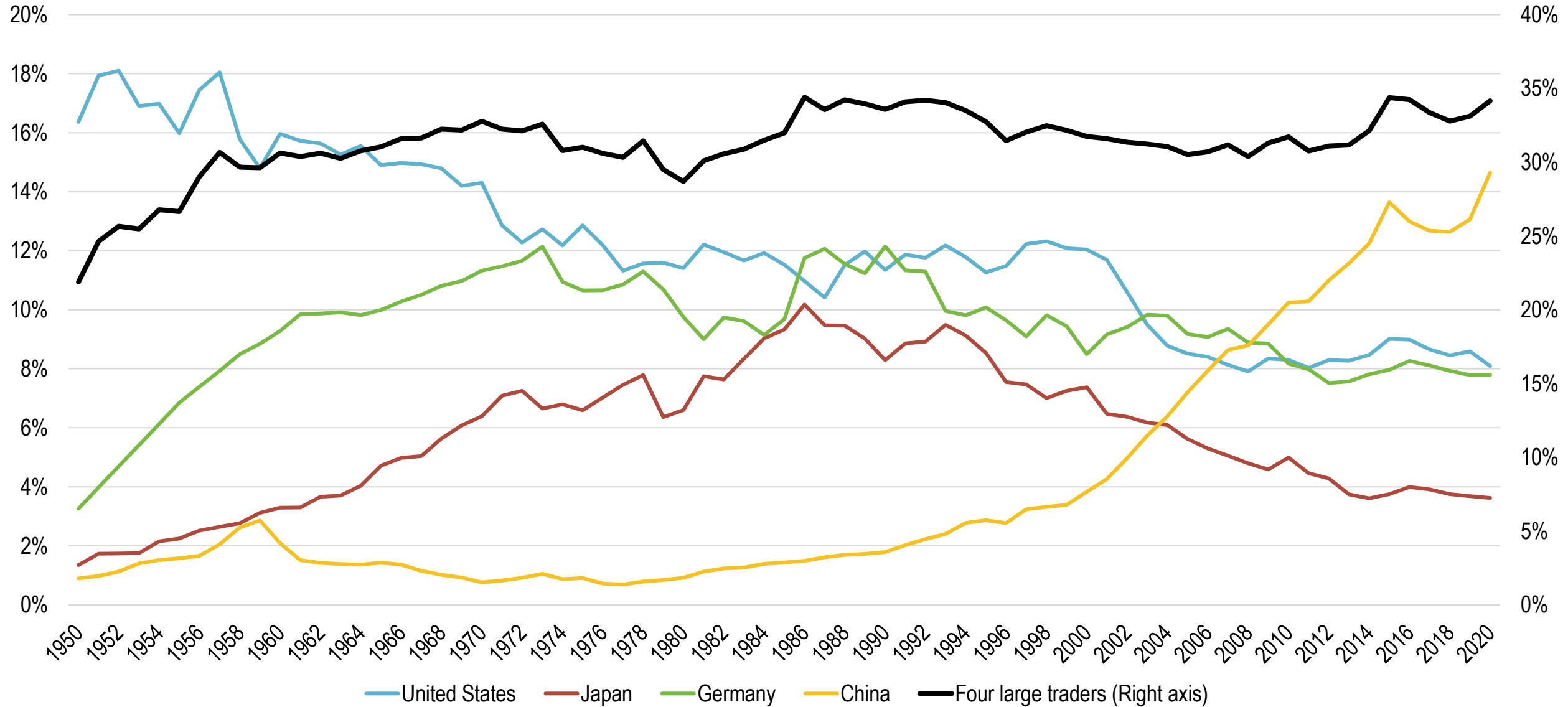
World's Most Traded Goods, Lead Exporter and Concentration, 2016



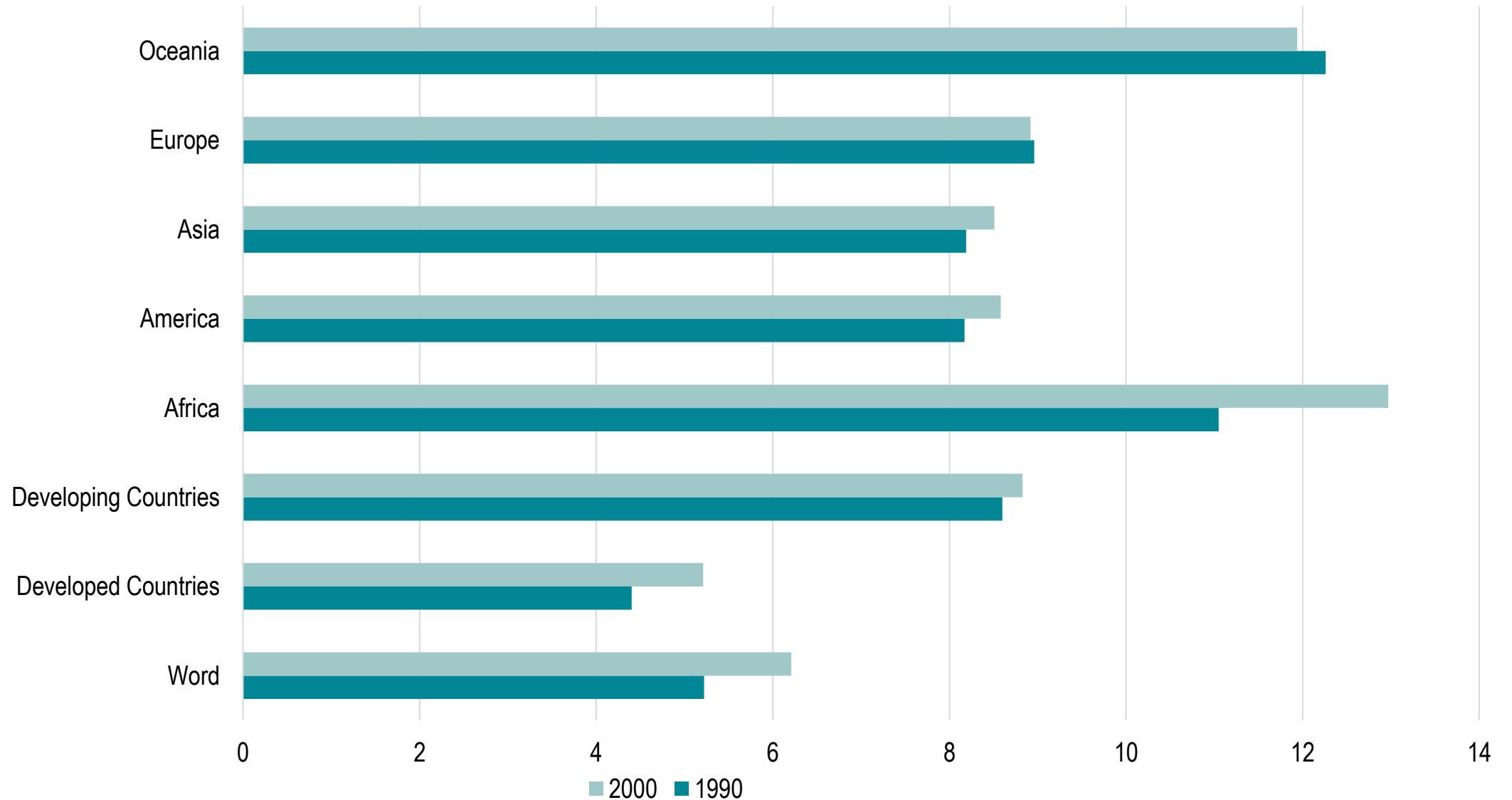
Personal Consumption Expenditures, United States 2010



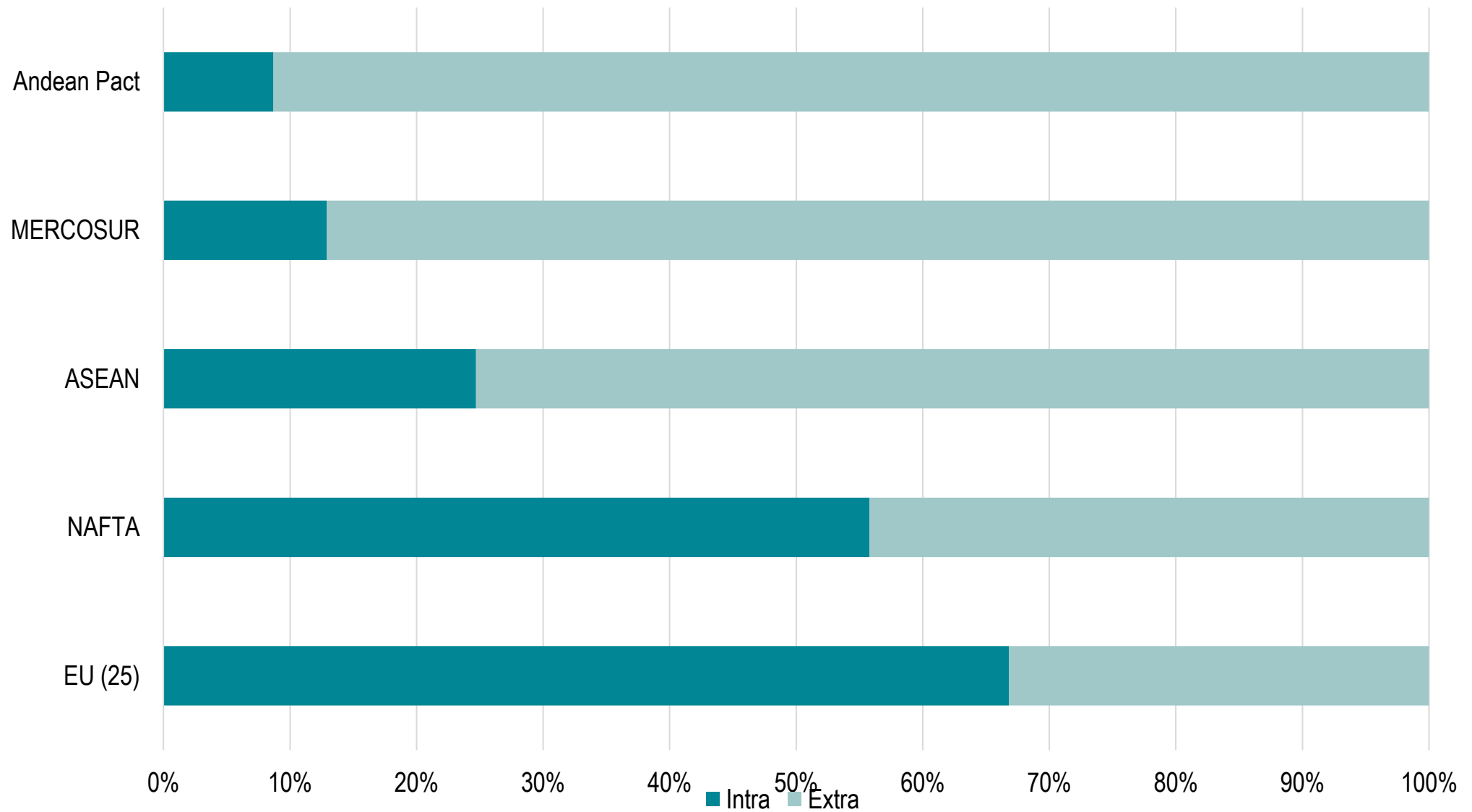
Share of World Goods Exports, Leading Exporters, 1950-2020



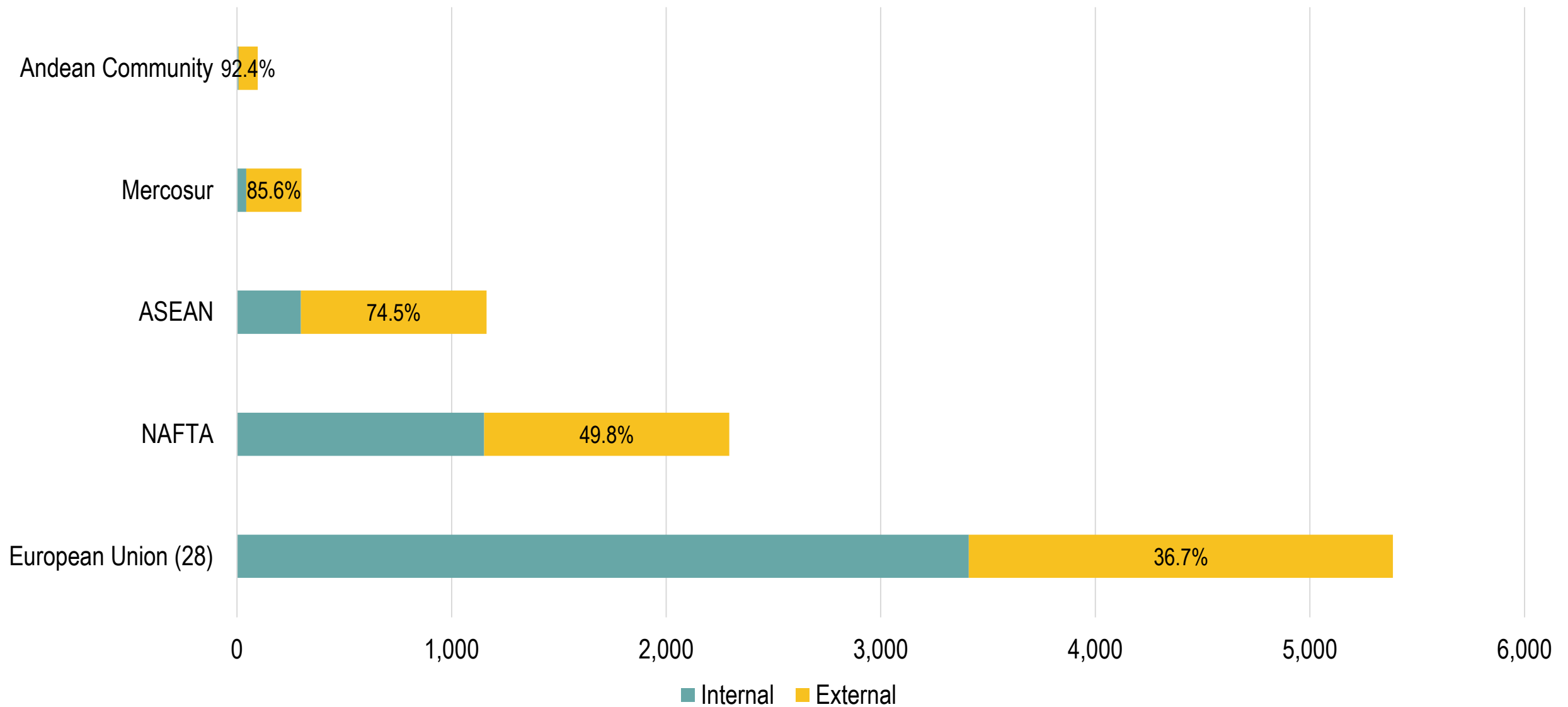
Total Freight Costs for Imports in World Trade (% of Total Costs)



Merchandise Exports by Trade Agreement, 2005



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



Trends Shaping International Trade

Volume

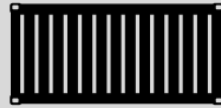


Peak growth

1980-2020:

- Population: 1.7 times.
- GDP: 7.2 times.
- Exports (value): 8.9 times.
- TEU: 20 times.

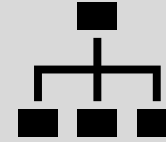
Support



Containerization

- Growing proportion of global trade.
- Intermodal transport chains.

Actors



Multinational Corporations

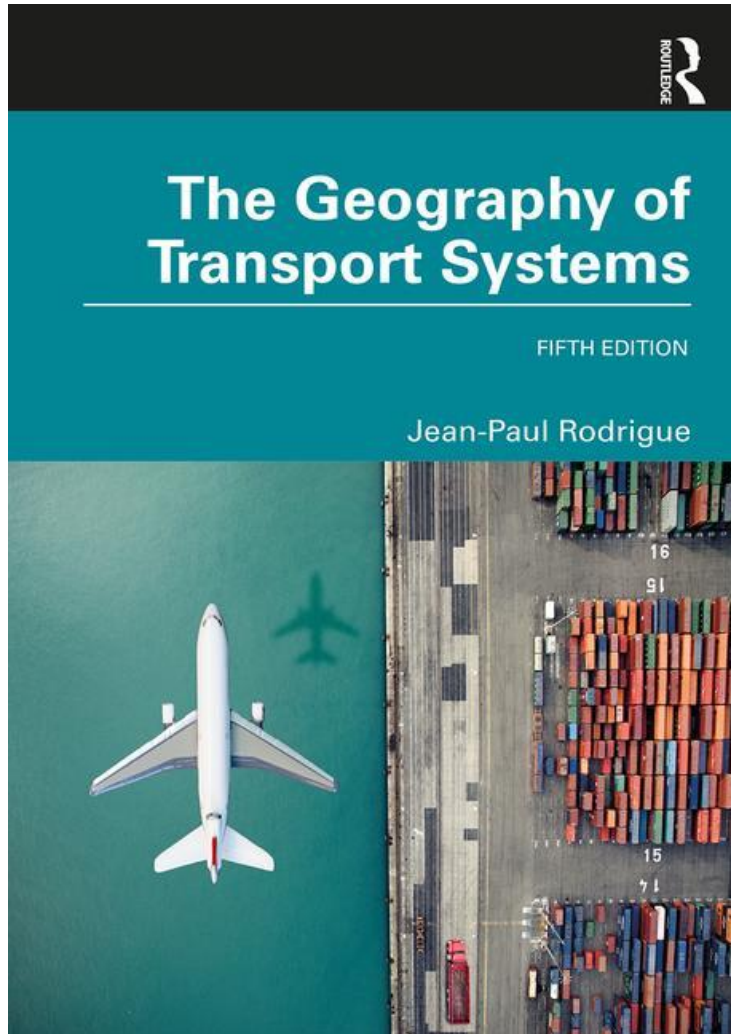
- Transnational production networks.
- Outsourcing and offshoring.

Geography



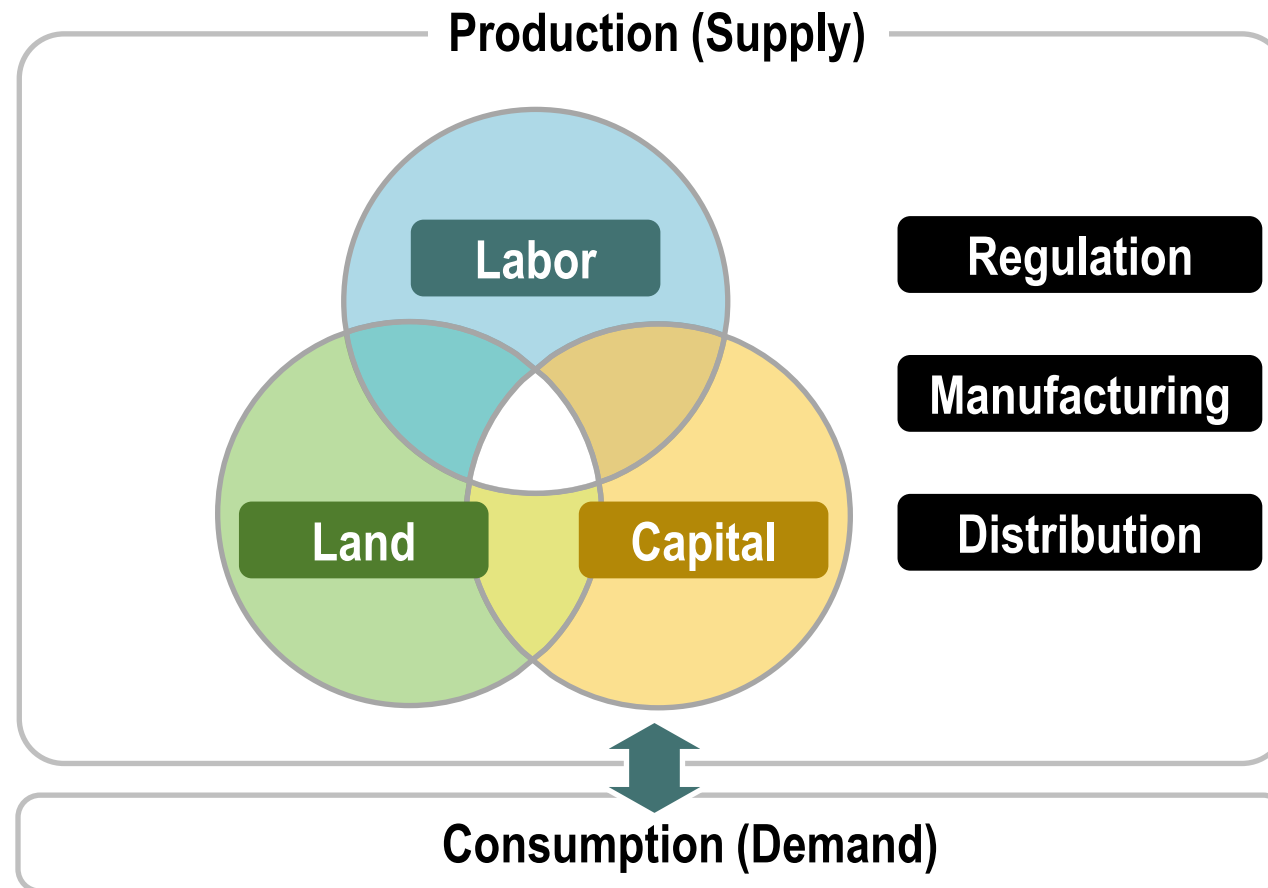
Export-Oriented Economies

- Focus on exports to promote economic growth.
- Imbalances in trade relations.

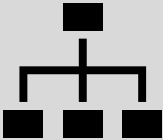
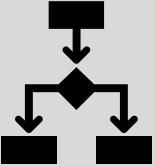
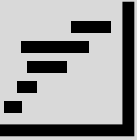


7.3 - Freight Transportation and Value Chains

Elements of an Economic System



The Corporation as a Decision, Management and Planning Unit

	Management Unit	Decision Unit	Planning Unit
Nature	 <p>Maintain operational conditions.</p>	 <p>Decisions about the allocation of resources.</p>	 <p>Anticipate market changes and opportunities. Allocate its factors of production.</p>
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).

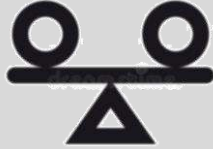
Competitive Advantages of Multinational Corporations

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 on the short term.

Product Quality





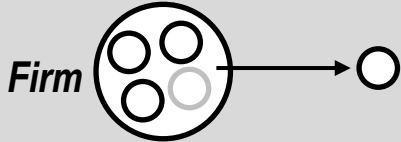
- Performance, service and maintenance.
- A quantitatively competitive product has limited advantages if not qualitatively competitive.

Logistics Flexibility

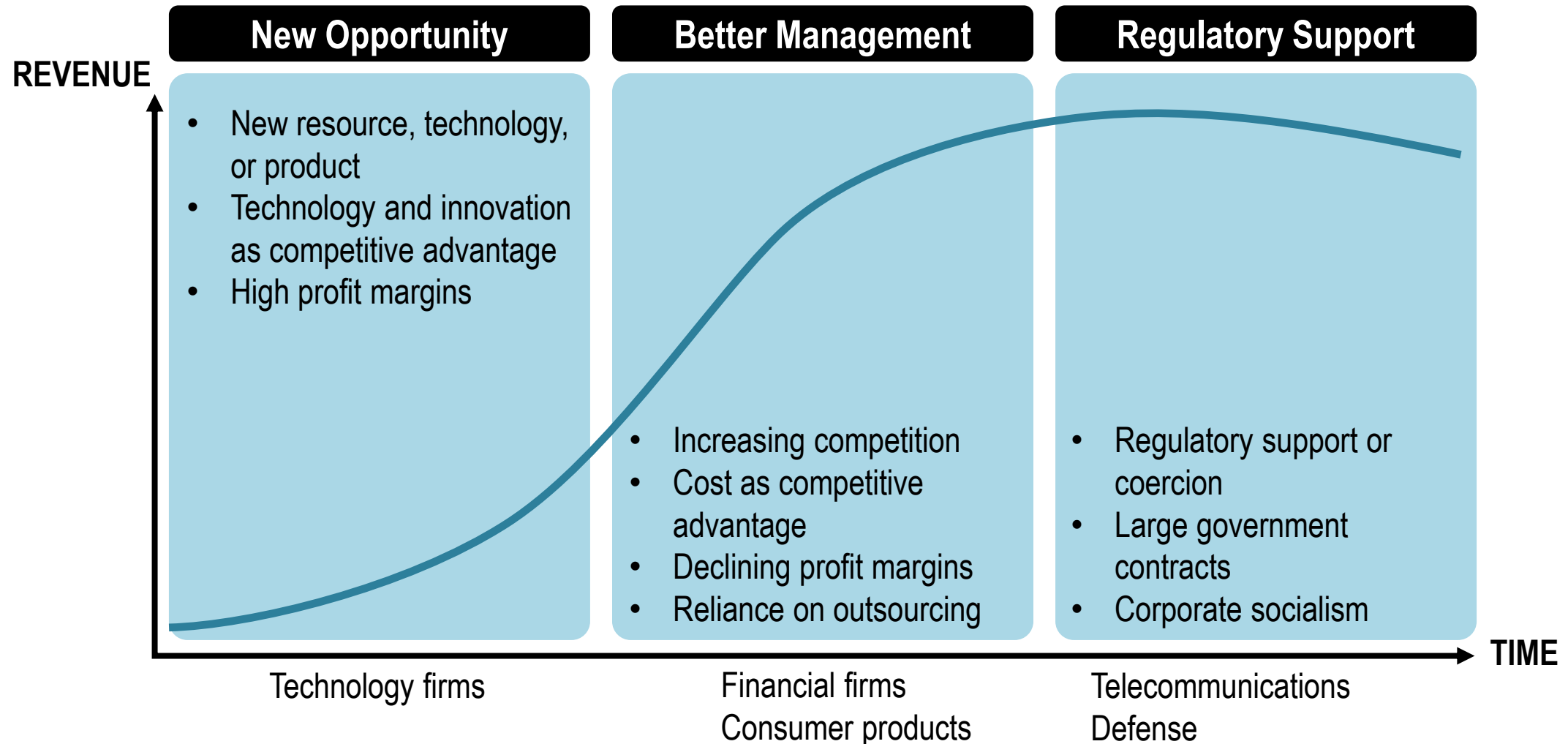


- Adapting to changes in the demand confers an advantage.
- Ability to withstand disruptions (resilience).

The Corporation and its Expansion

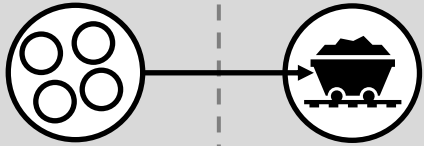
	Vertical Integration	Horizontal Integration	Outsourcing
Nature			
Goals	Expand backward (suppliers) or forward (customers) along the supply chain.	Acquiring or merging with competitors.	Some activities performed by another corporation.
Issues	Lower costs. Enhance and protect product quality. Improve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

The Growth Cycle of Large Multinationals



Types of Corporations by Multinational Expansion Strategy

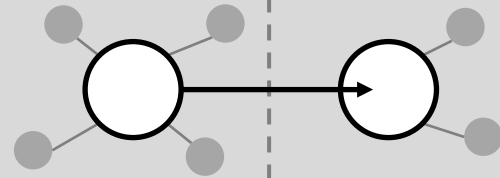
Raw Material Seekers



- Lower input costs
- Resource acquisition
- First MNCs to emerge

Energy, mining, agricultural, forest

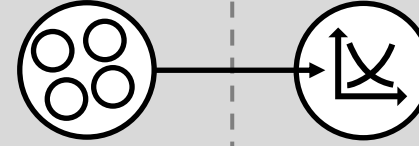
Market Seekers



- Achieve economies of scale
- Expand market
- Large investors

Retailing, wholesalers

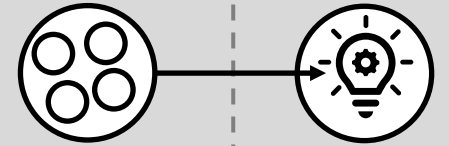
Low Cost Seekers



- Look for comparative advantages
- Lower production and distribution costs
- Remain competitive

Manufacturing

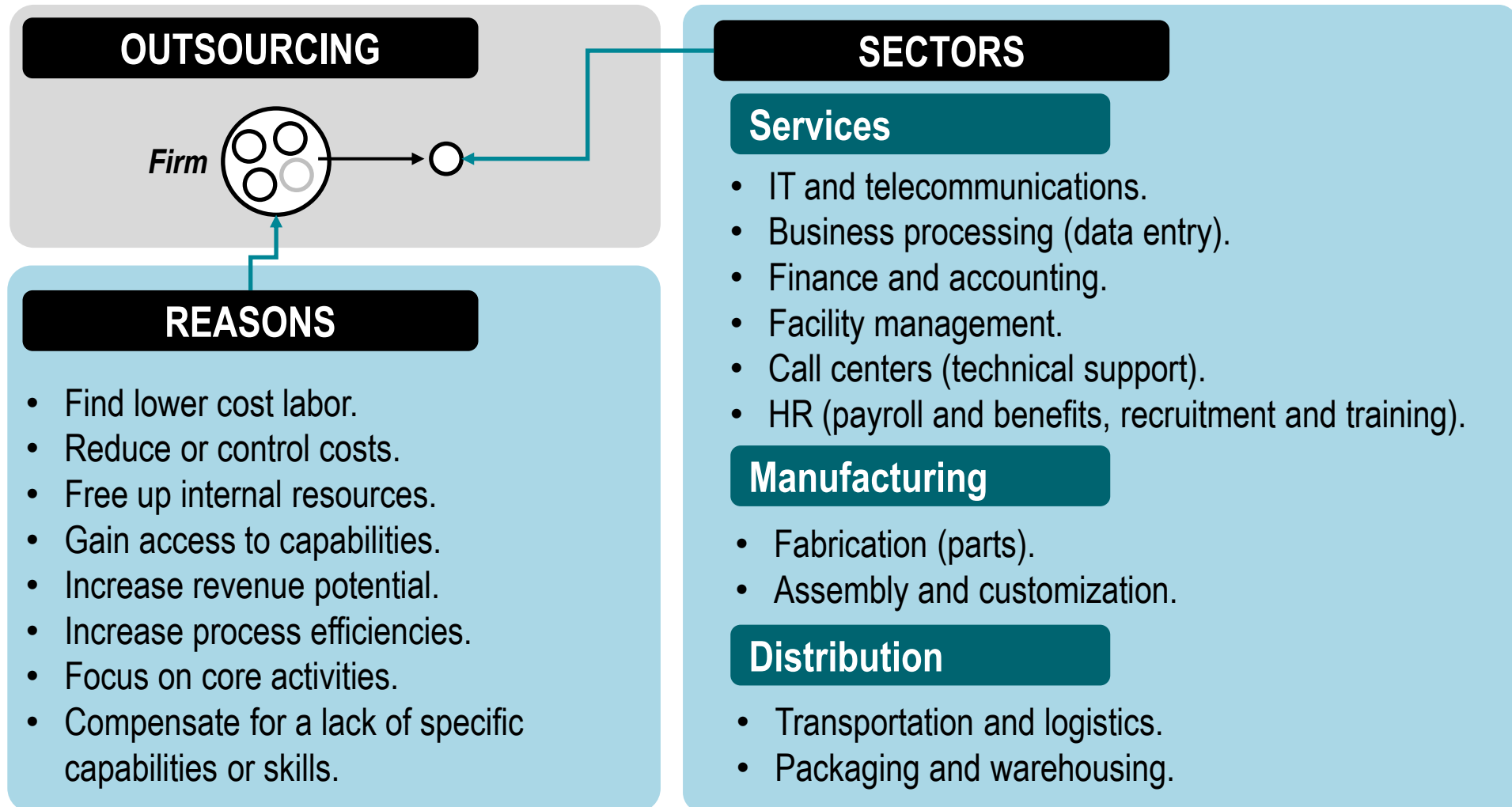
Knowledge Seekers



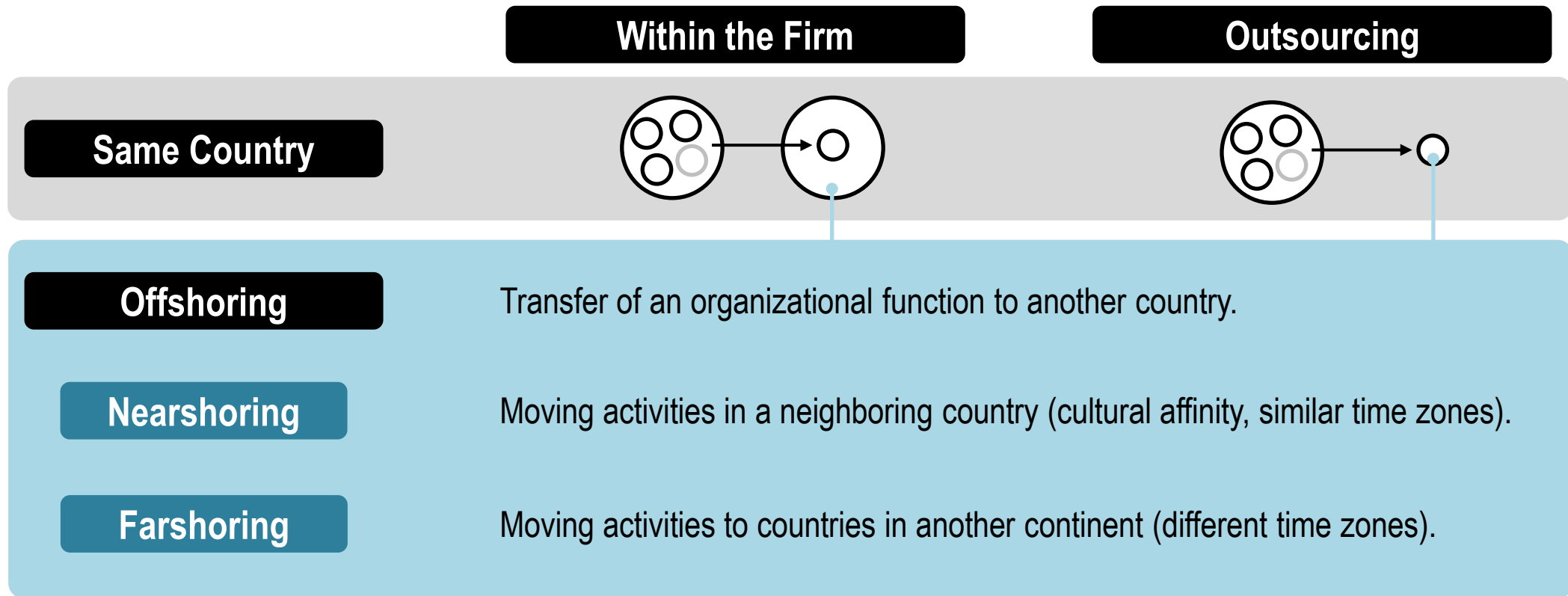
- Look for qualified labor, techniques and processes
- Increase innovative capabilities

Information technologies, pharmaceuticals

Rationale for Outsourcing

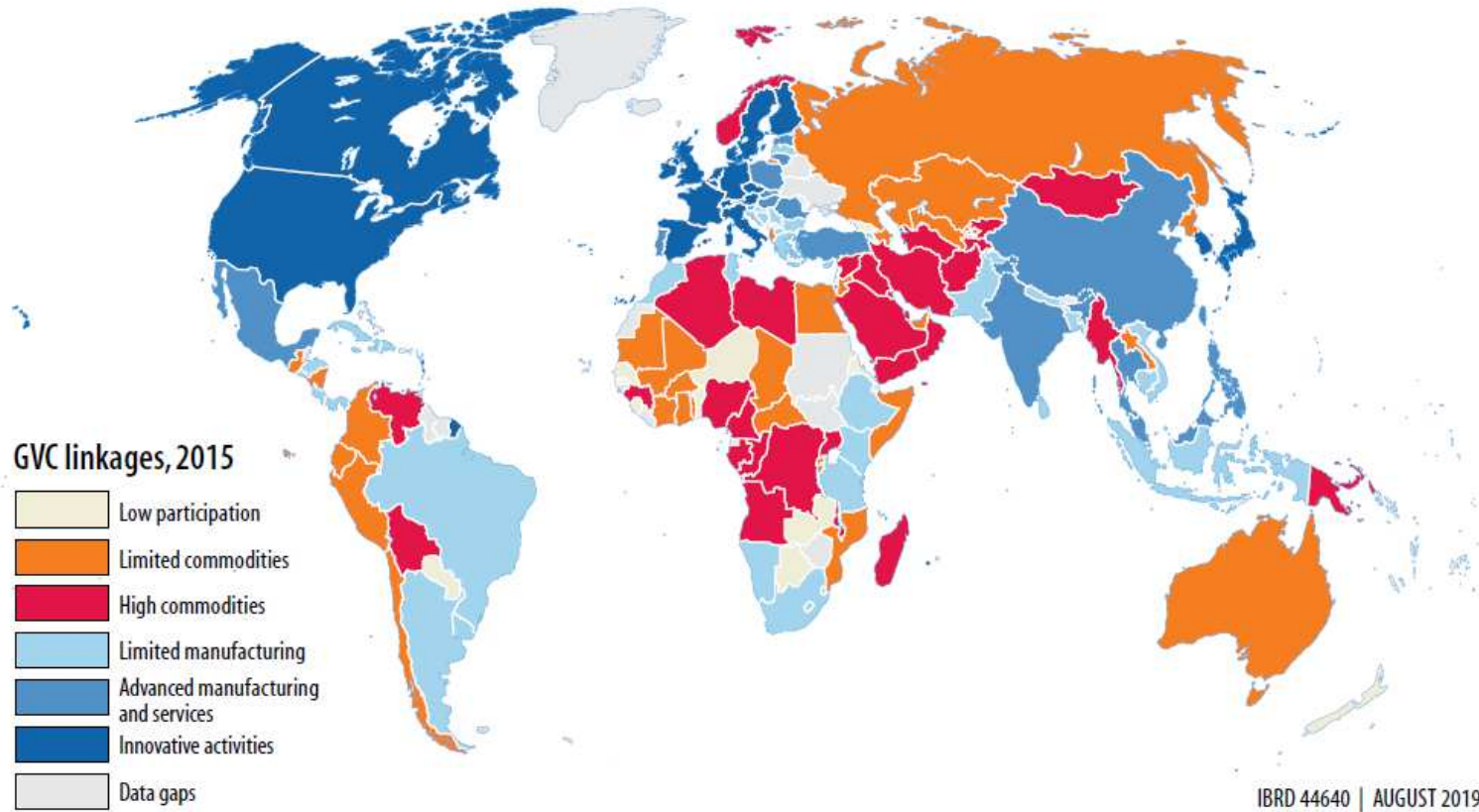


Offshoring, Nearshoring and Farshoring



The Configuration of Global Value Chains

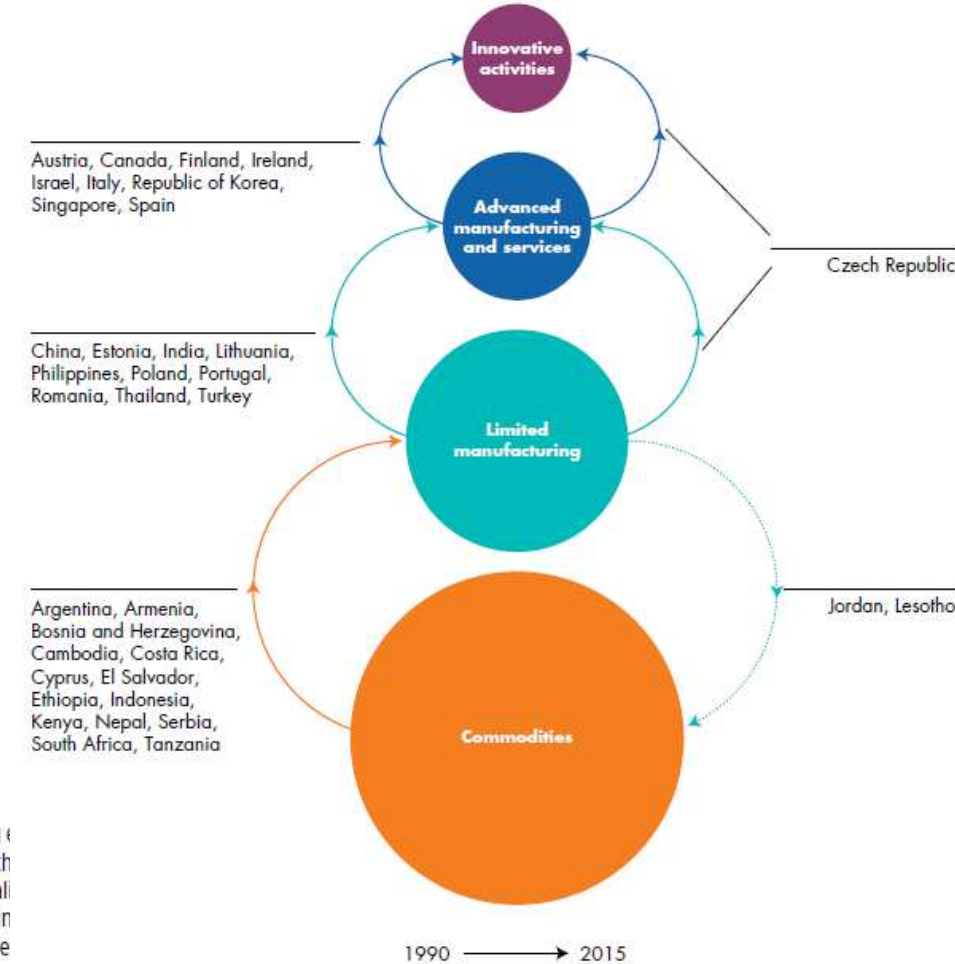
Map 1.1 All countries participate in GVCs—but not in the same way



Source: WDR 2020 team, based on the GVC taxonomy for 2015 (see box 1.3).

Note: The type of a country's GVC linkages is based on the country's extent of backward GVC participation, measured as the portion of imports embodied in manufacturing as a percentage of a country's total exports, combined with the country's sector specialization of domestic value added in exports and engagement in innovation. Countries in the 'High commodities' group have a small share of manufacturing exports and limited backward GVC integration. Their share of commodity exports can be low, medium, or high. Countries specialized in manufacturing GVCs engage in some manufacturing exports, often alongside commodities exports, and exhibit medium backward GVC integration. Countries specialized in manufacturing and services GVCs have a high share of manufacturing and business services exports and high backward GVC integration. Countries specialized in innovative activities spend a large share of GDP on research and development, receive a large share of GDP from intellectual property, and exhibit high backward GVC integration.

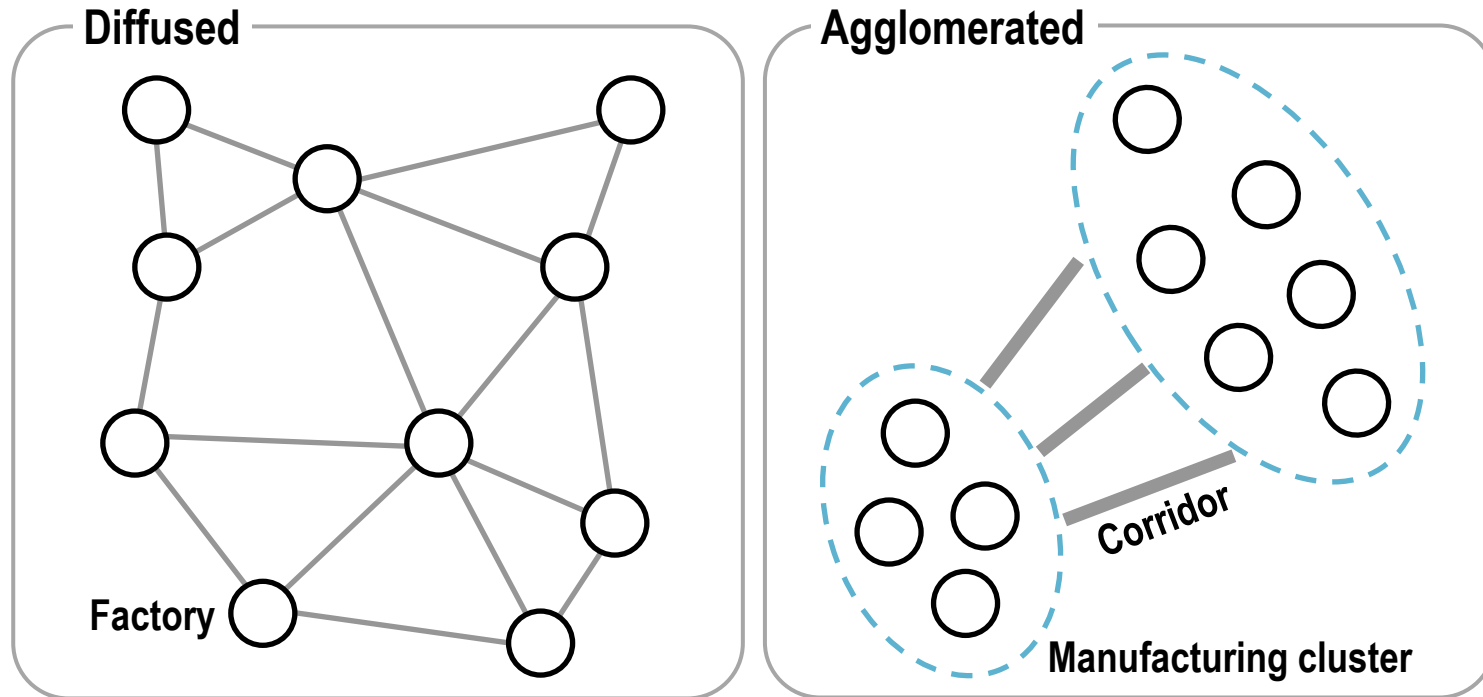
Figure 1.5 Country transitions between different types of GVC participation, 1990–2015



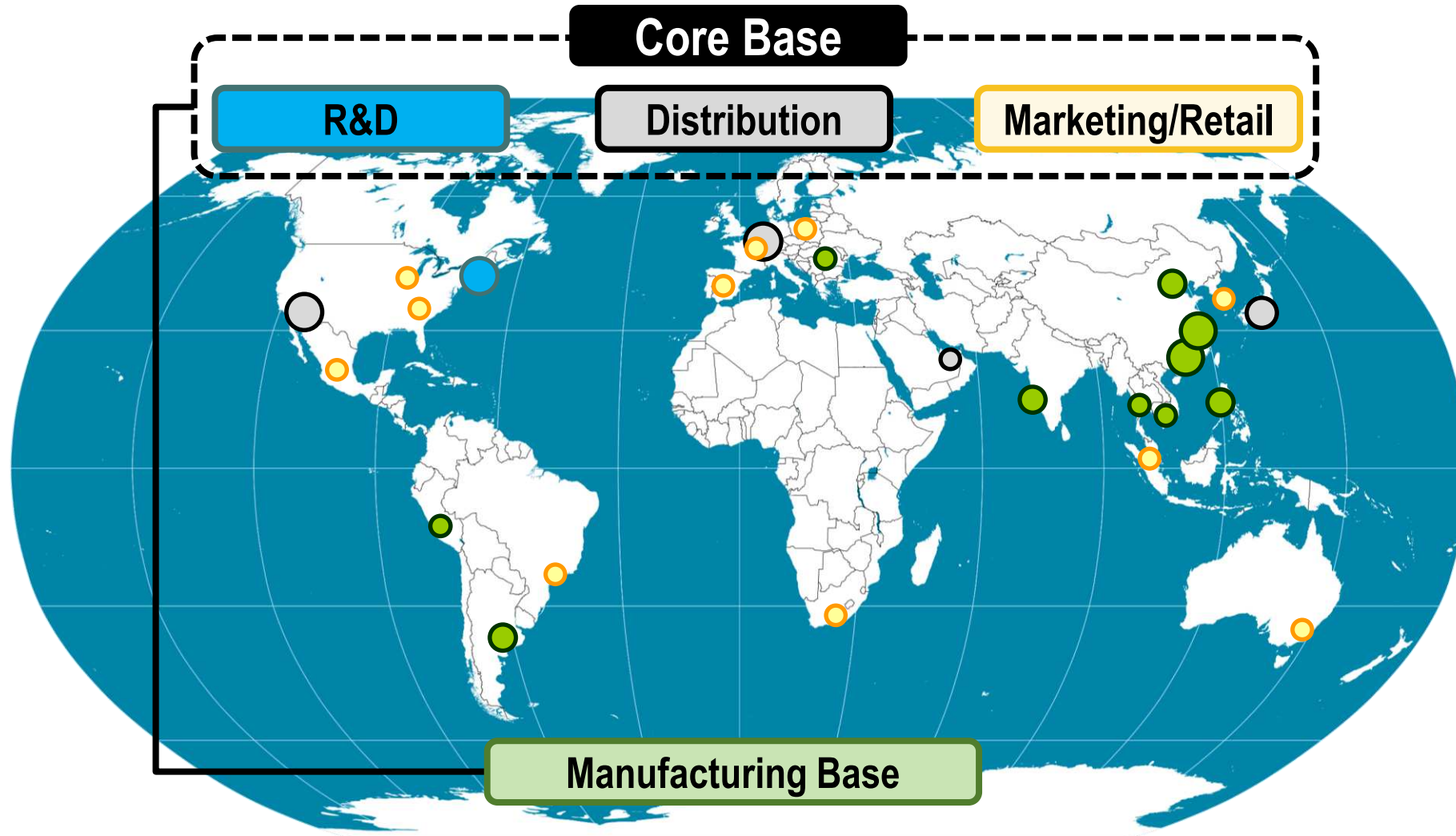
Private Firms Directly and Indirectly Related to Freight Distribution

	Function	Infrastructure
Transport firms	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

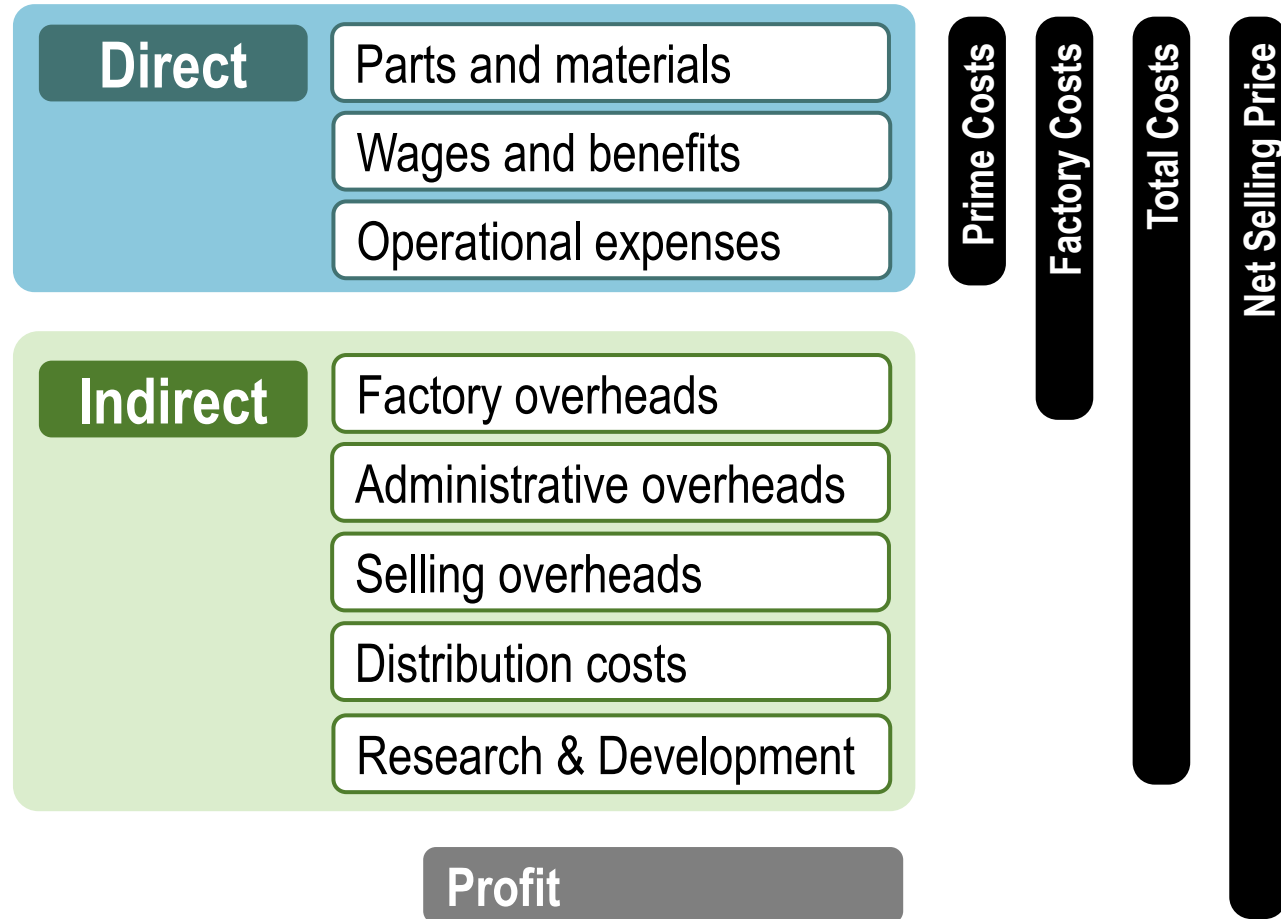
Industrial Agglomeration and Transportation



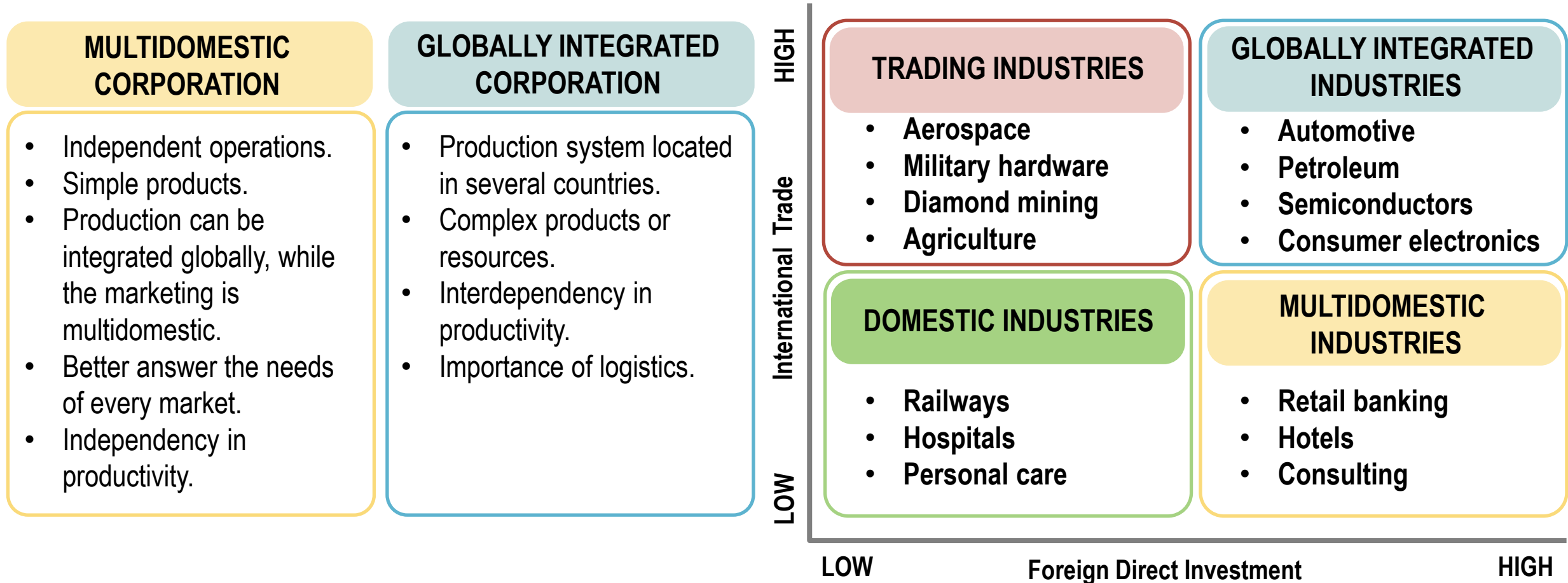
Disconnection of Global Production and Distribution



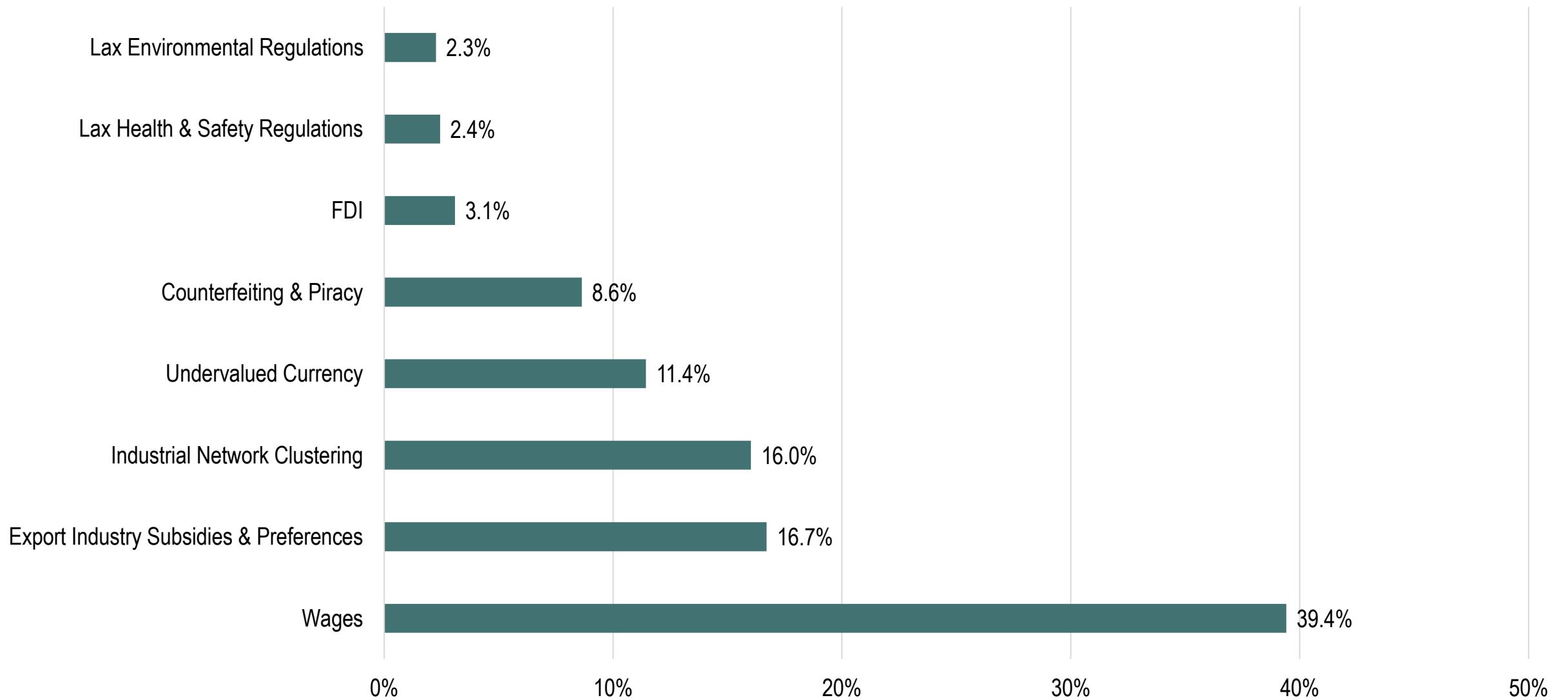
Manufacturing Cost Structure



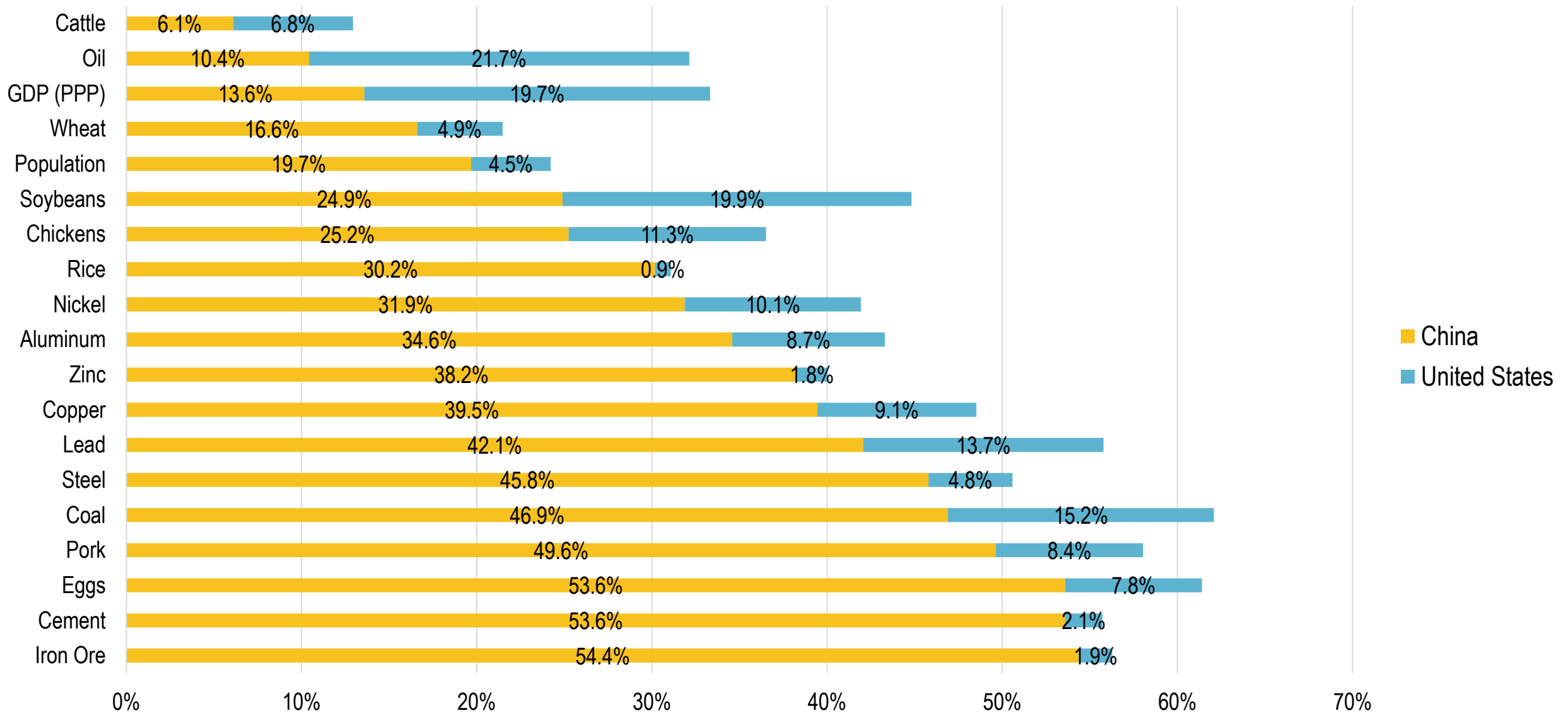
Types of Internationalization in Manufacturing



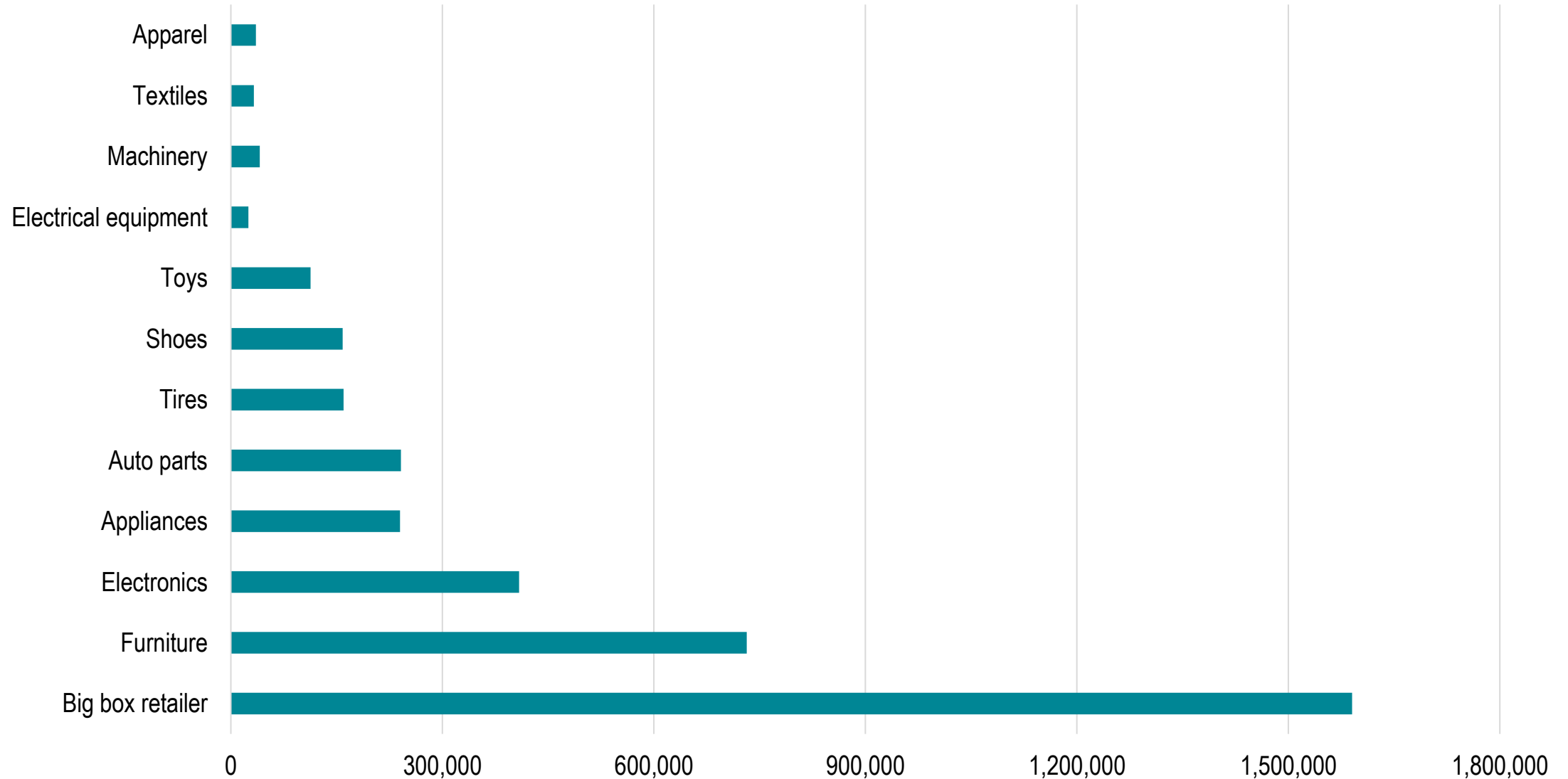
Major Components to Price Reductions by the Chinese Manufacturing Sector, 2005



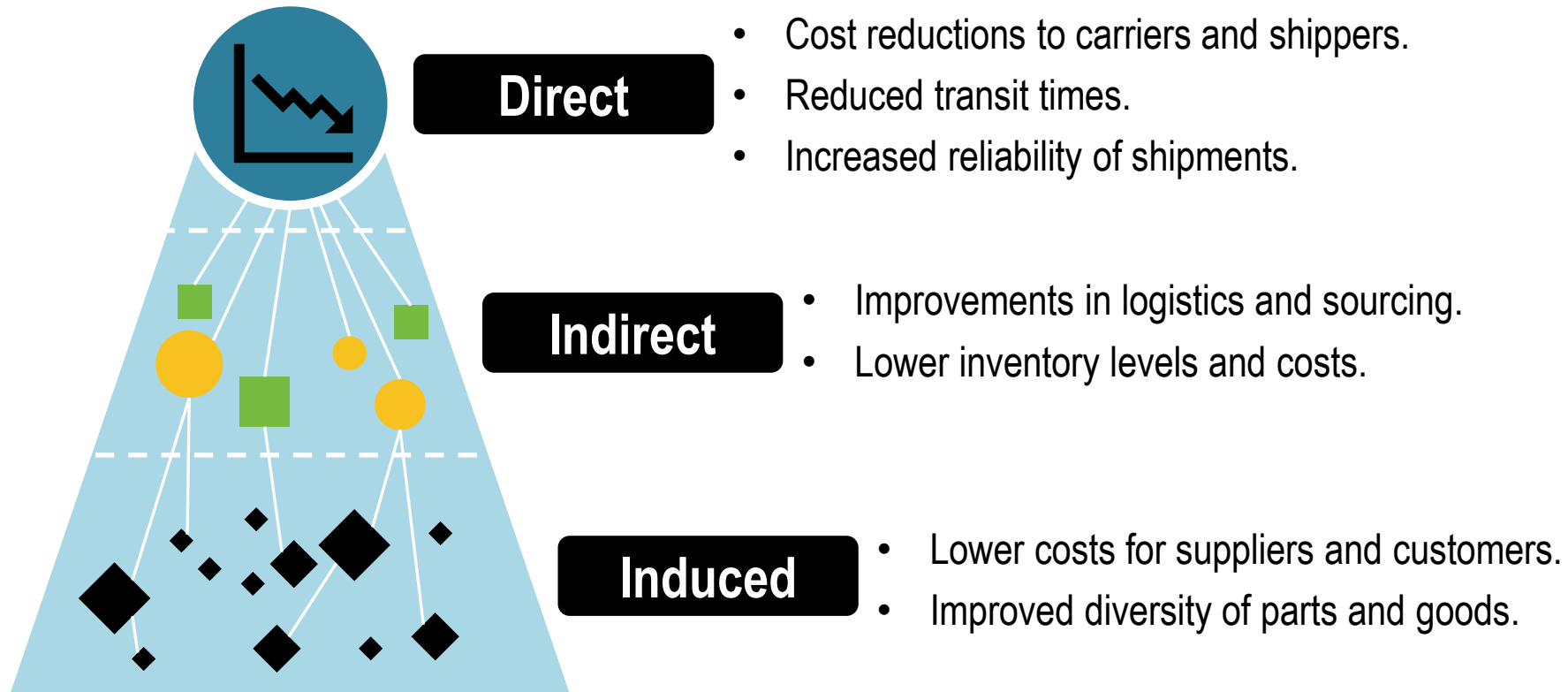
Share of the World Commodity Consumption, China and United States, c2009/10



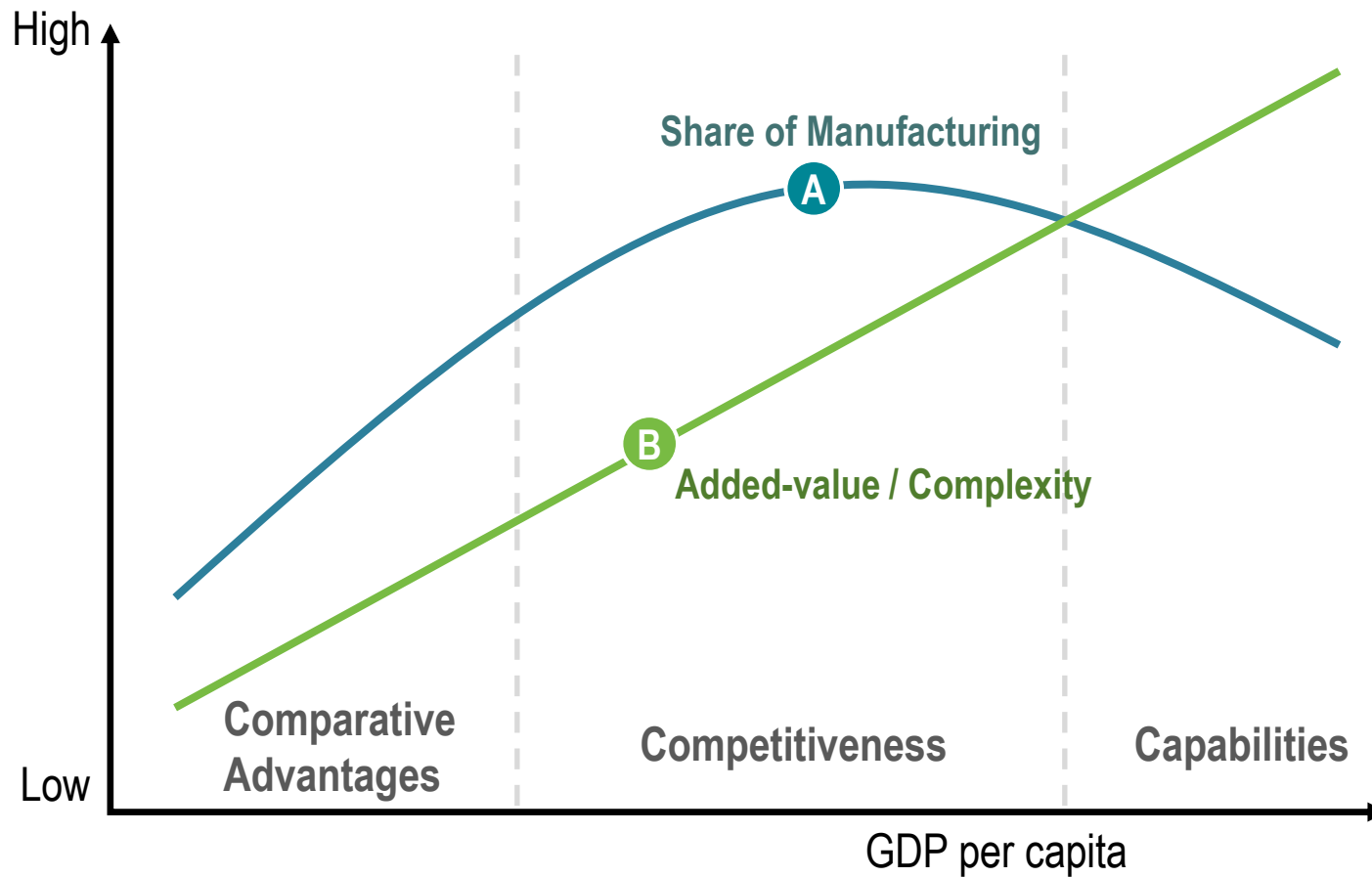
Sectors of American Imports of Asian Goods Through Maritime Container Shipping, 2004 (in TEUs)



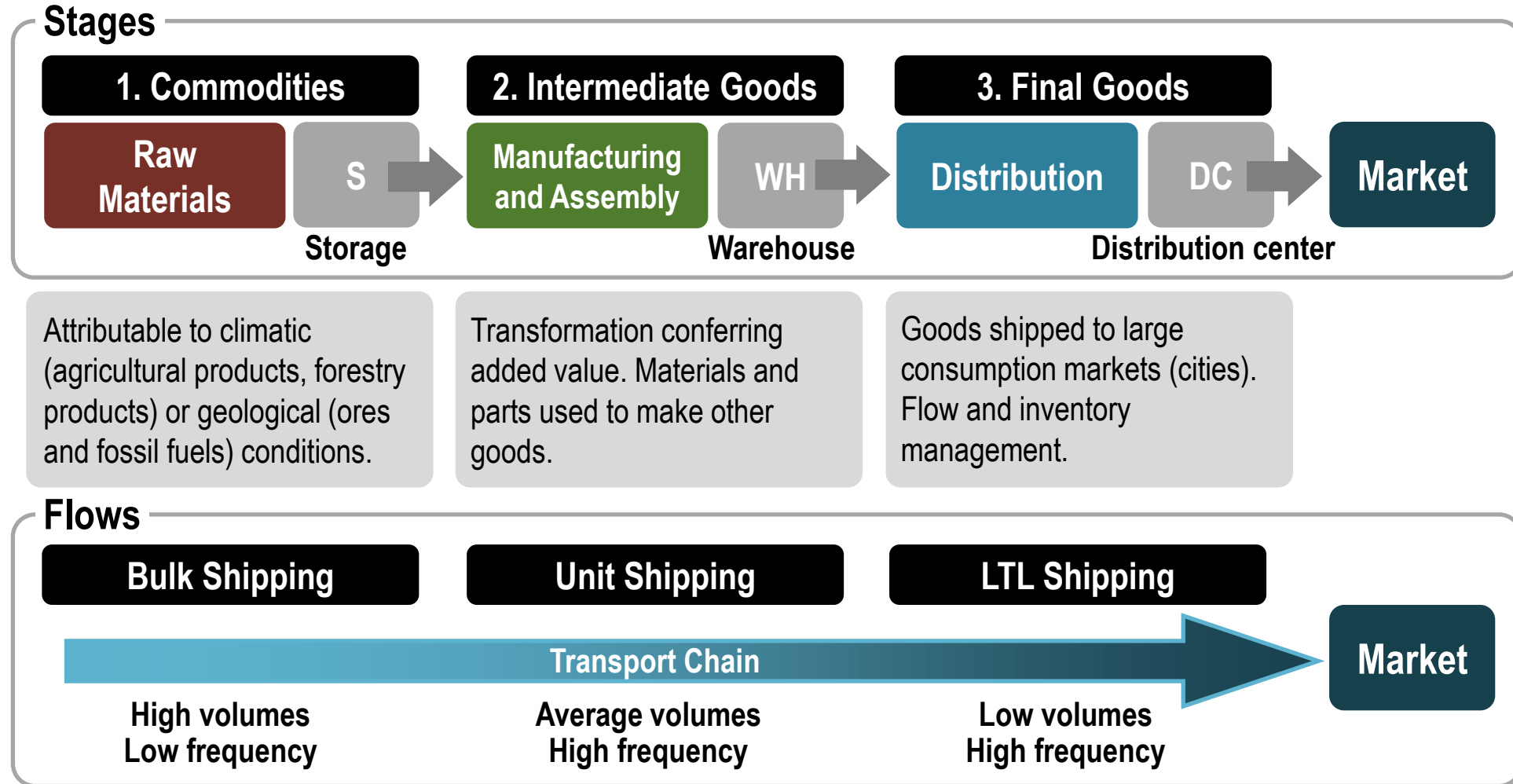
Benefits of Improved Freight Transportation on Value Chains



The Transition Towards Manufacturing Capabilities



The Value Chain (or Commodity Chain)

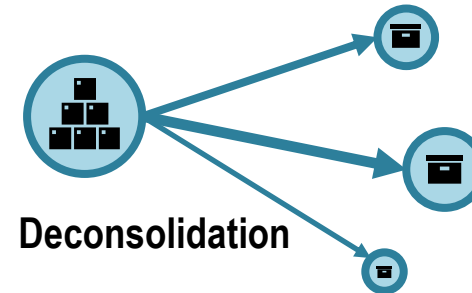


The Configuration of Value Chains

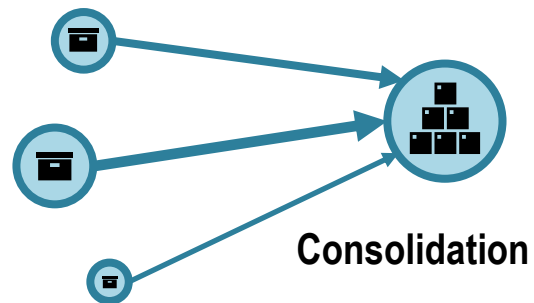
1. One-to-one



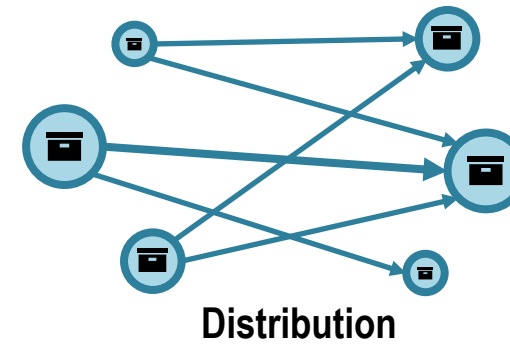
2. One-to-many



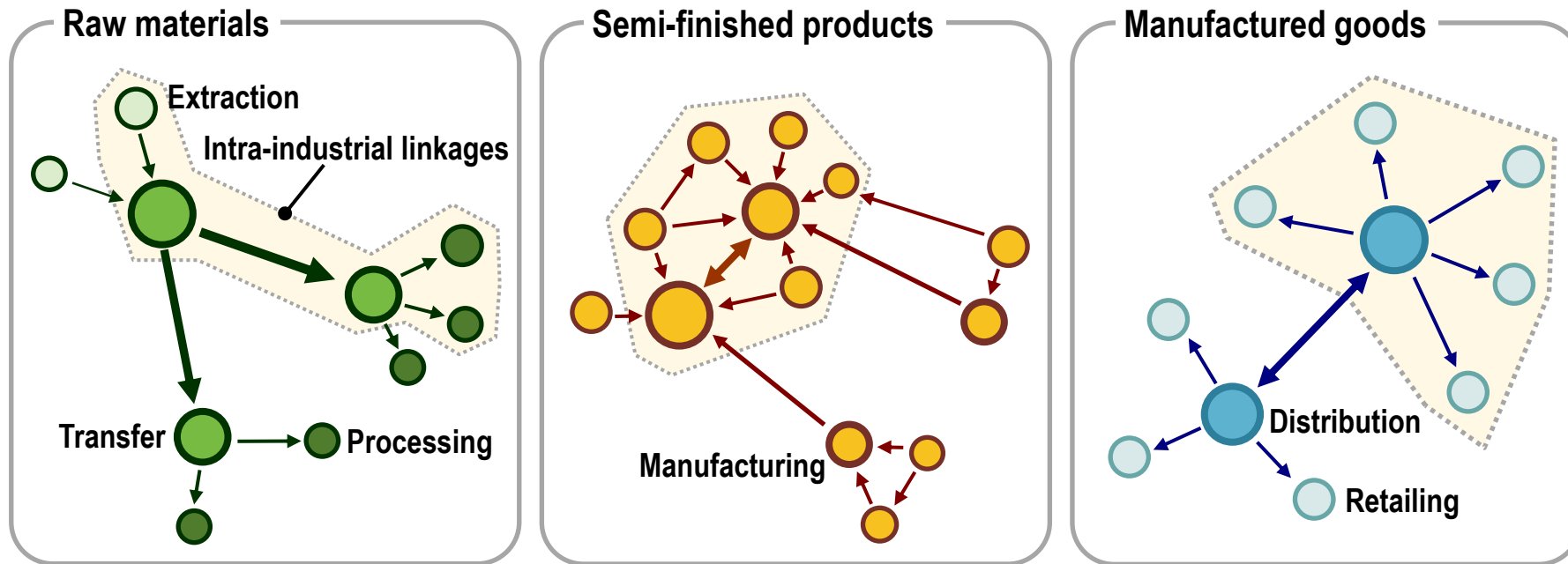
3. Many-to-one



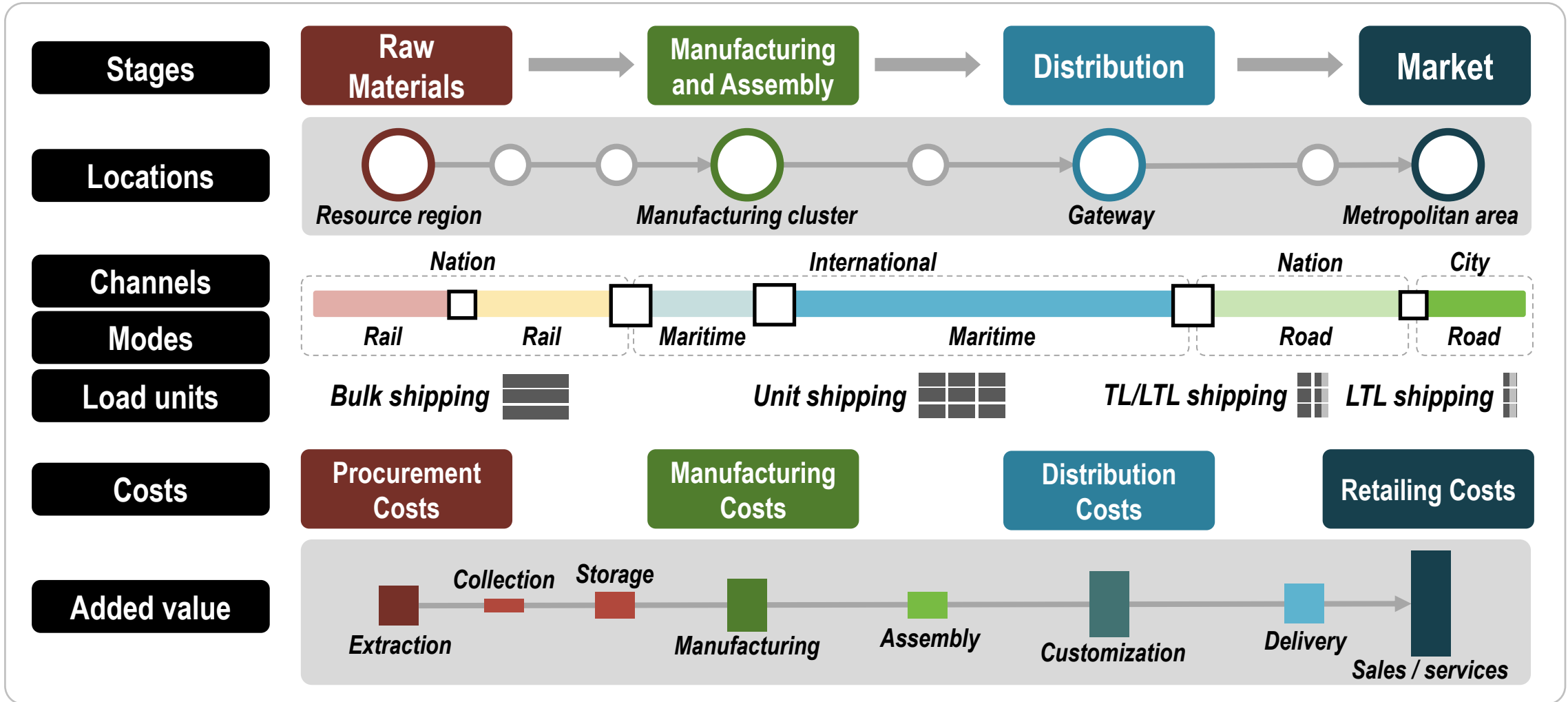
4. Many-to-many



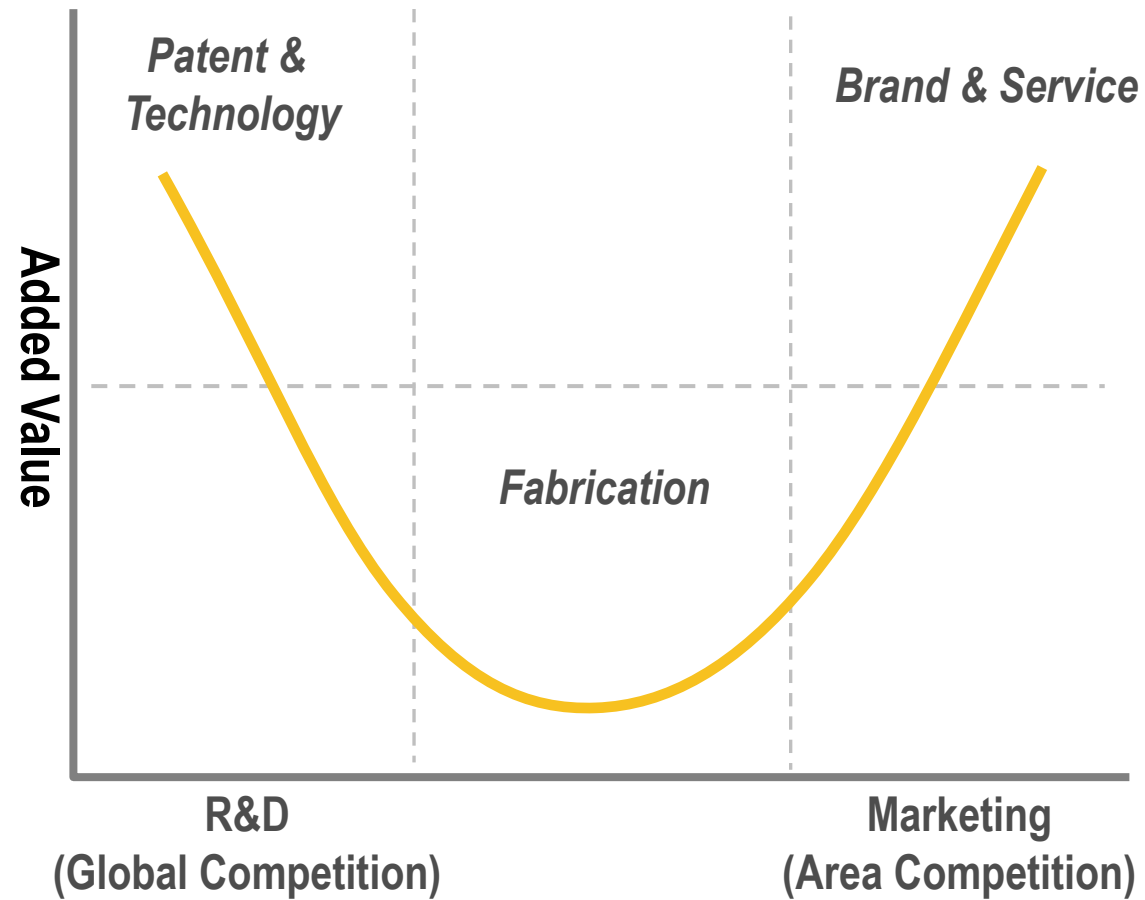
Value Chains and Freight Transport Systems



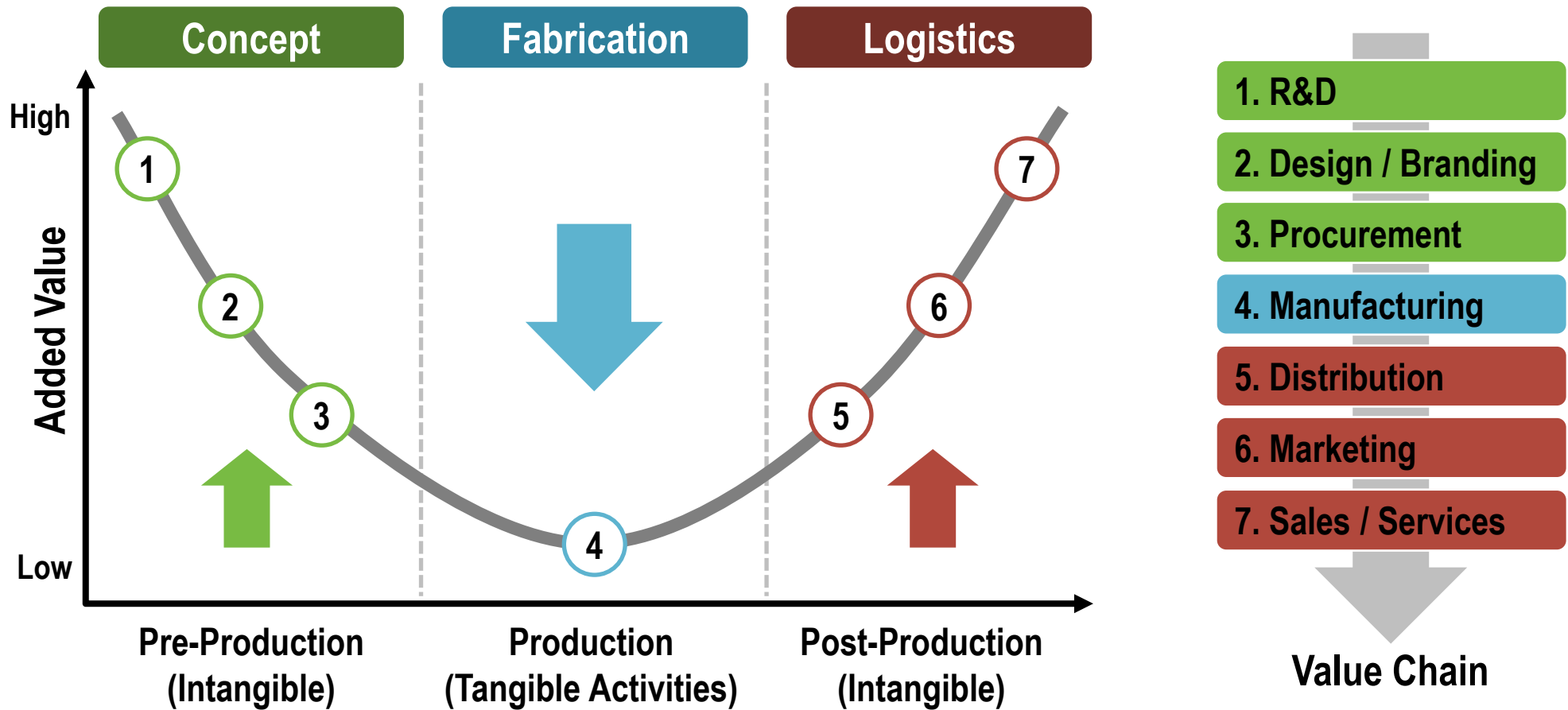
Supply Chain Analysis



Generic Smile Curve in a Value Chain



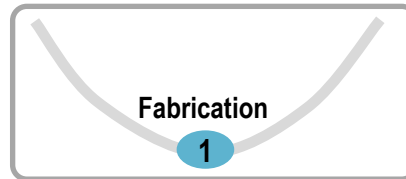
The Value Chain and its Added Value



Upgrading the Value Chain

1. Fabrication

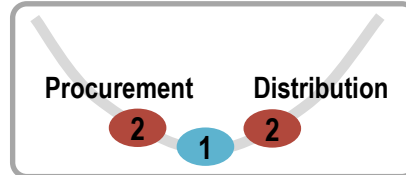
(Value chain entry)



- 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

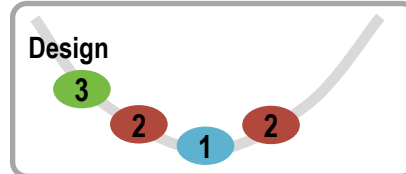
(Functional upgrading)



- 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

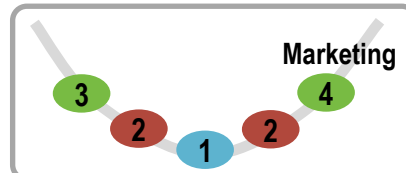
(Functional upgrading)



- 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

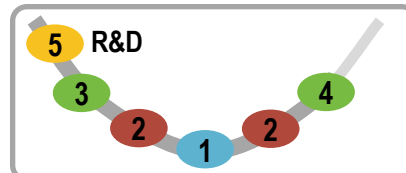
(Functional upgrading)



- 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

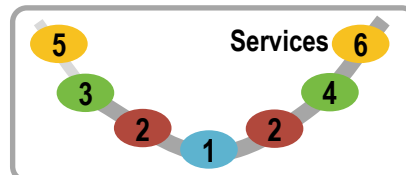
(Product upgrading)



- 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.

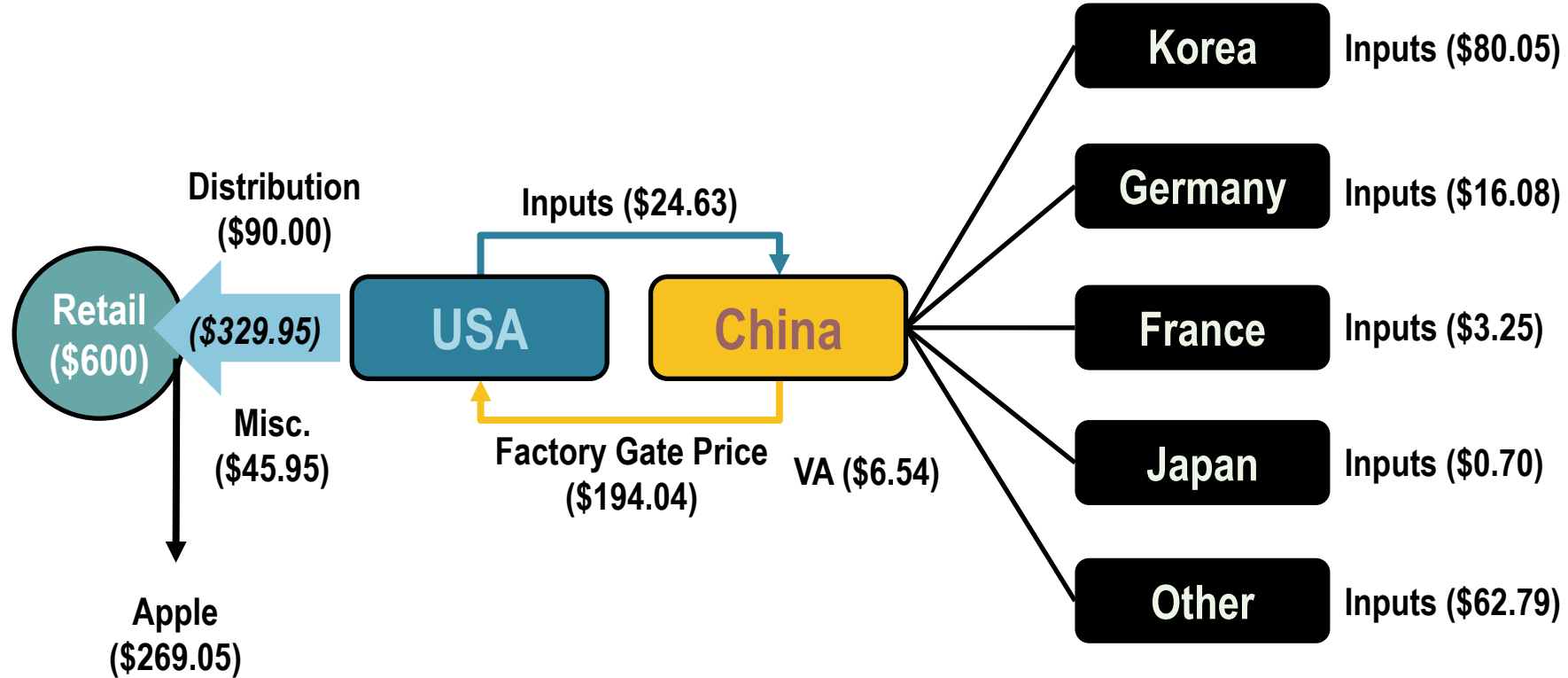
6. Advanced Services

(Process upgrading)

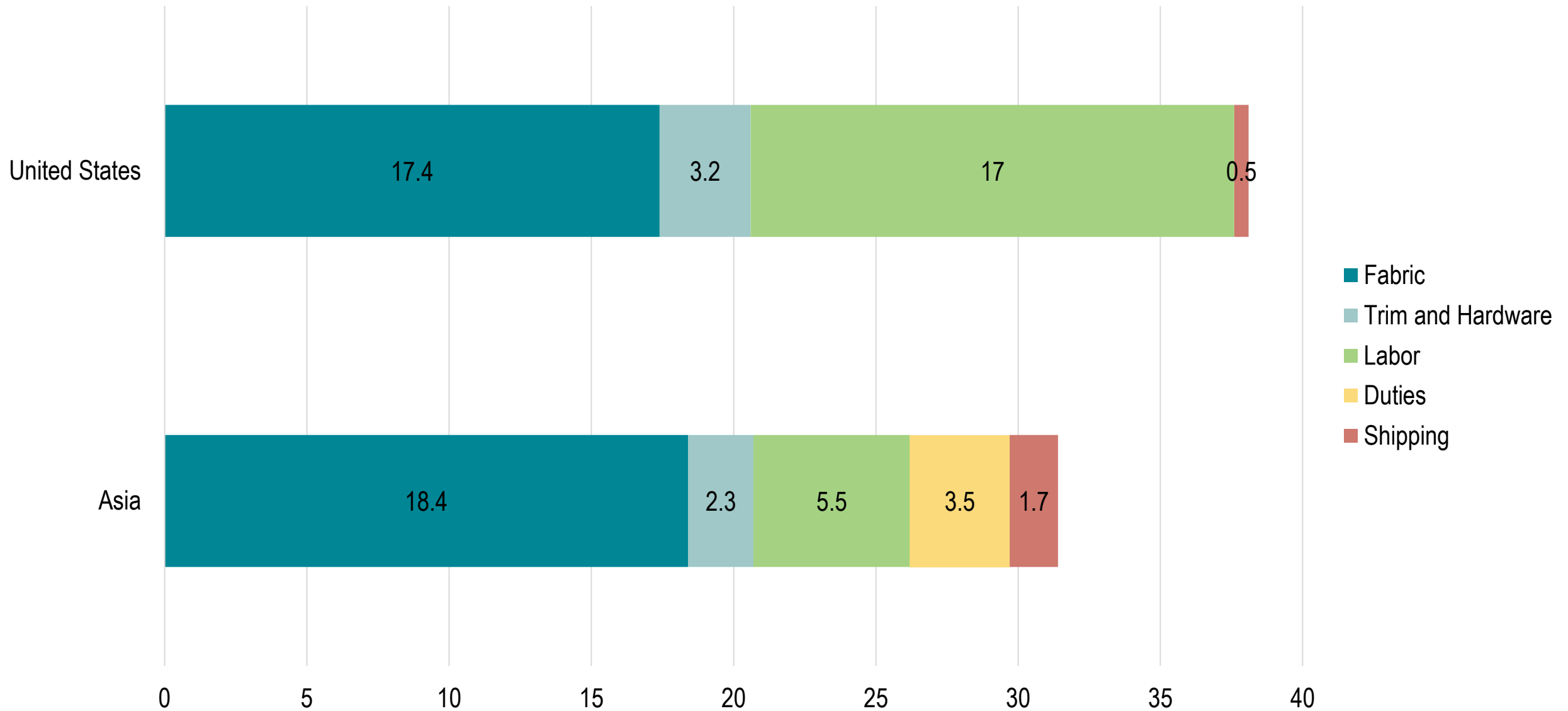


- Improving productivity through new capital investments.
- Improving IT and logistics.
- Reducing lead time and increasing the flexibility of the supply chain process.

Value Creation and Capture, iPhone 4 (in USD)



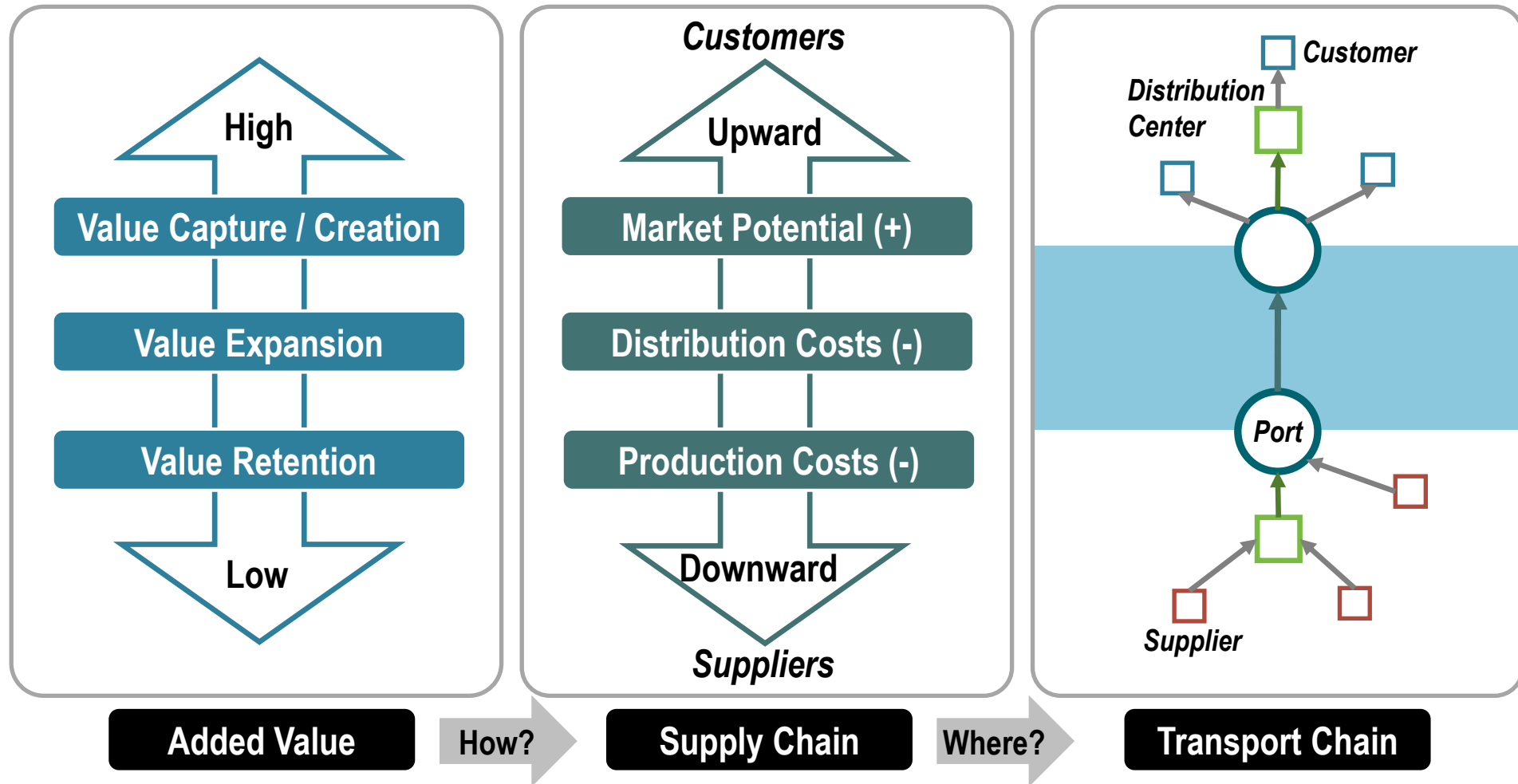
Cost to Manufacture a Cotton Vest, Asia and United States, 2013



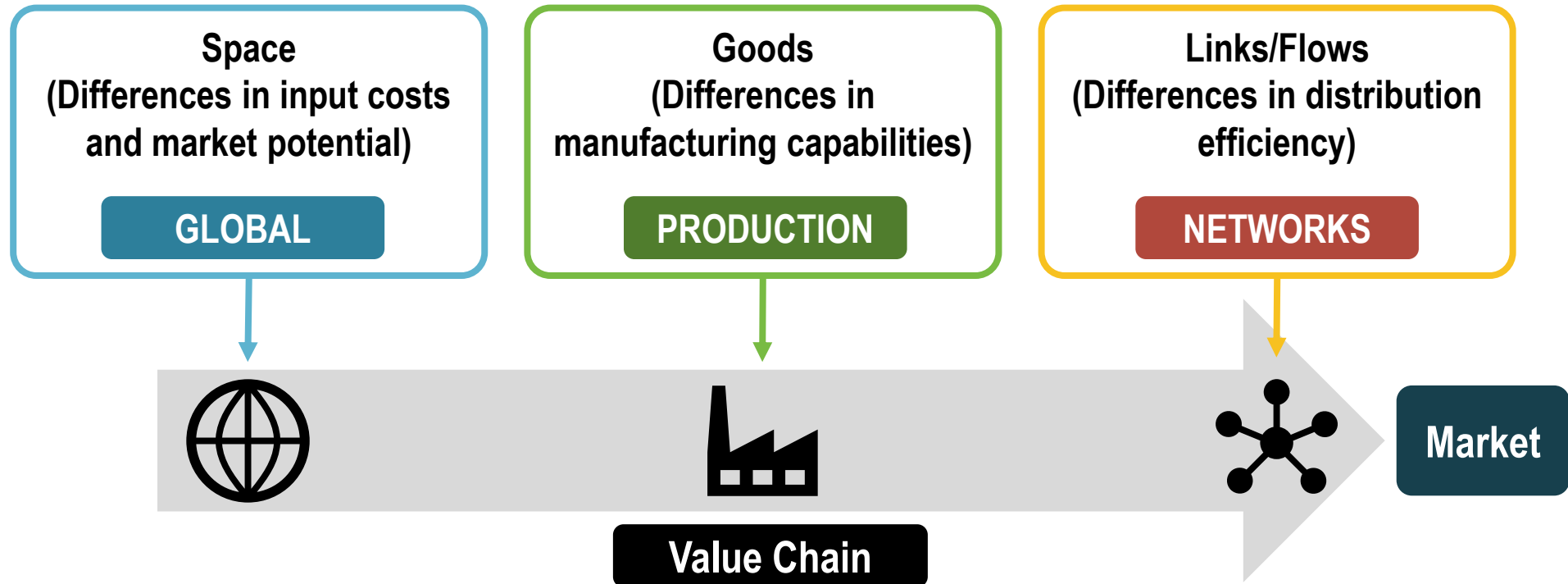
Freight Transport Costs as Share of Commodity Market Value

	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%

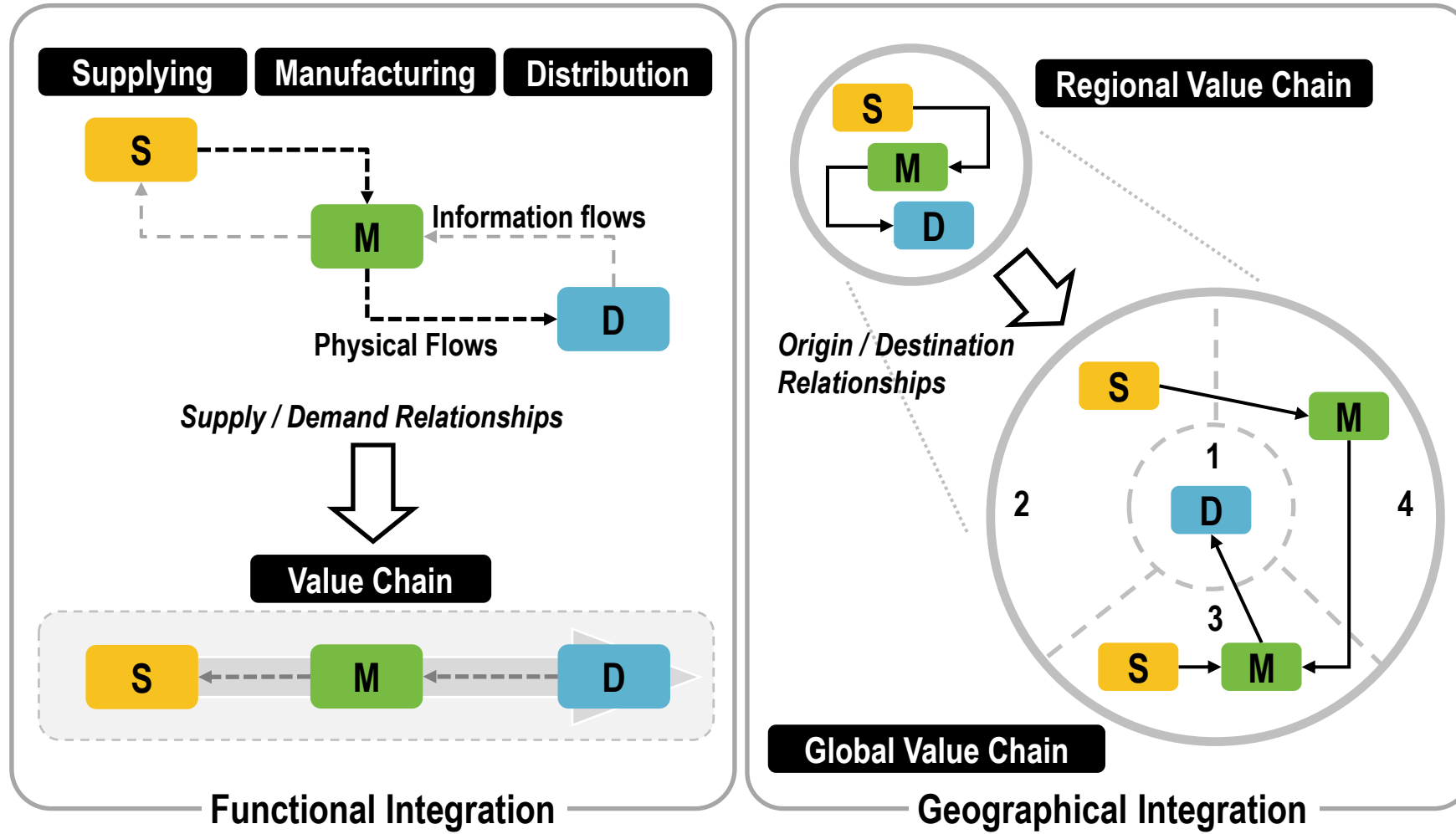
Added Value, Supply Chains and Transport Chains



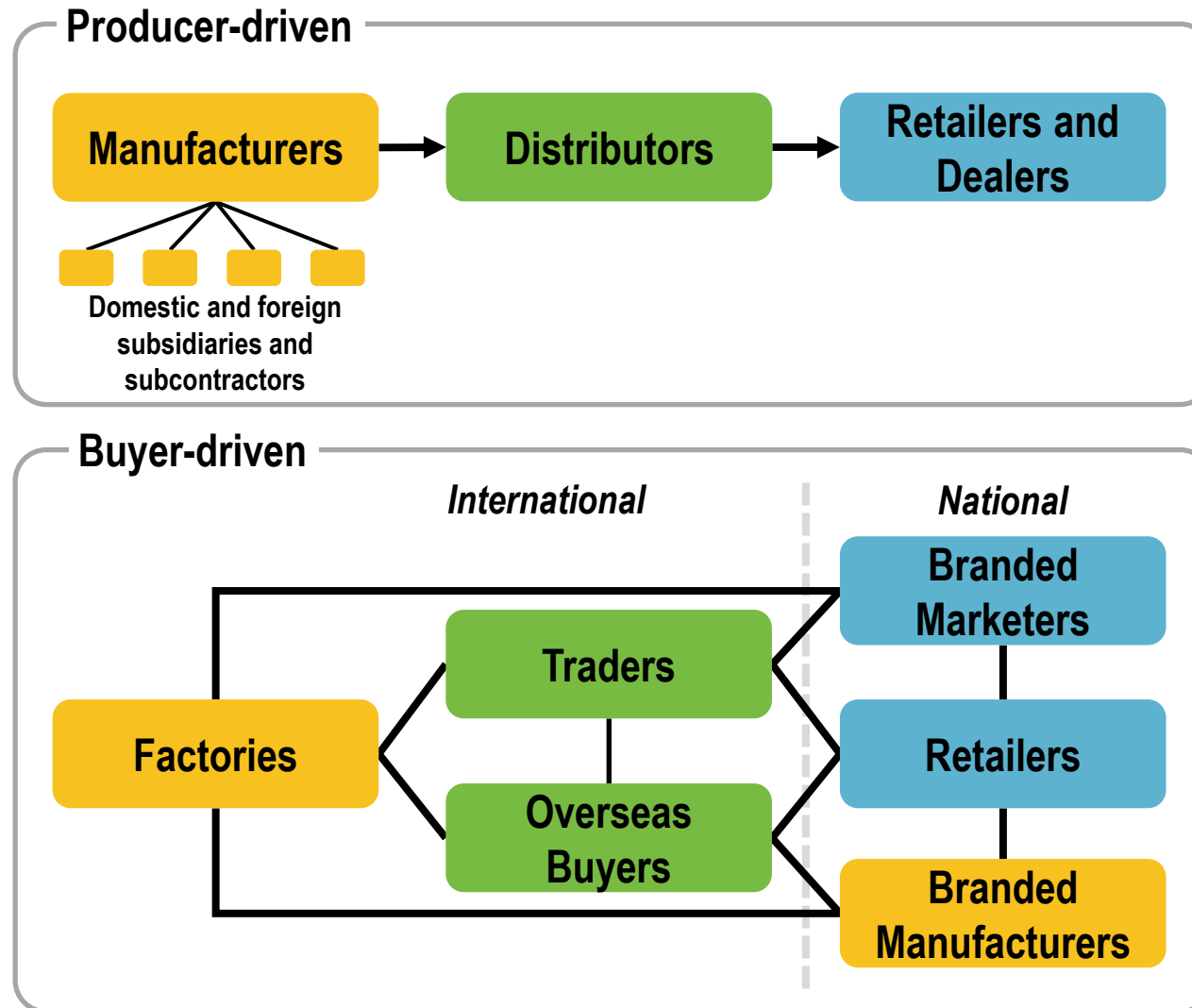
Global Production Networks



The Functional and Geographical Integration of Value Chains



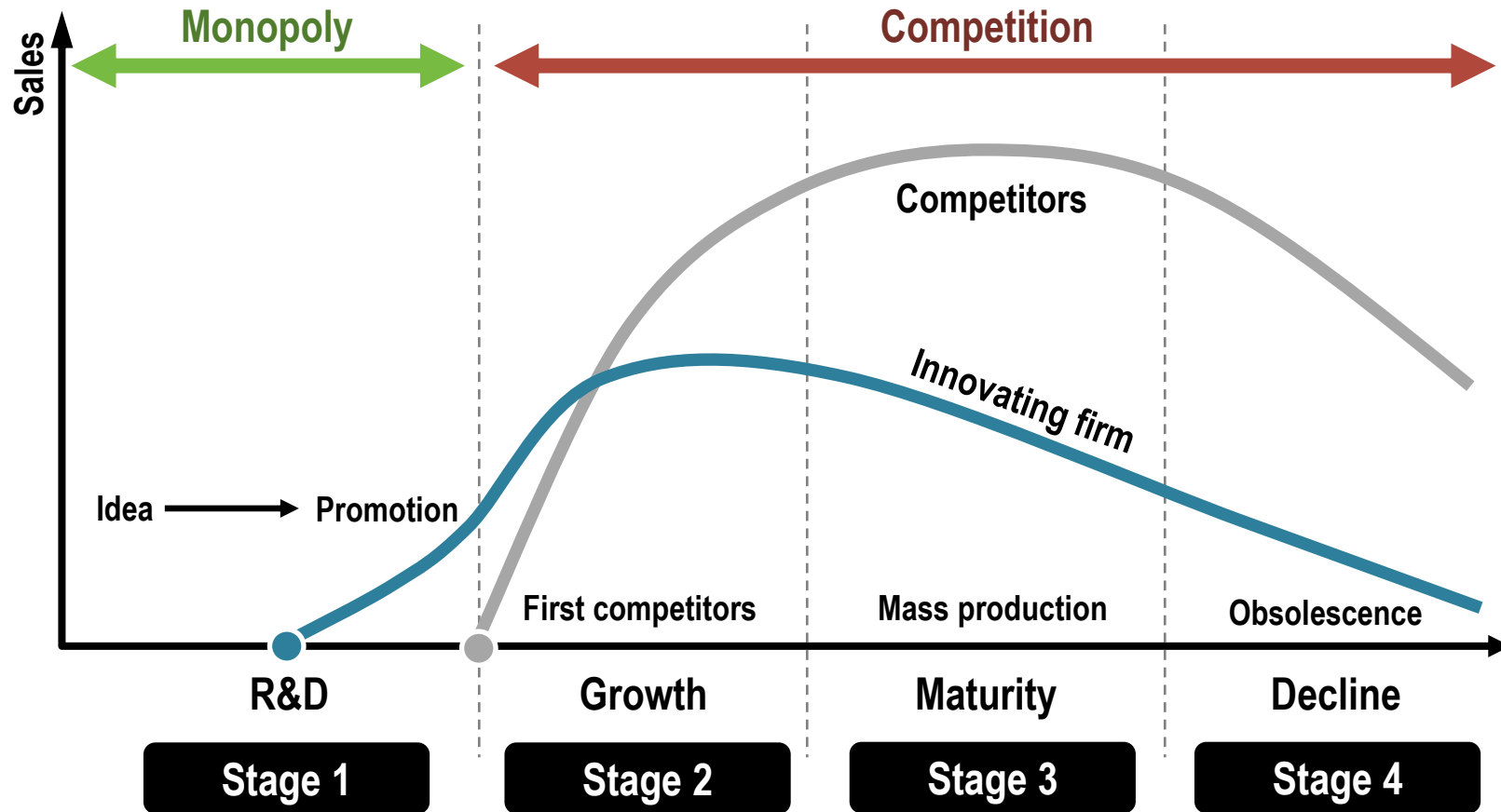
Producer and Buyer-driven Value Chains



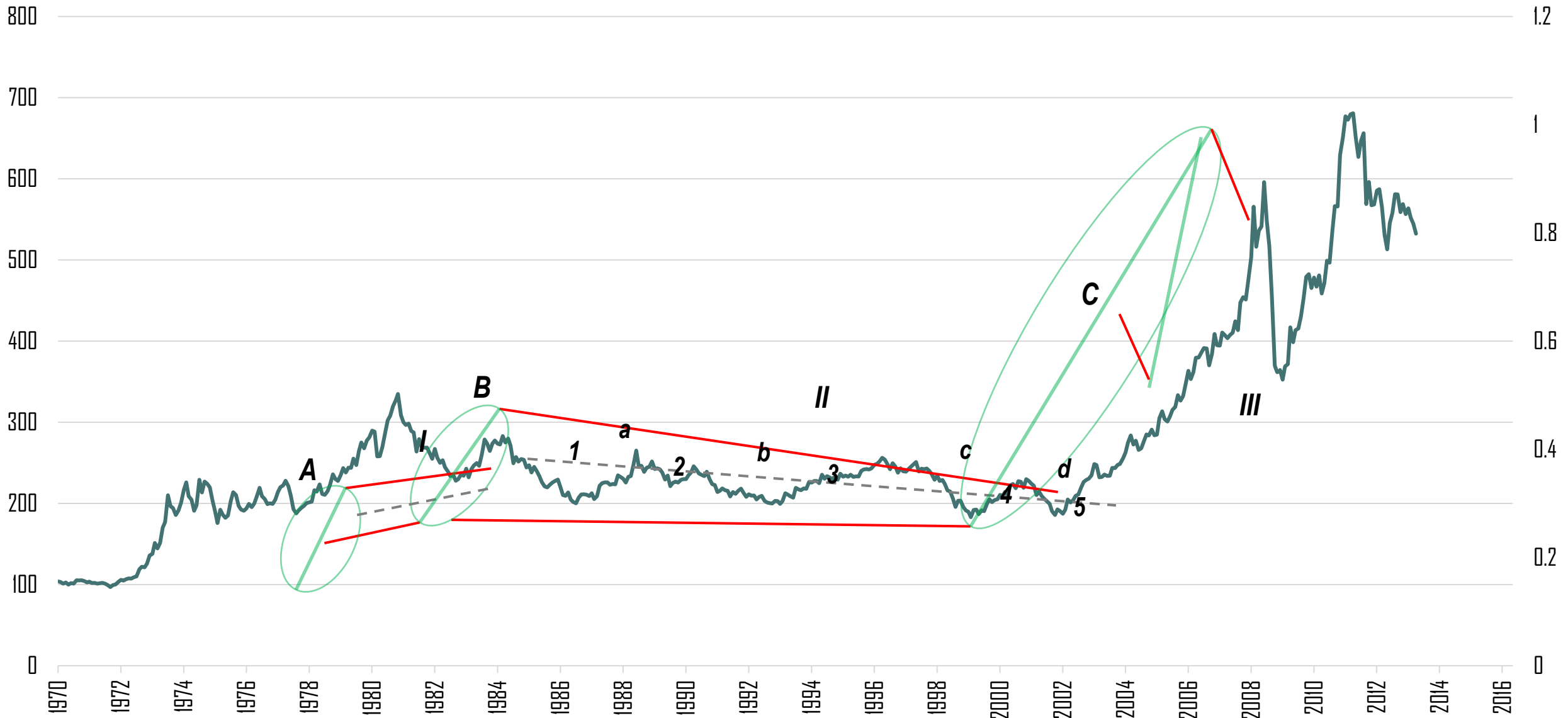
Characteristics of Producer-Driven and Buyer-Driven Global Commodity Chains

	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

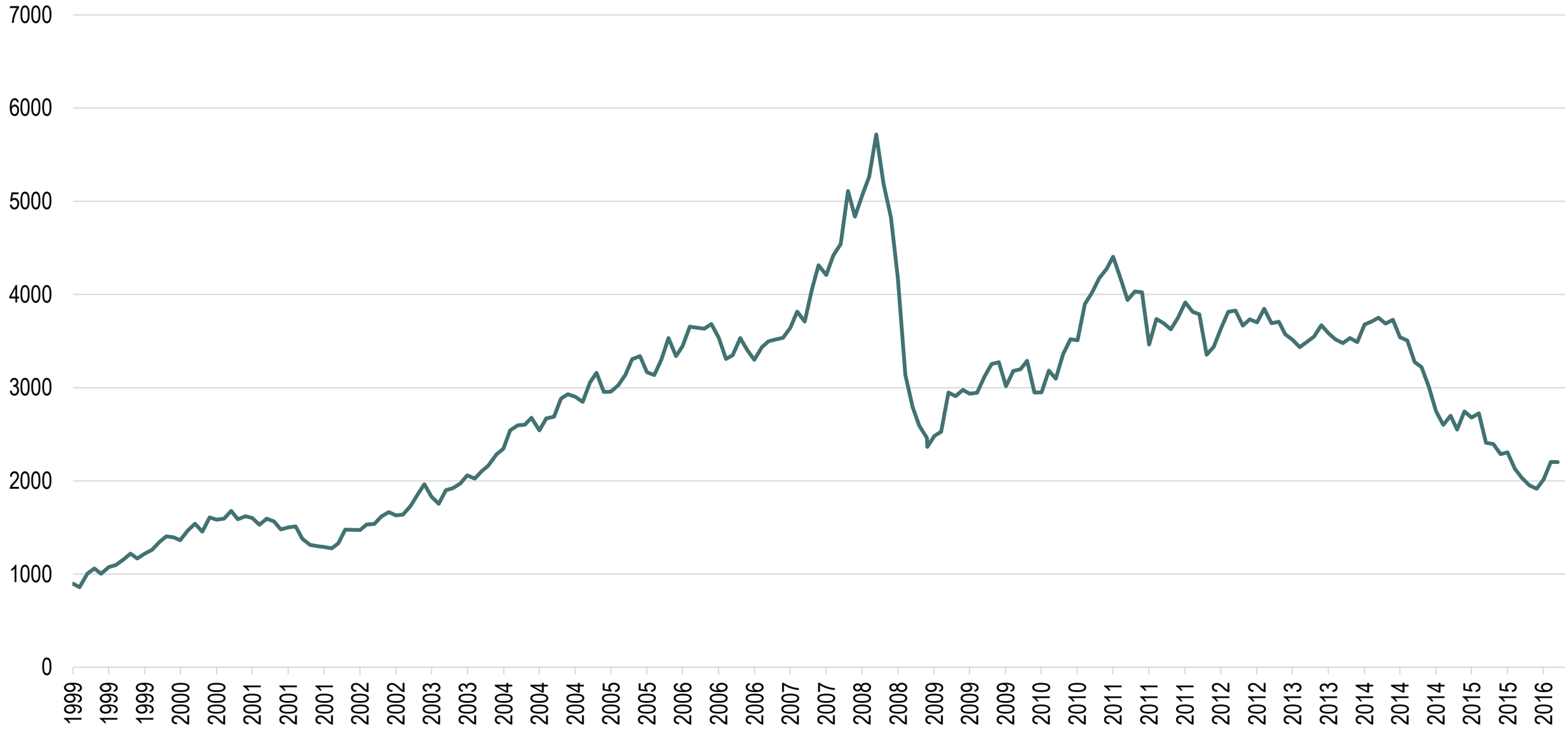
Product Life Cycle



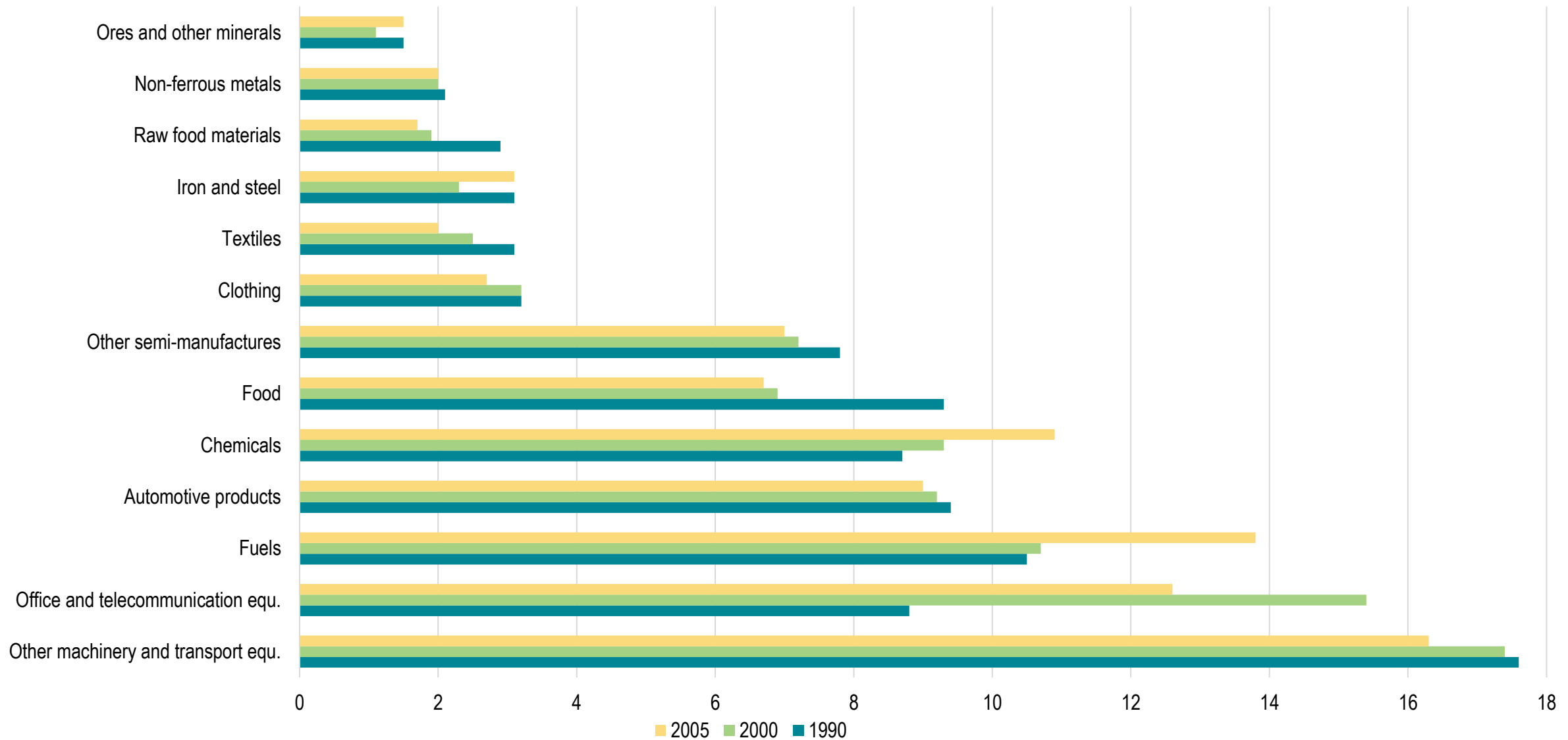
CRB Index (CCI), Monthly Close, 1970-2013



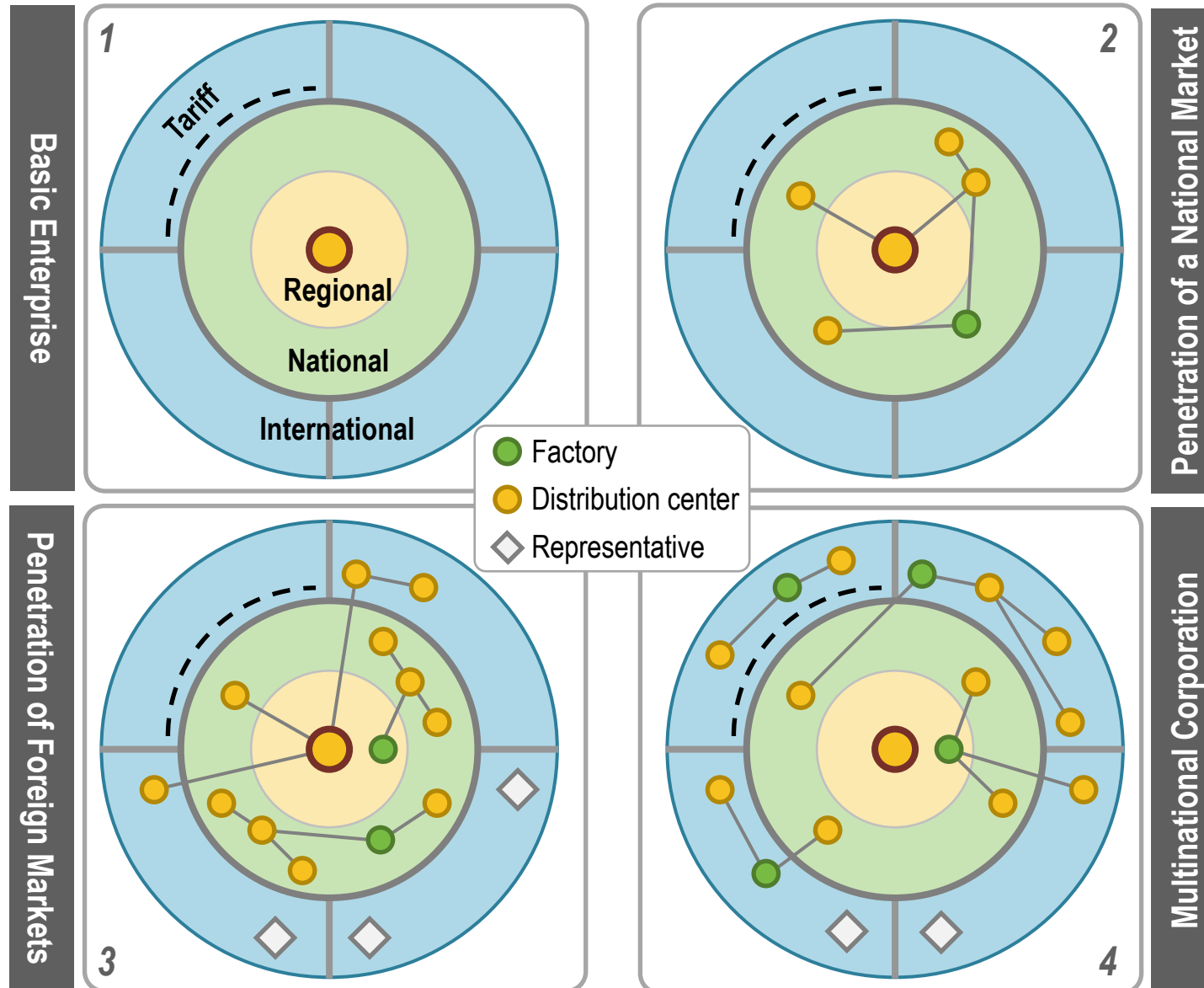
Rogers International Commodity Index 1999-2016



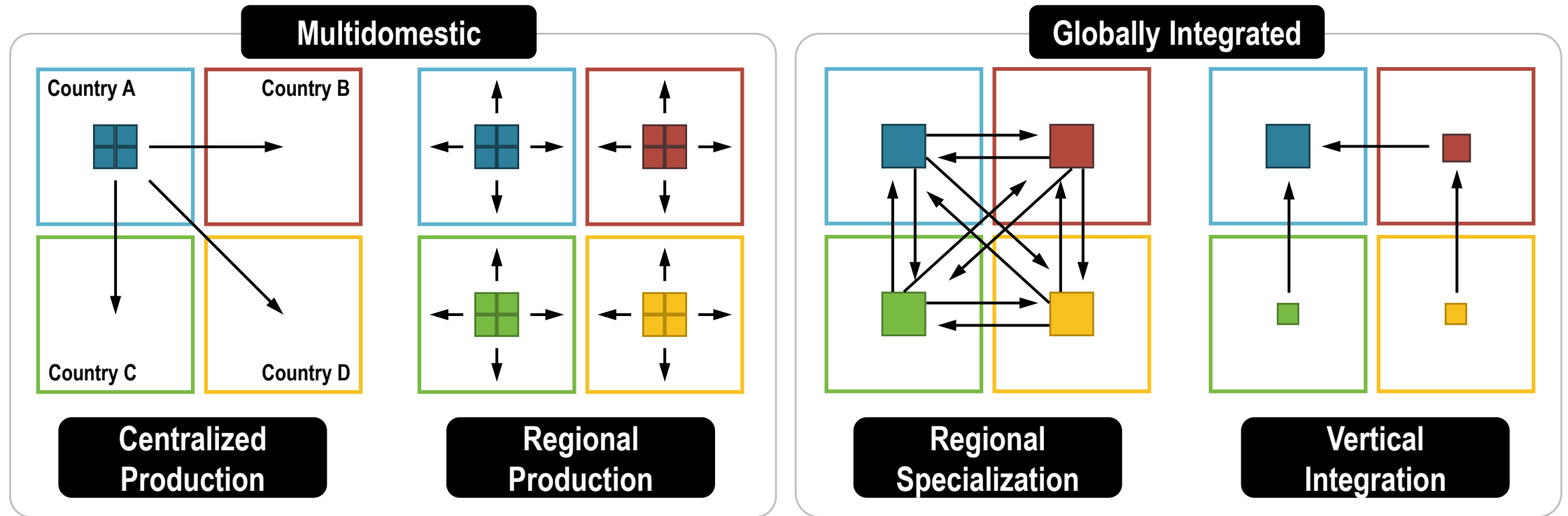
Global Merchandises Exports by Product, 1990-2005 (in % of value)



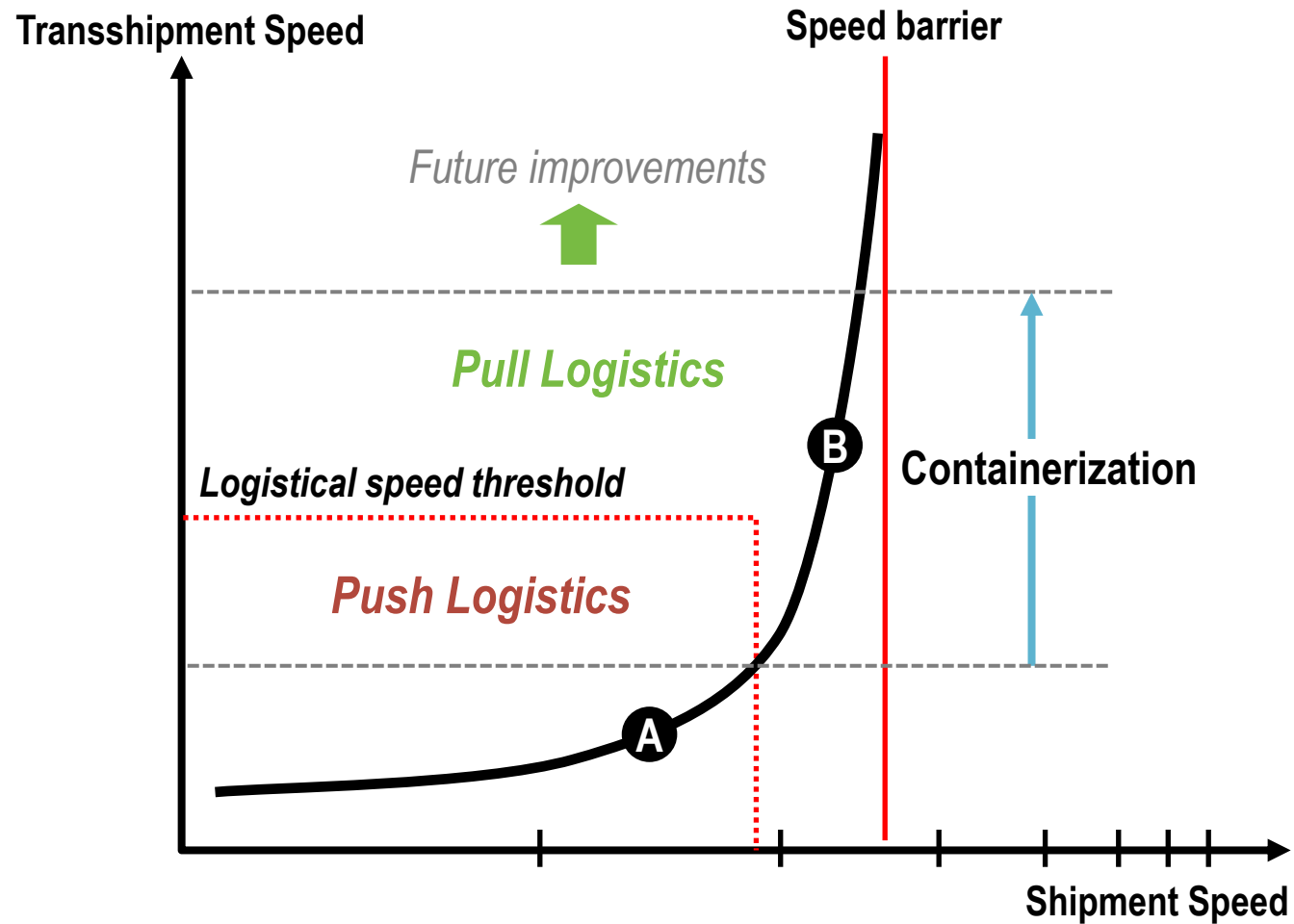
Geographical Growth of a Multinational Corporation



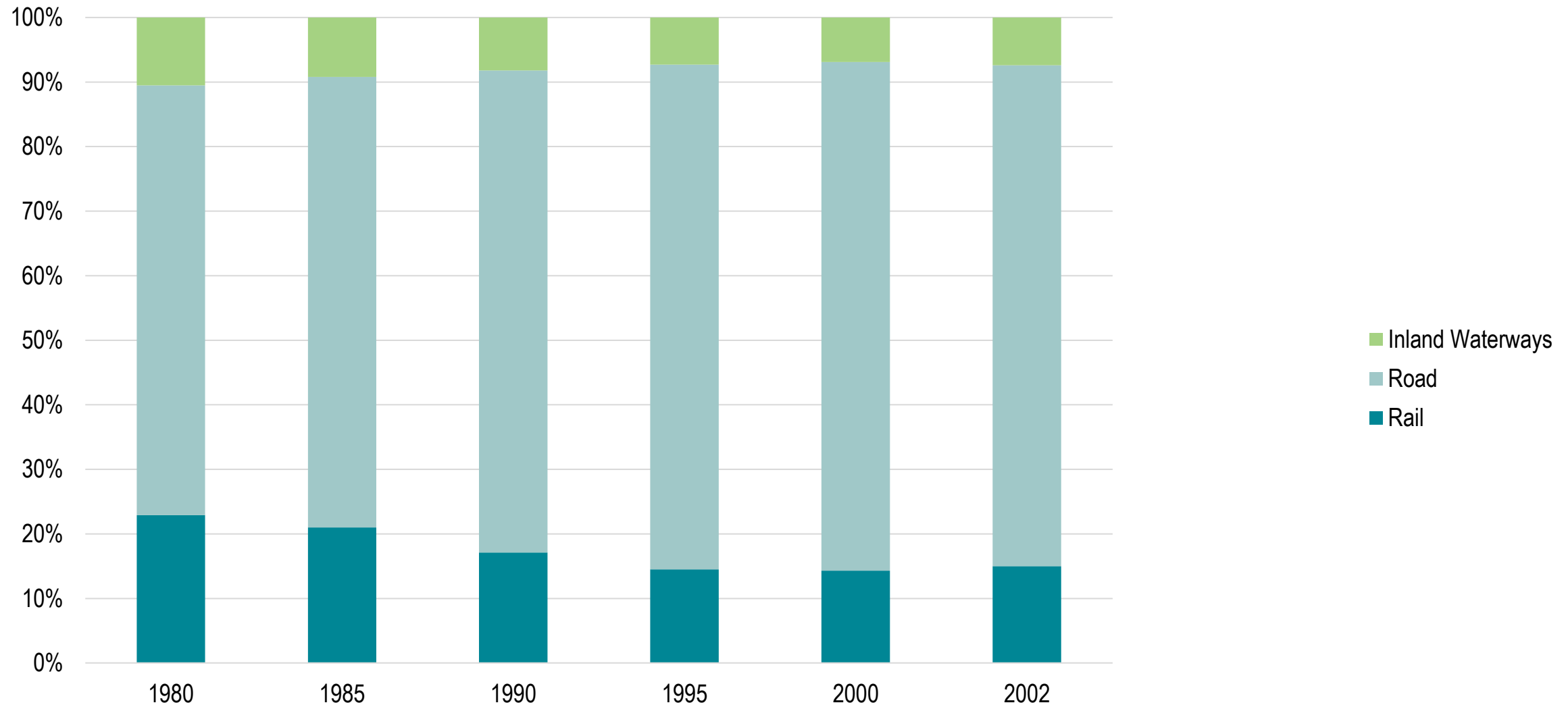
Global Production Networks and Location Strategies



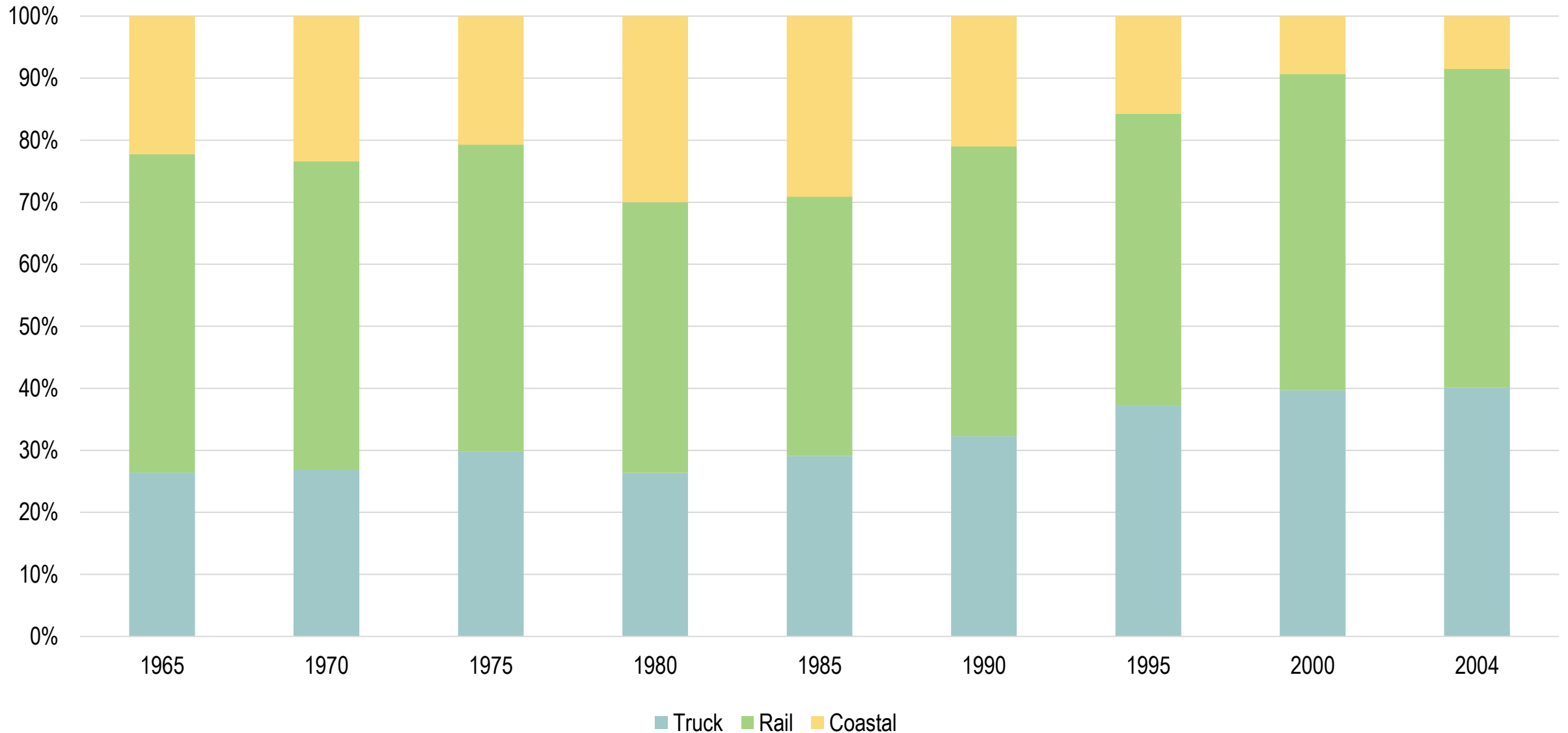
The Velocity of Freight



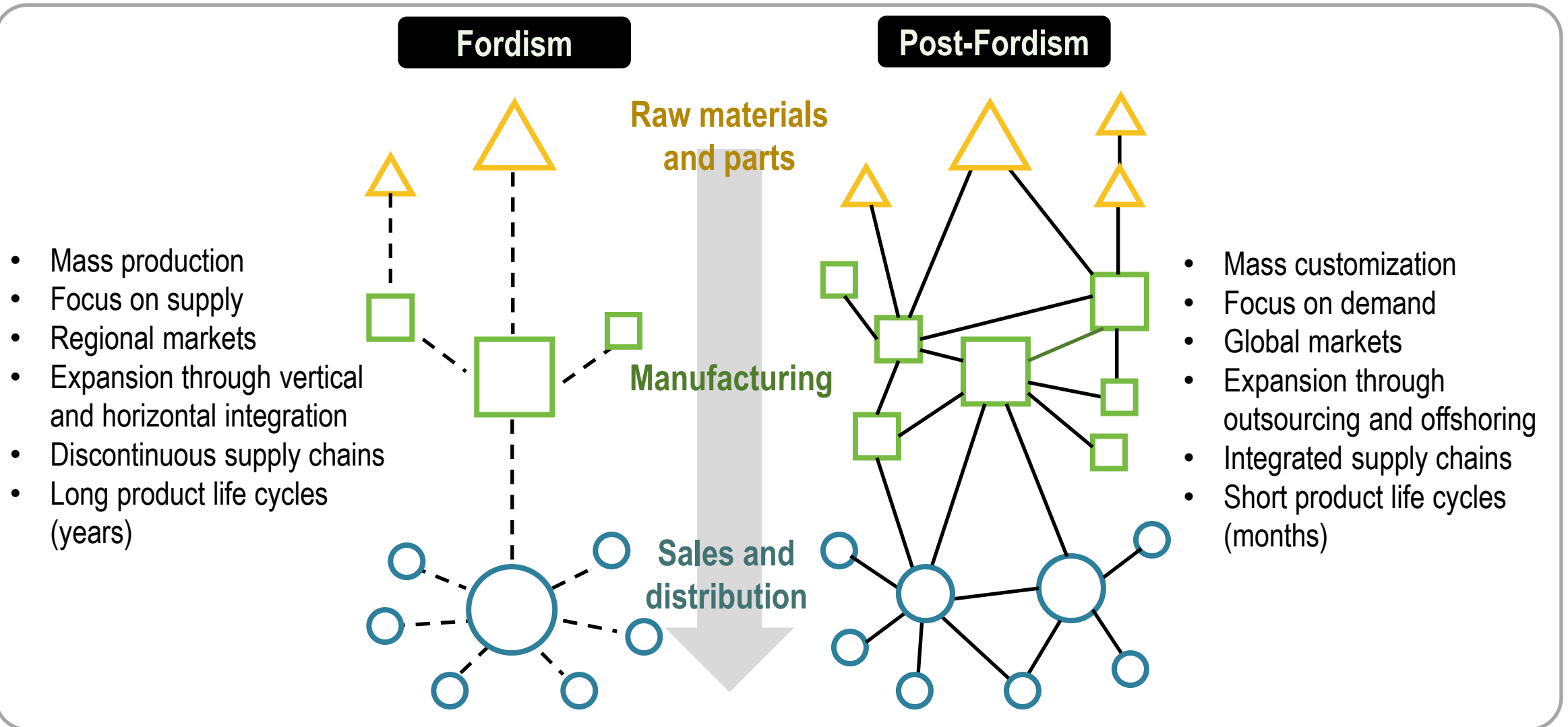
Market Share by Freight Transport Mode, Western Europe, 1980-2002 (in ton-km)



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

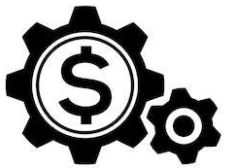
Characteristics	Fordism	Post-Fordism
Production Mode	Mass Production	Mass Customization
Organization	Structured (Pyramidal)	Networked (Flexible)
Focus	Supply	Demand
Market Reach	Regional / National	Global
Expansion	Vertical or horizontal integration	Outsourcing and offshoring
Core Resources	Physical 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

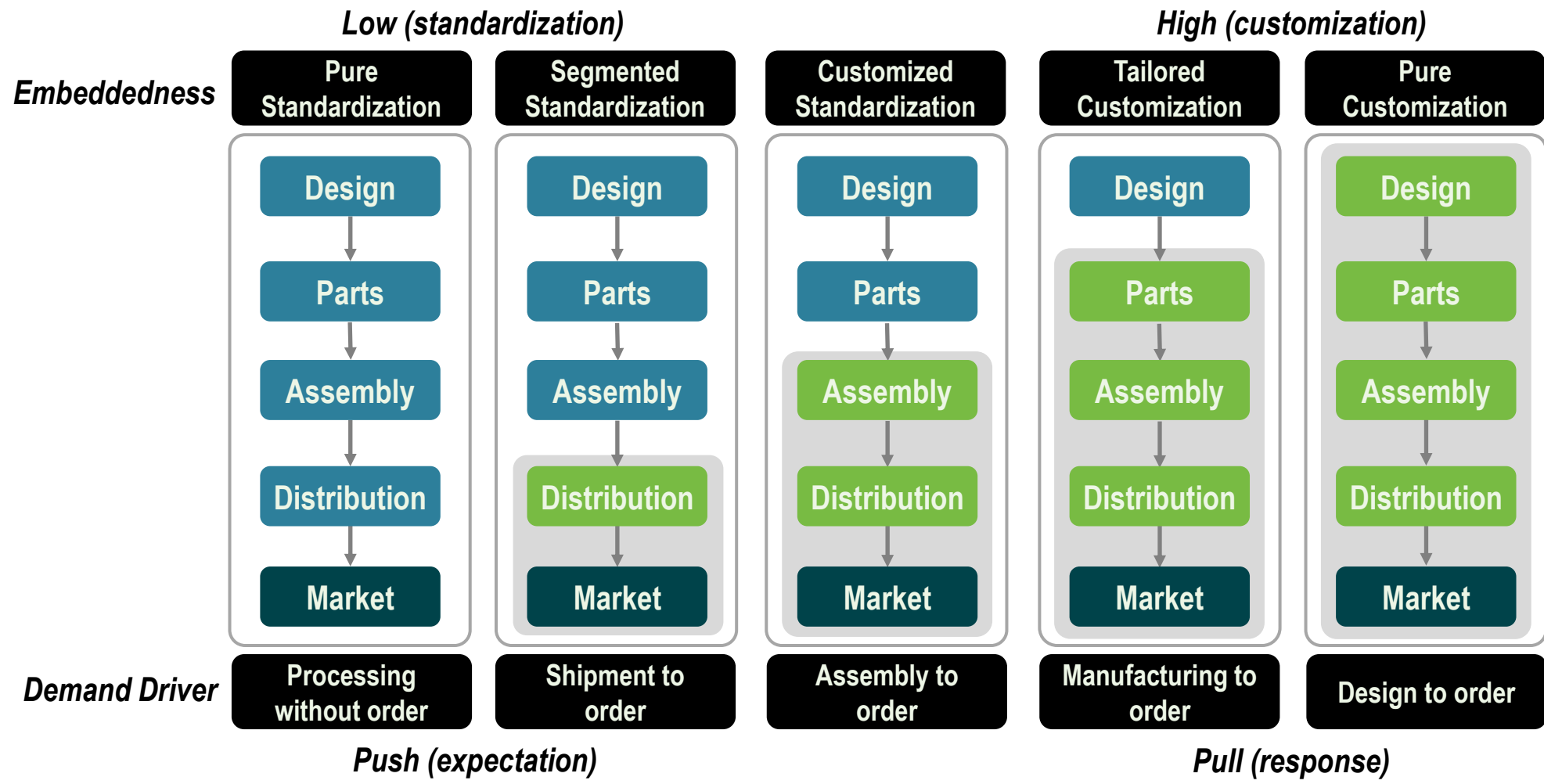
- Declining importance of “blue collar” tasks.
- Increasing importance of technical and creative tasks.



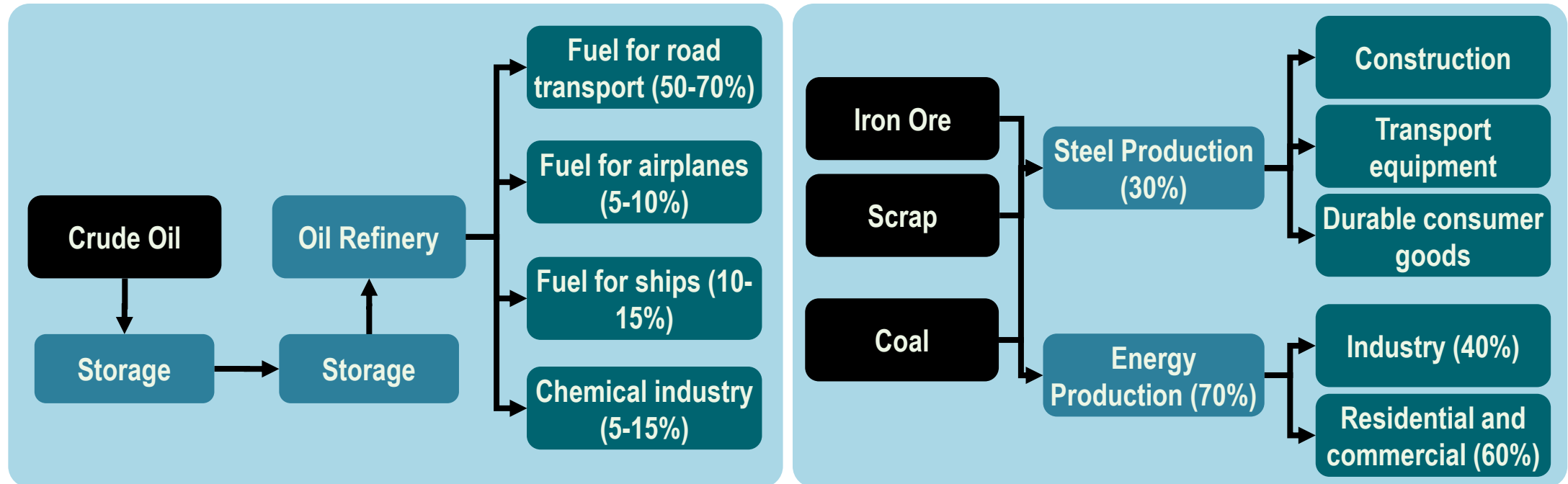
Information Technologies

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

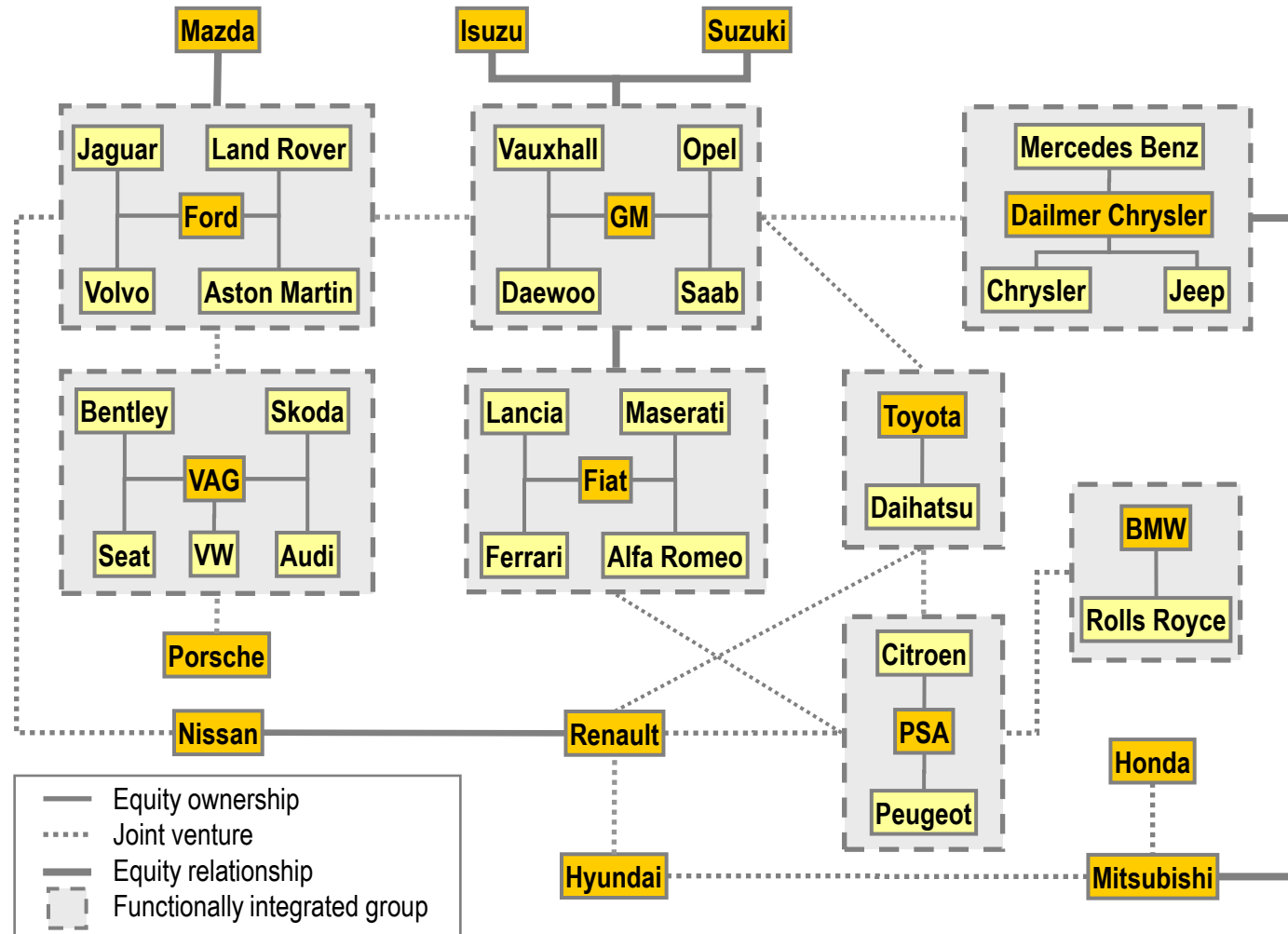
Level of Embeddedness of Value Chains



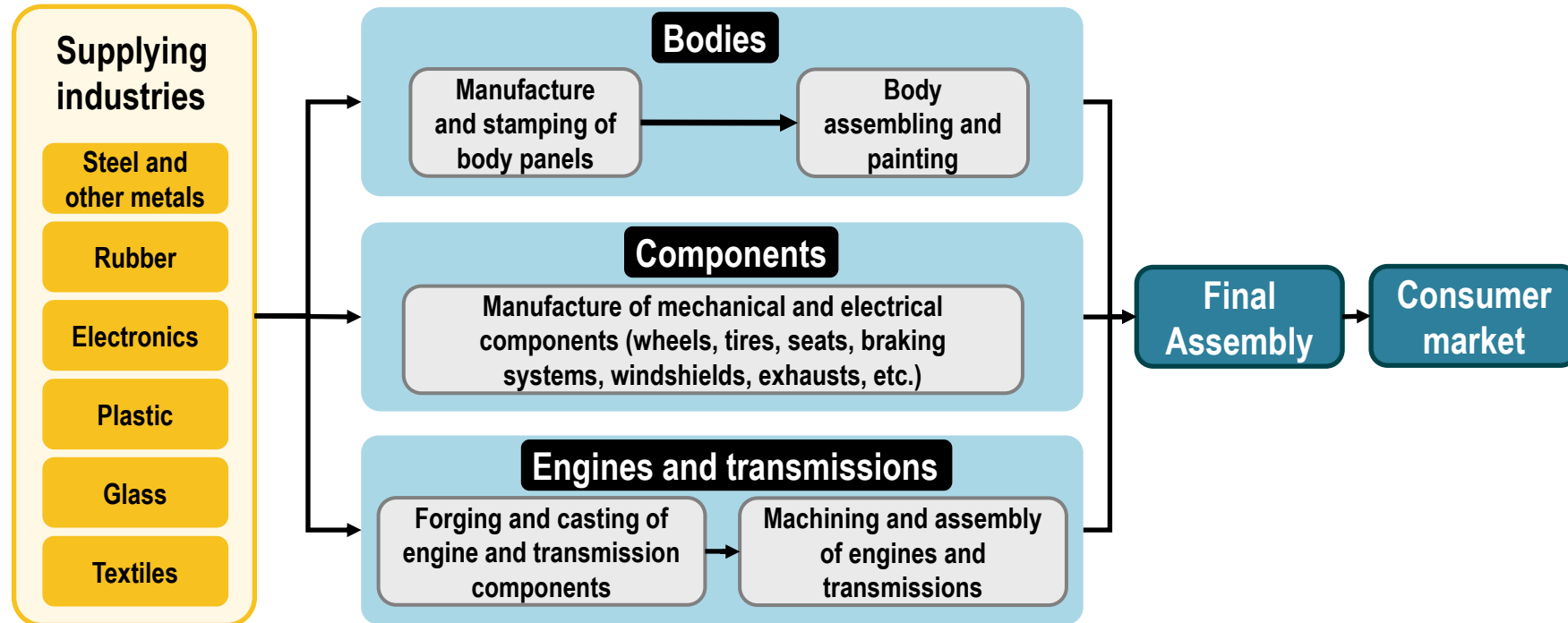
Energy and Minerals Supply Chains



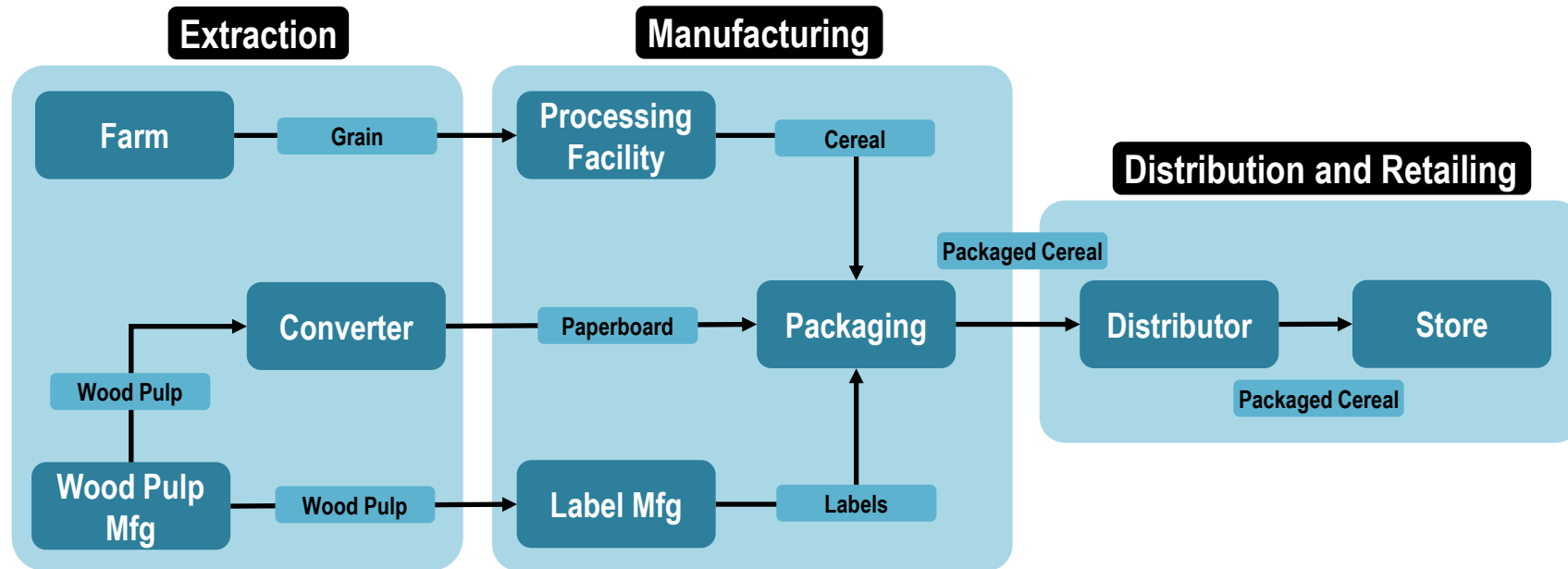
The Global Car Production Network, 2003



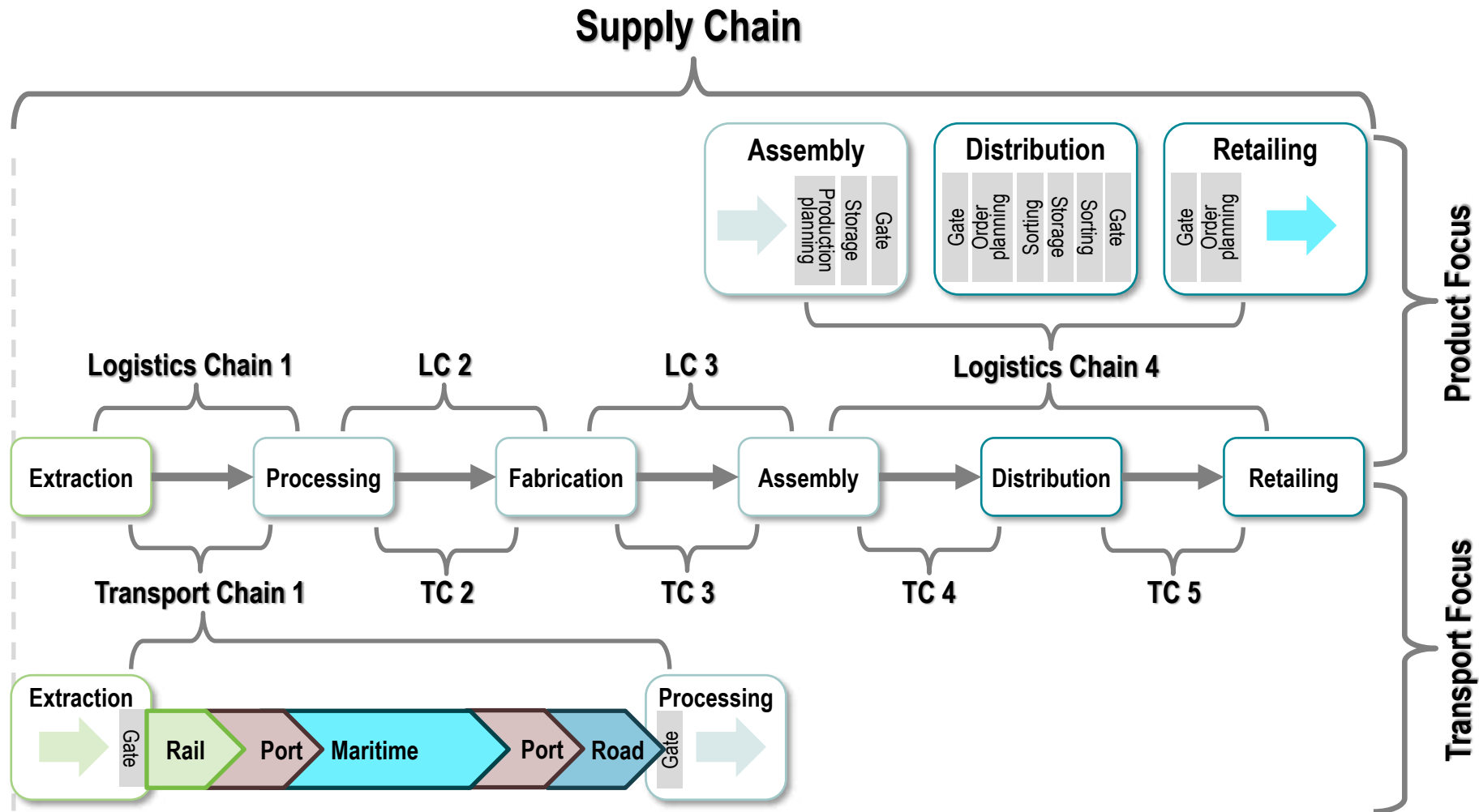
The Automobile Supply Chain



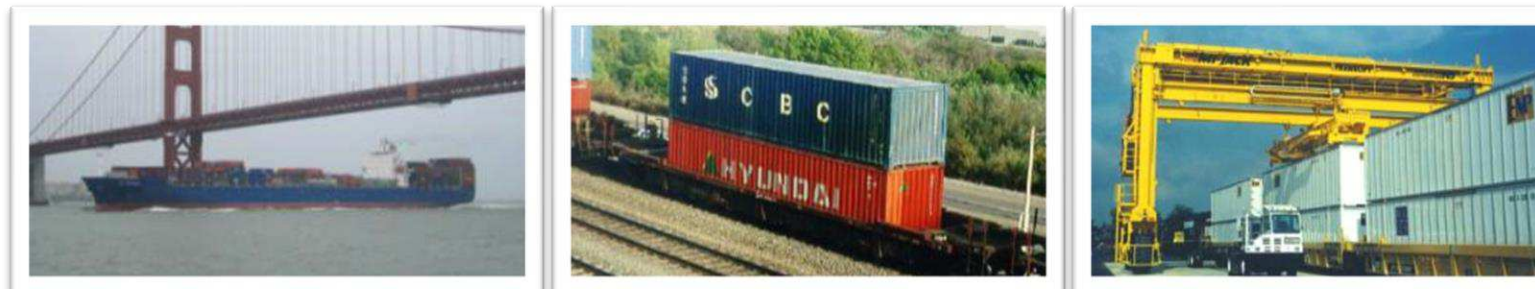
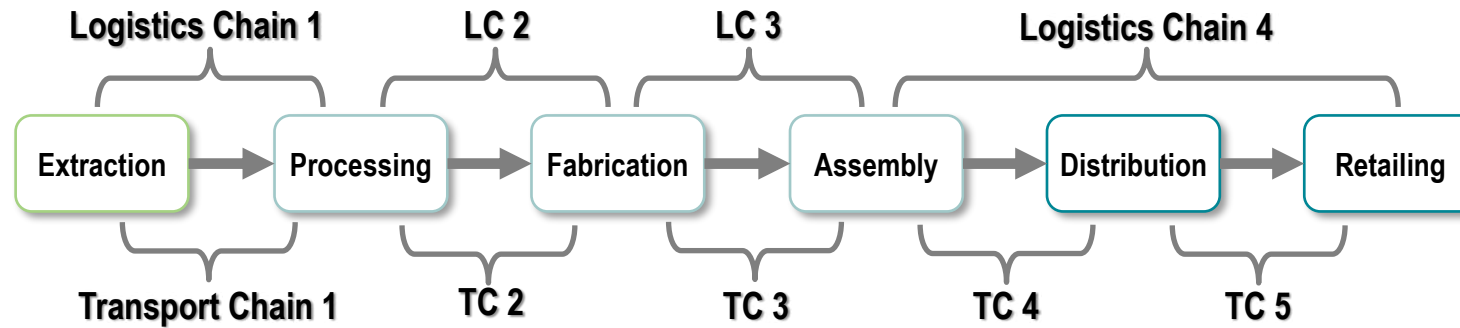
Cereals Supply Chain

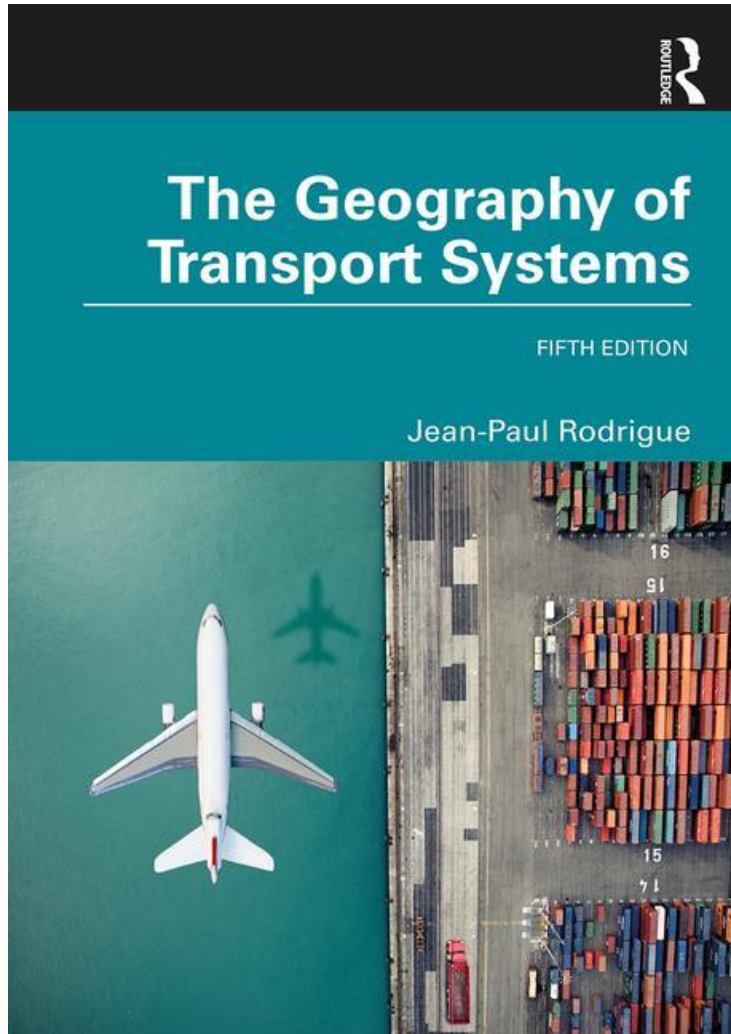


The Scope of a Supply Chain, Logistics Chains and Transport Chains



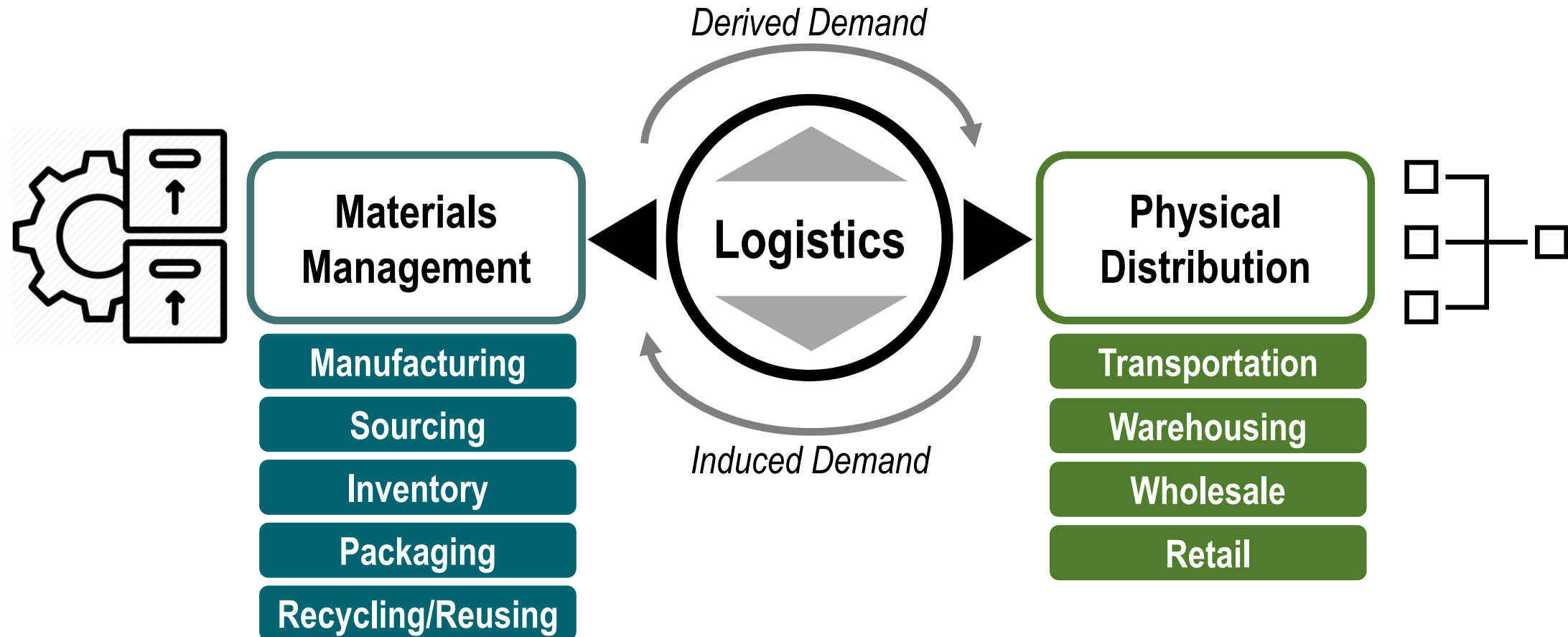
Supply Chains: Alternating First and Last Miles



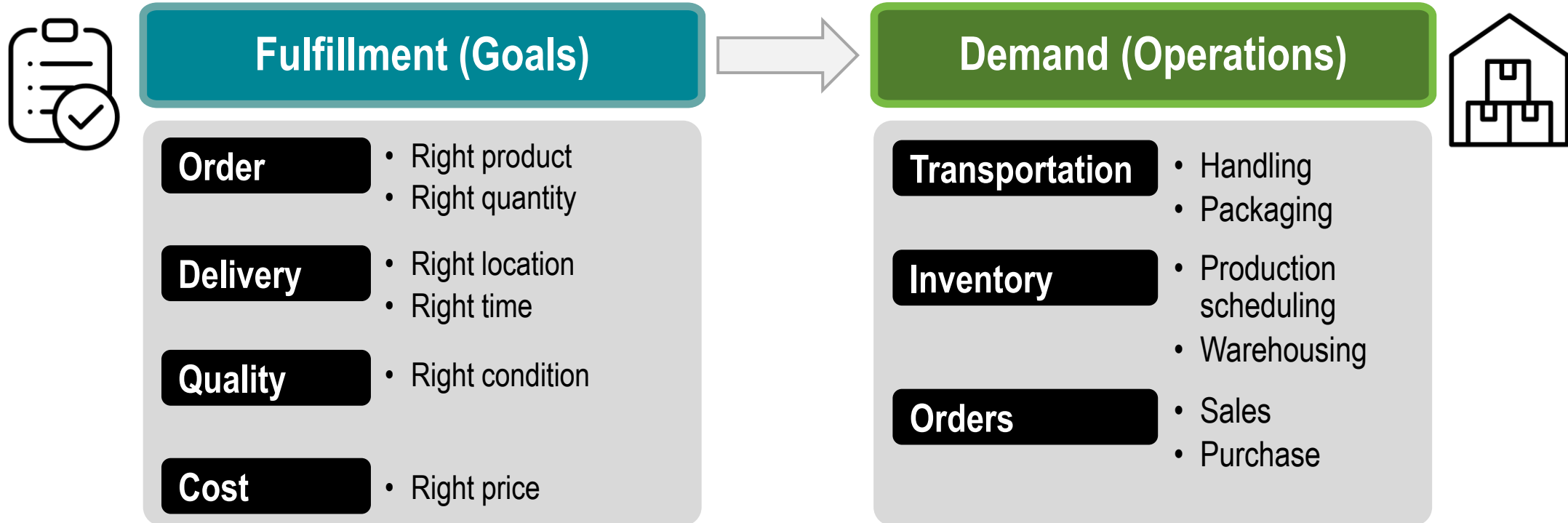


7.4 - Logistics and Freight Distribution

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.

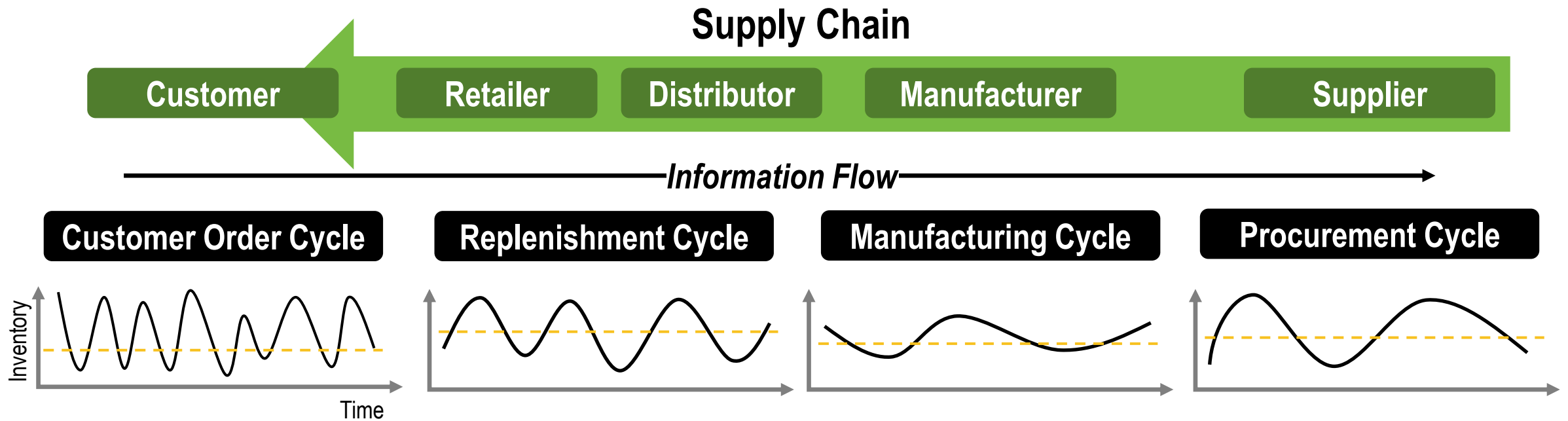
Secondary Packaging

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

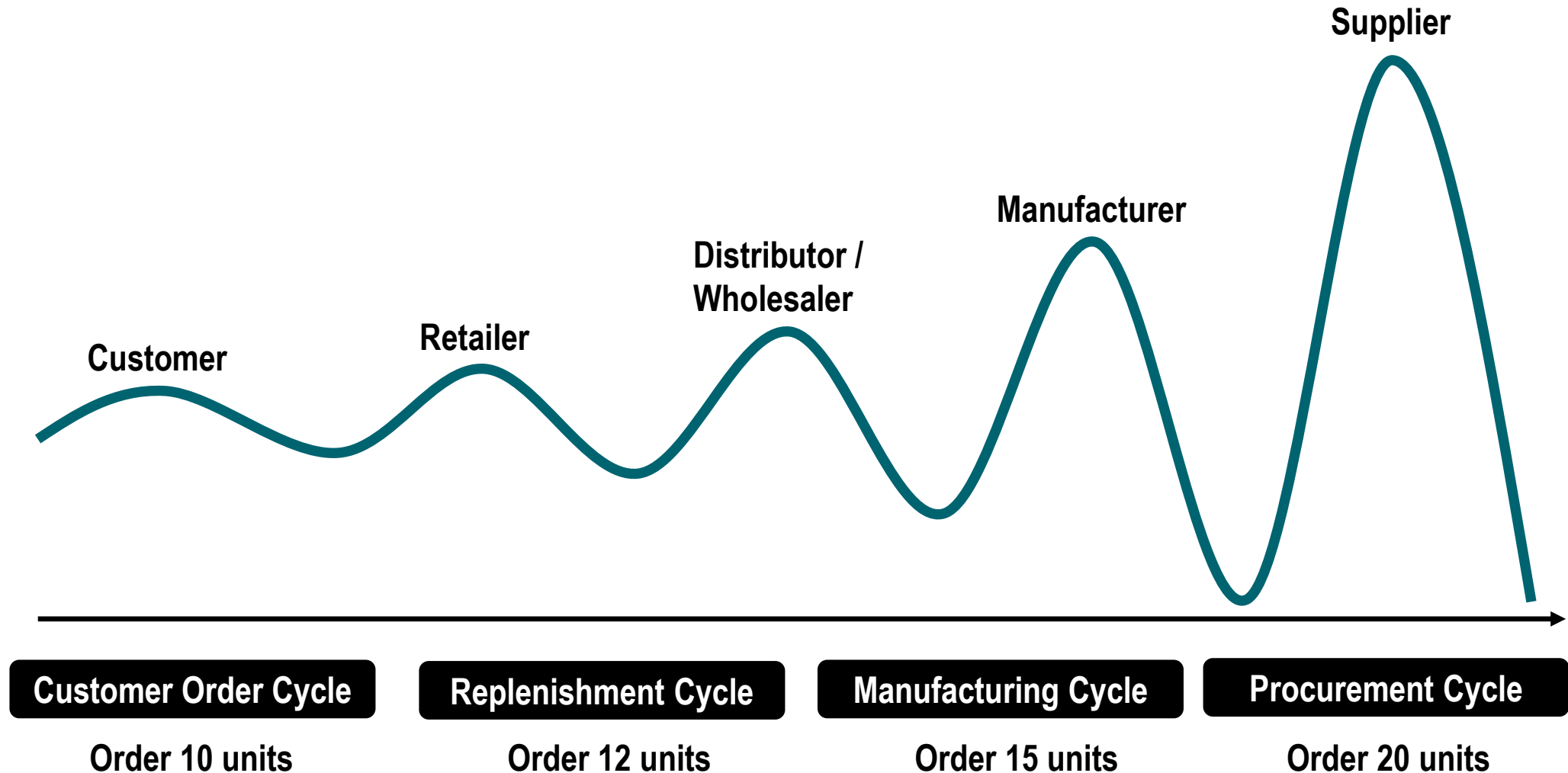
Tertiary Packaging

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

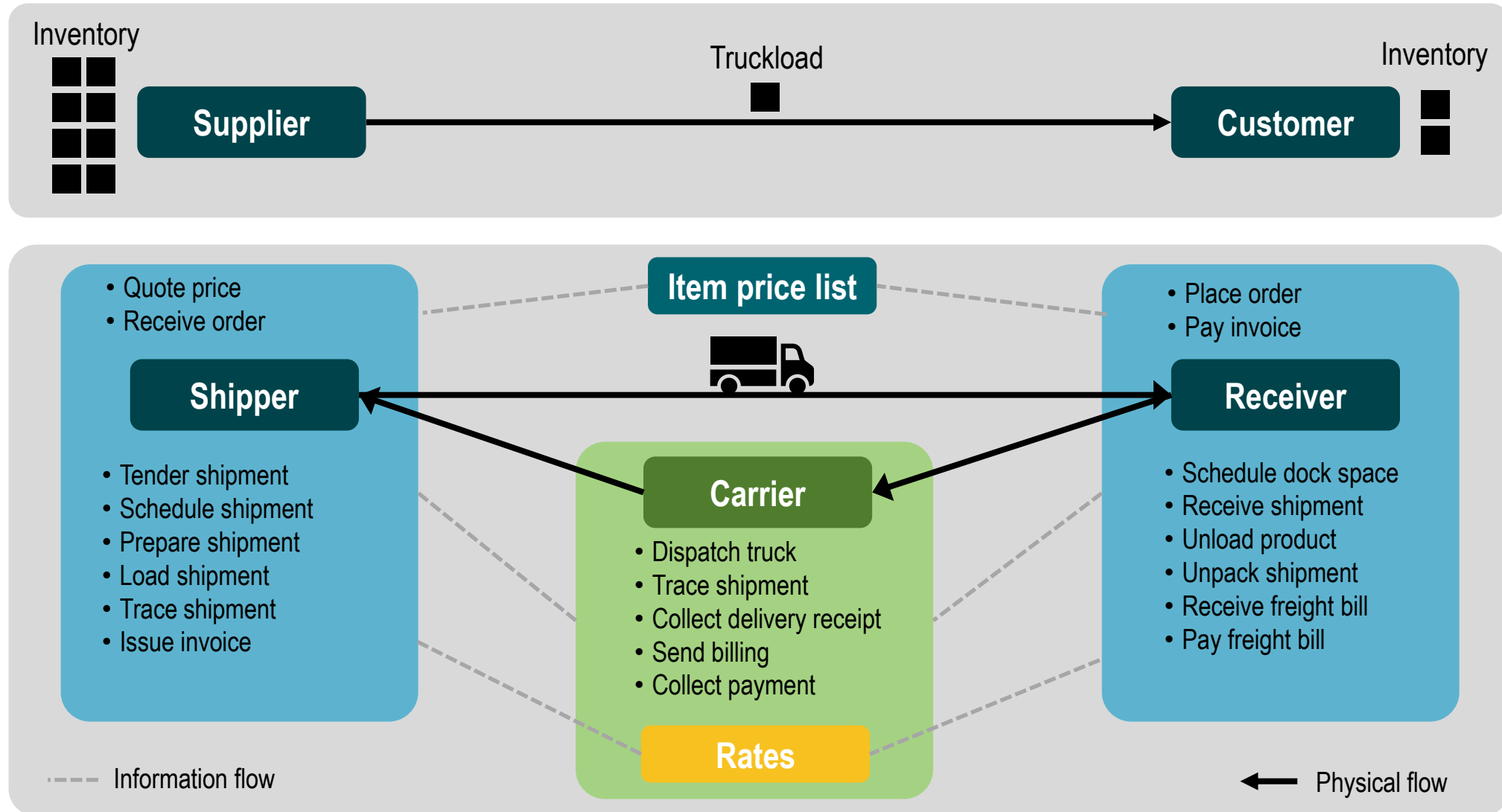
The Supply Chain and its Cycles



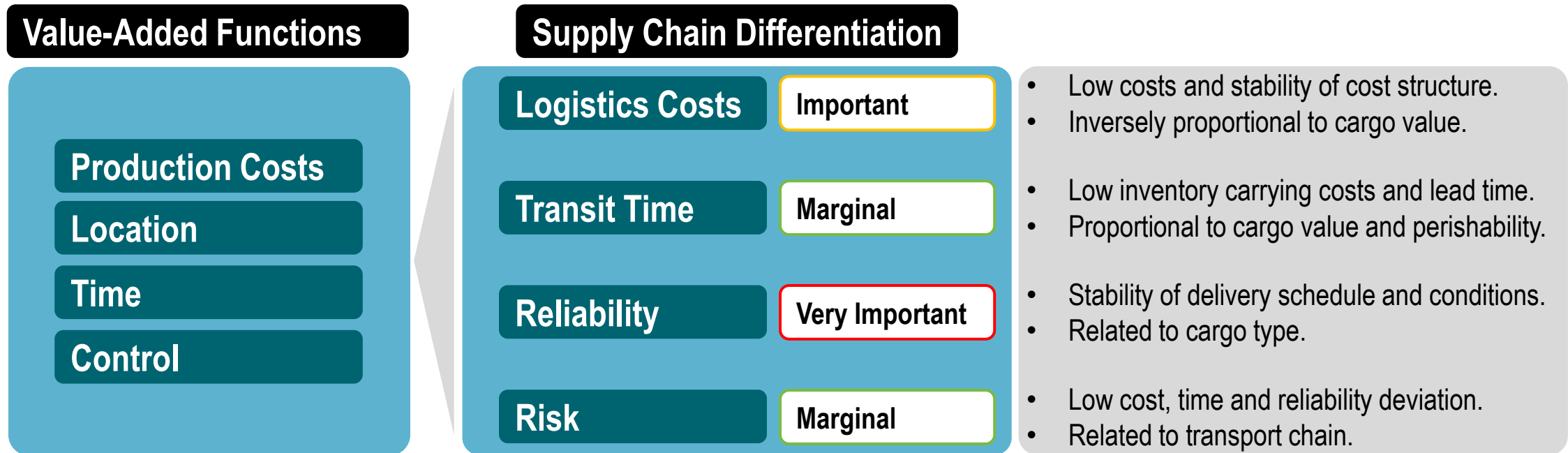
The “Bullwhip Effect” in Supply Chains



Distribution and Related Logistics Activities



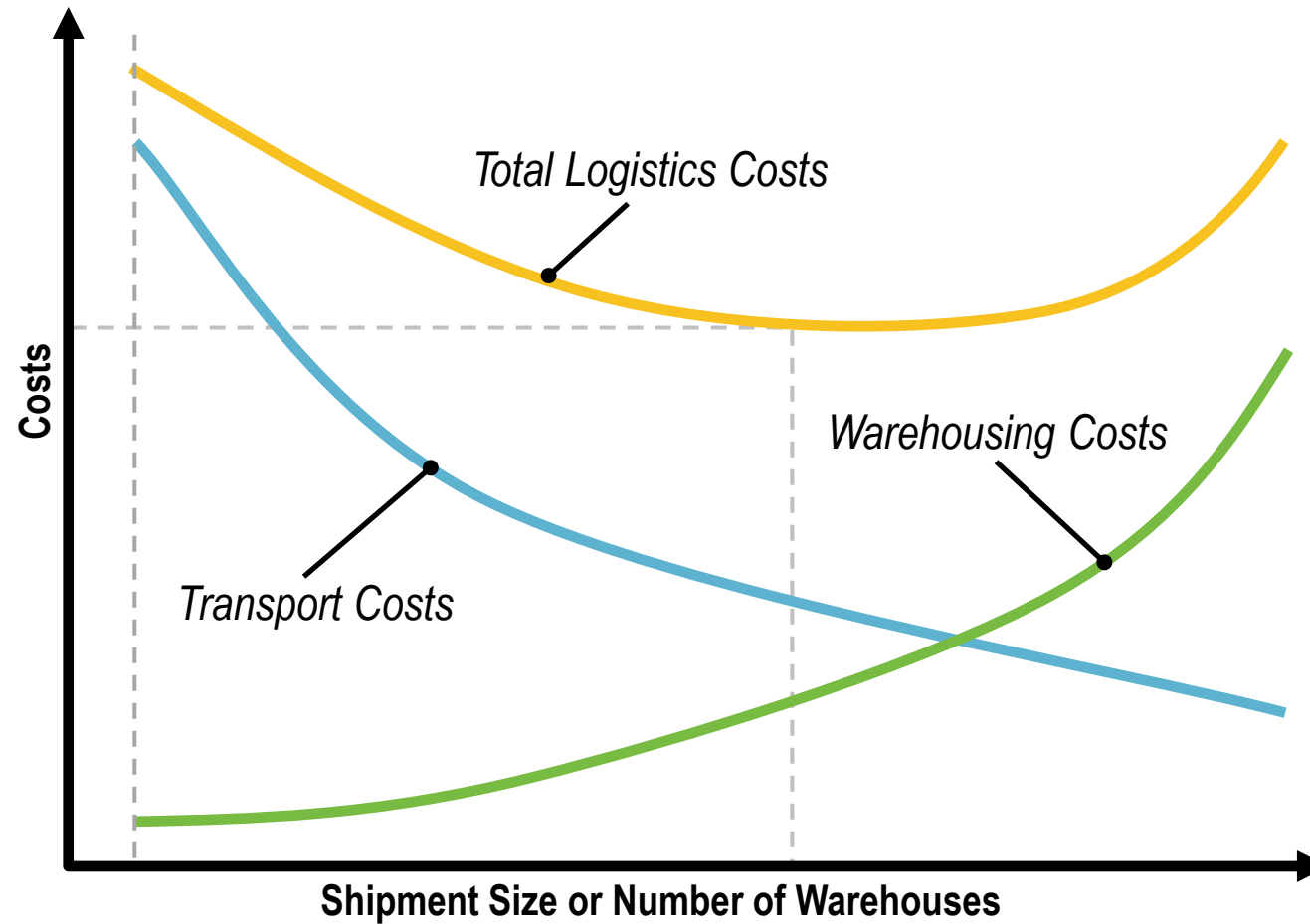
Value-Added Functions and Differentiation of Supply Chains



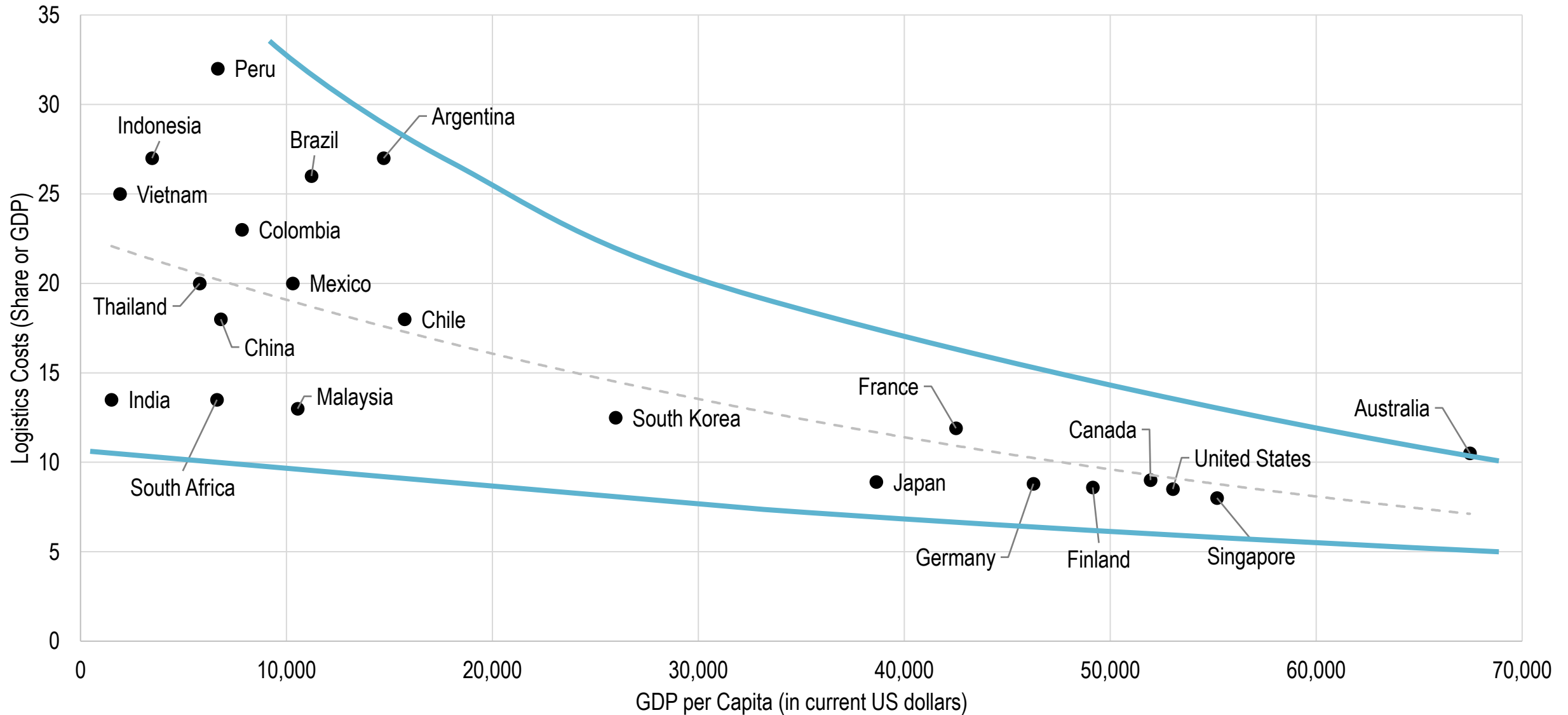
Taxonomy of Logistics Decisions

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.

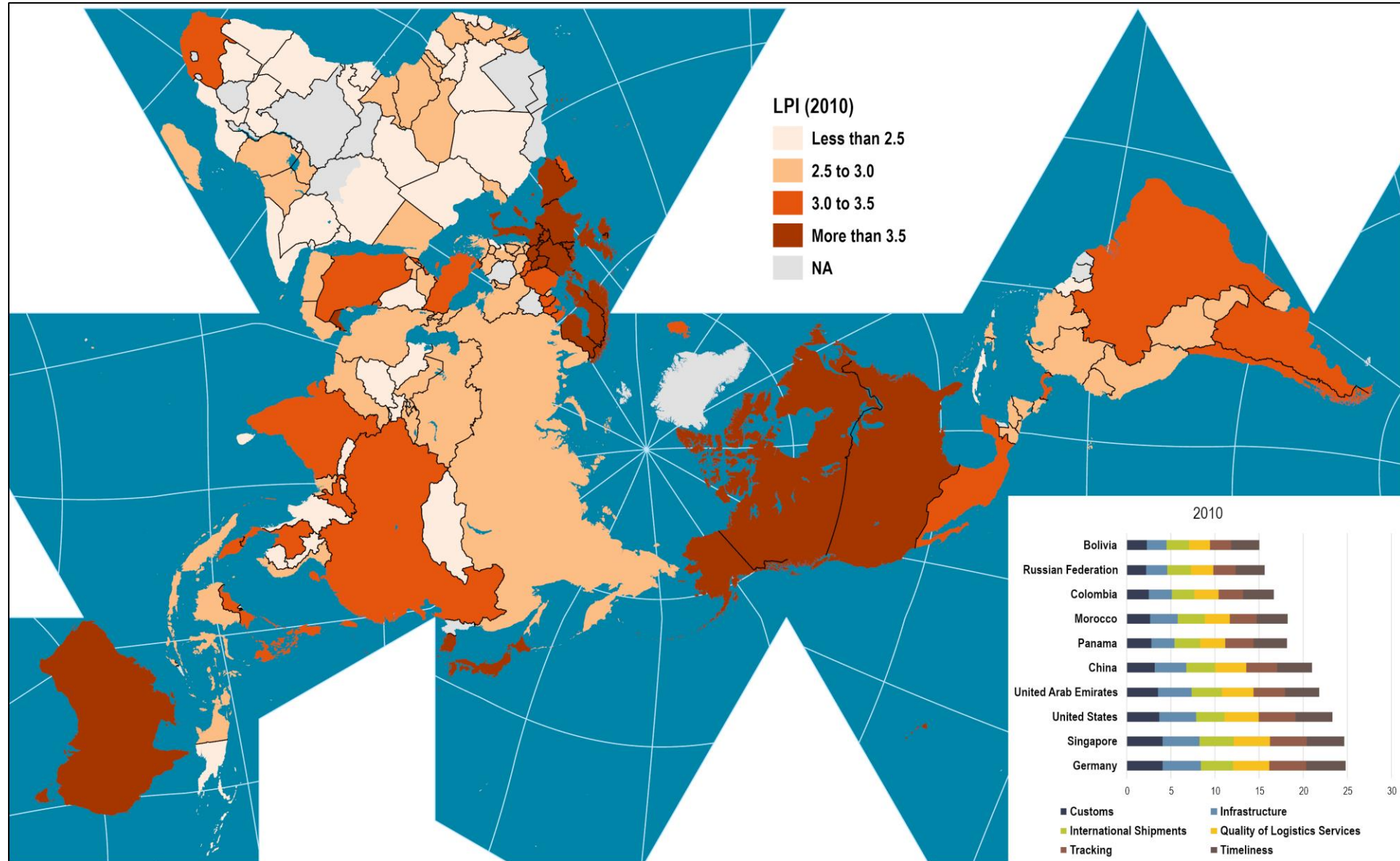
Total Logistics Costs Tradeoff



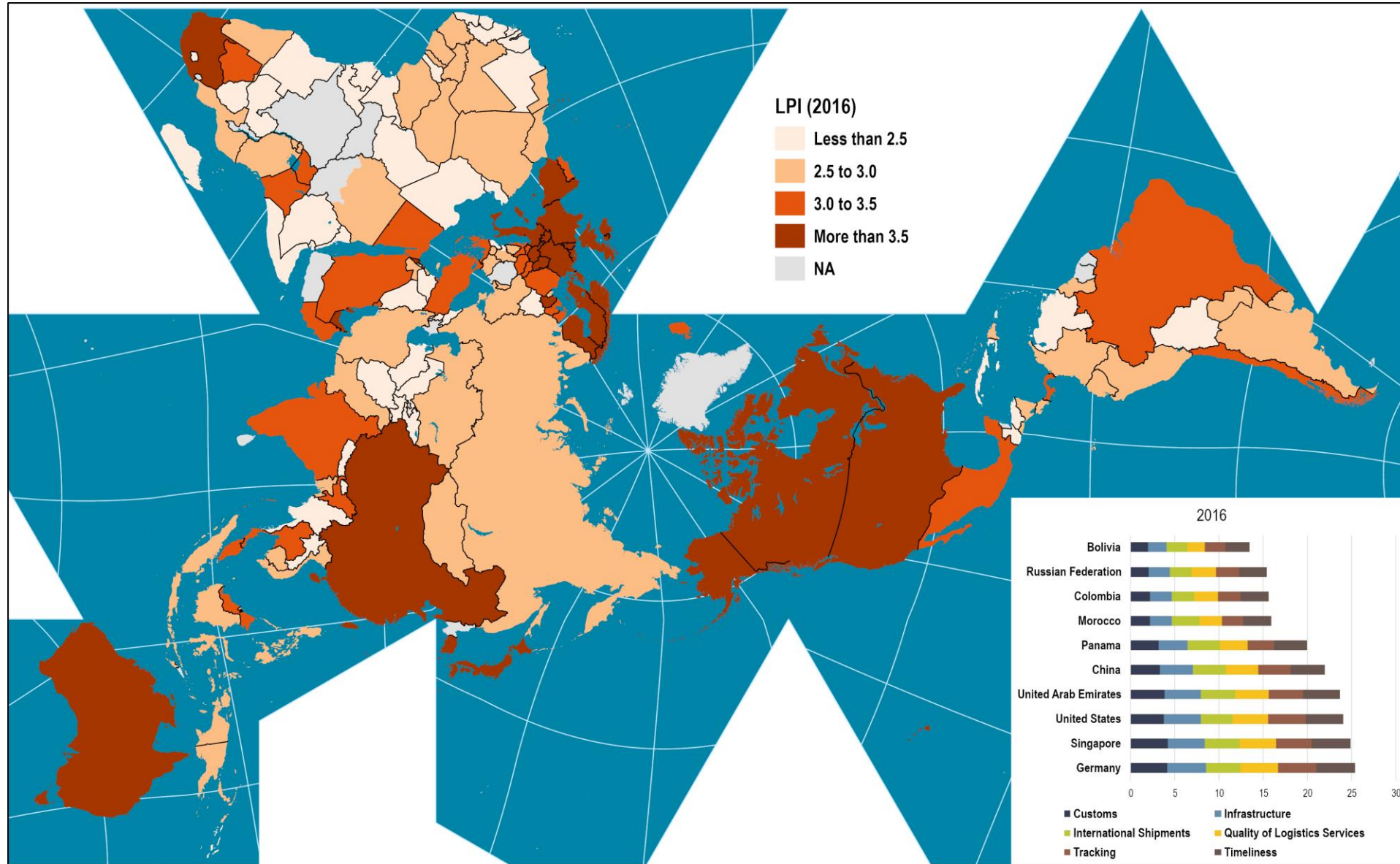
Logistics Costs and Economic Development



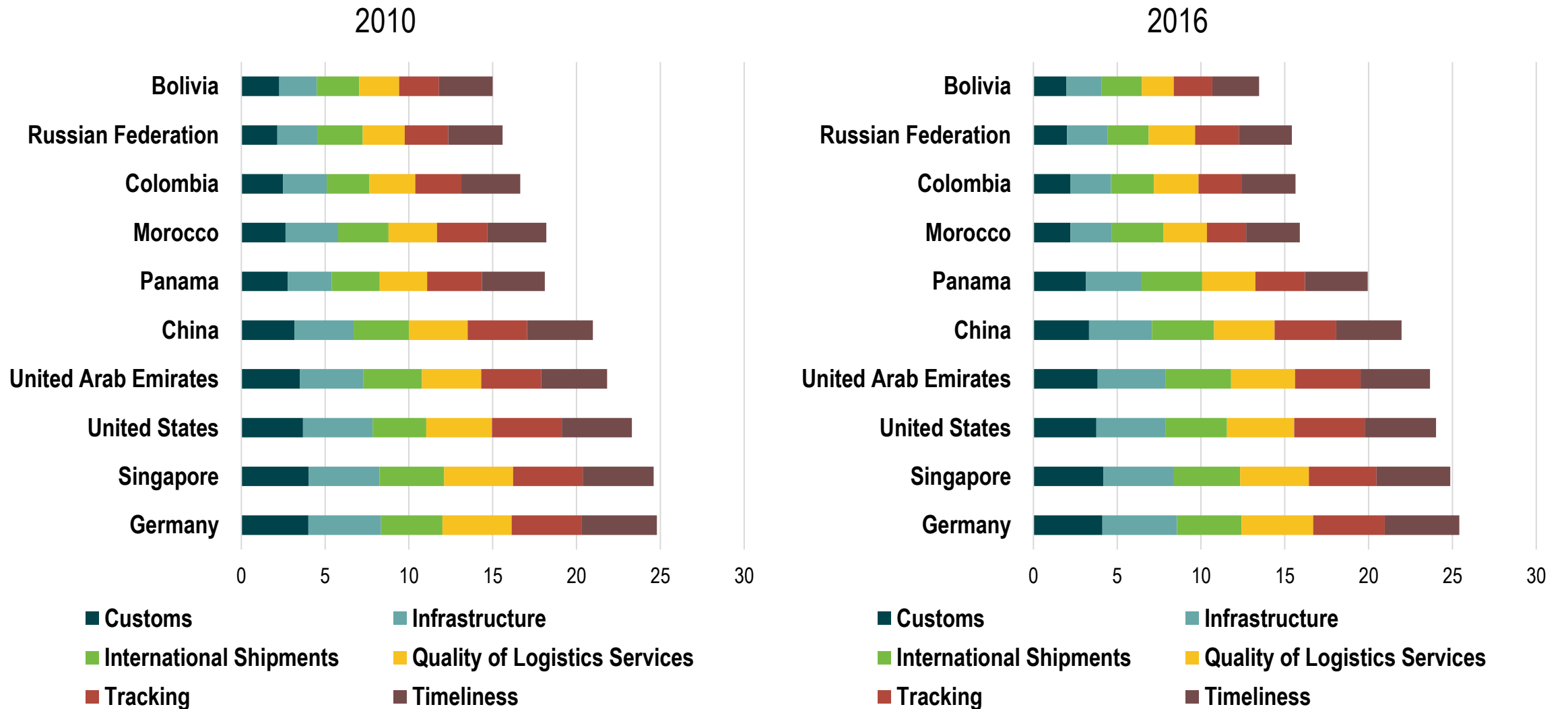
Logistic Performance Index, 2010



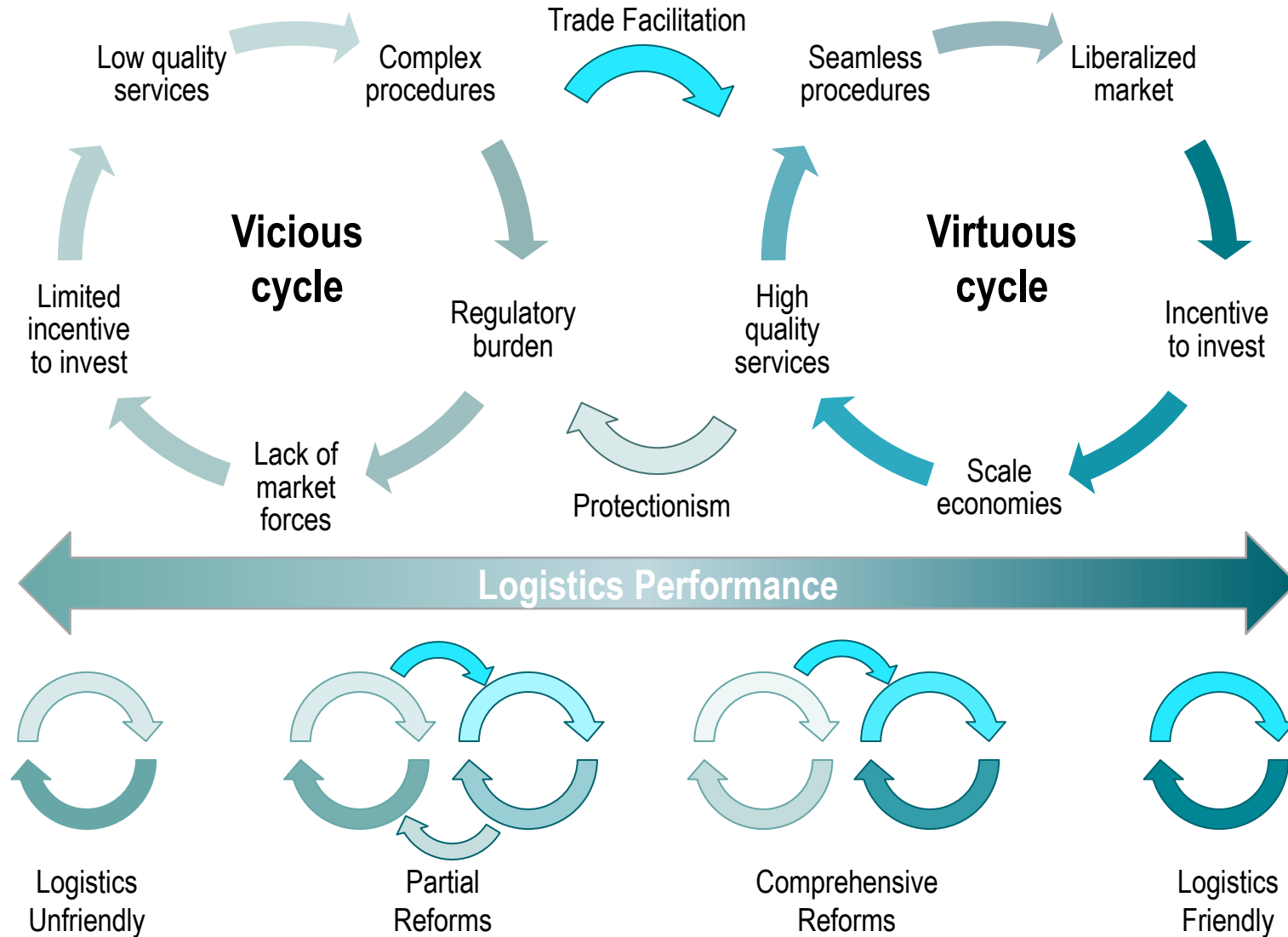
Logistic Performance Index, 2016



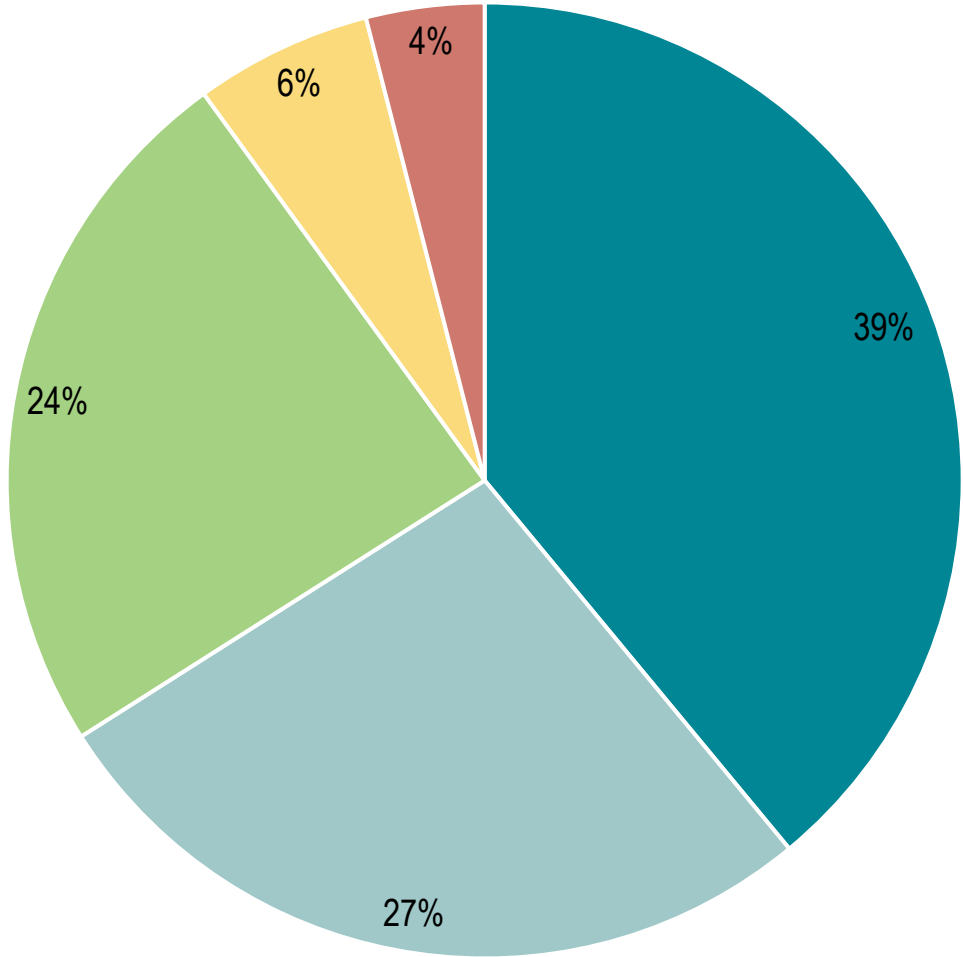
Composition of the Logistics Performance Index, Selected Countries



The Logistics Virtuous and Vicious Cycles

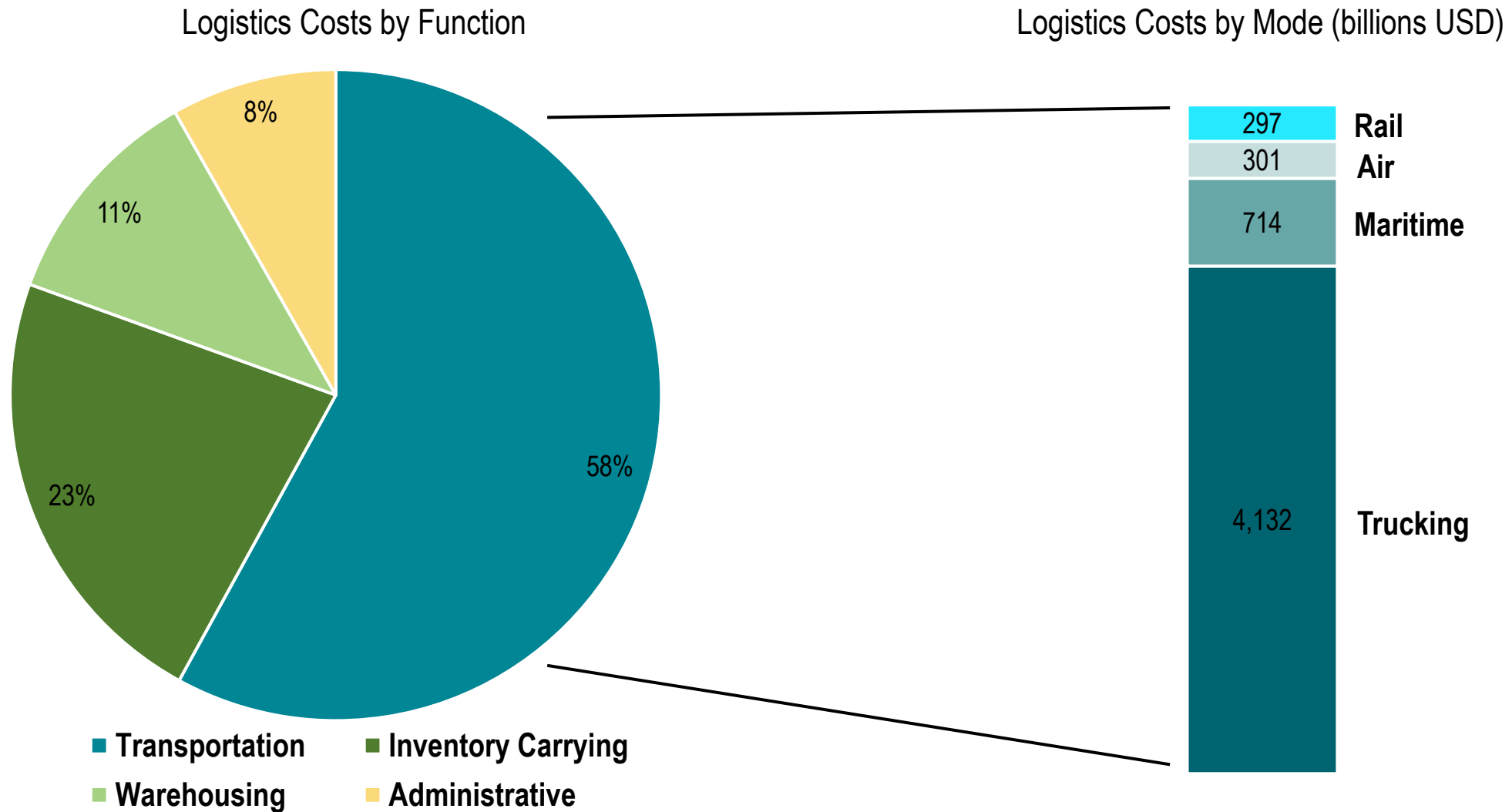


Worldwide Logistics Costs, 2002

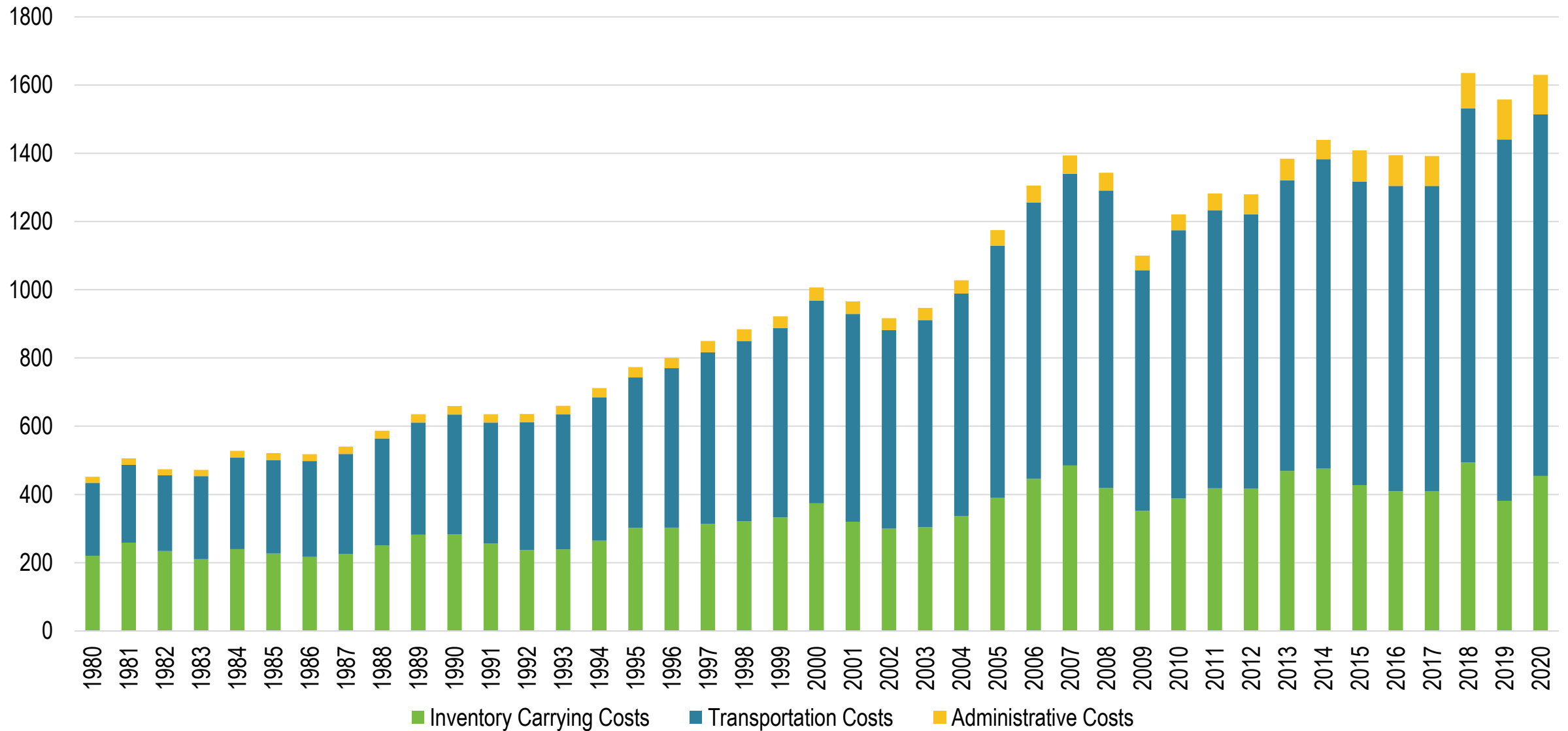


- Transportation
- Warehousing
- Inventory Carrying
- Order Processing
- Administration

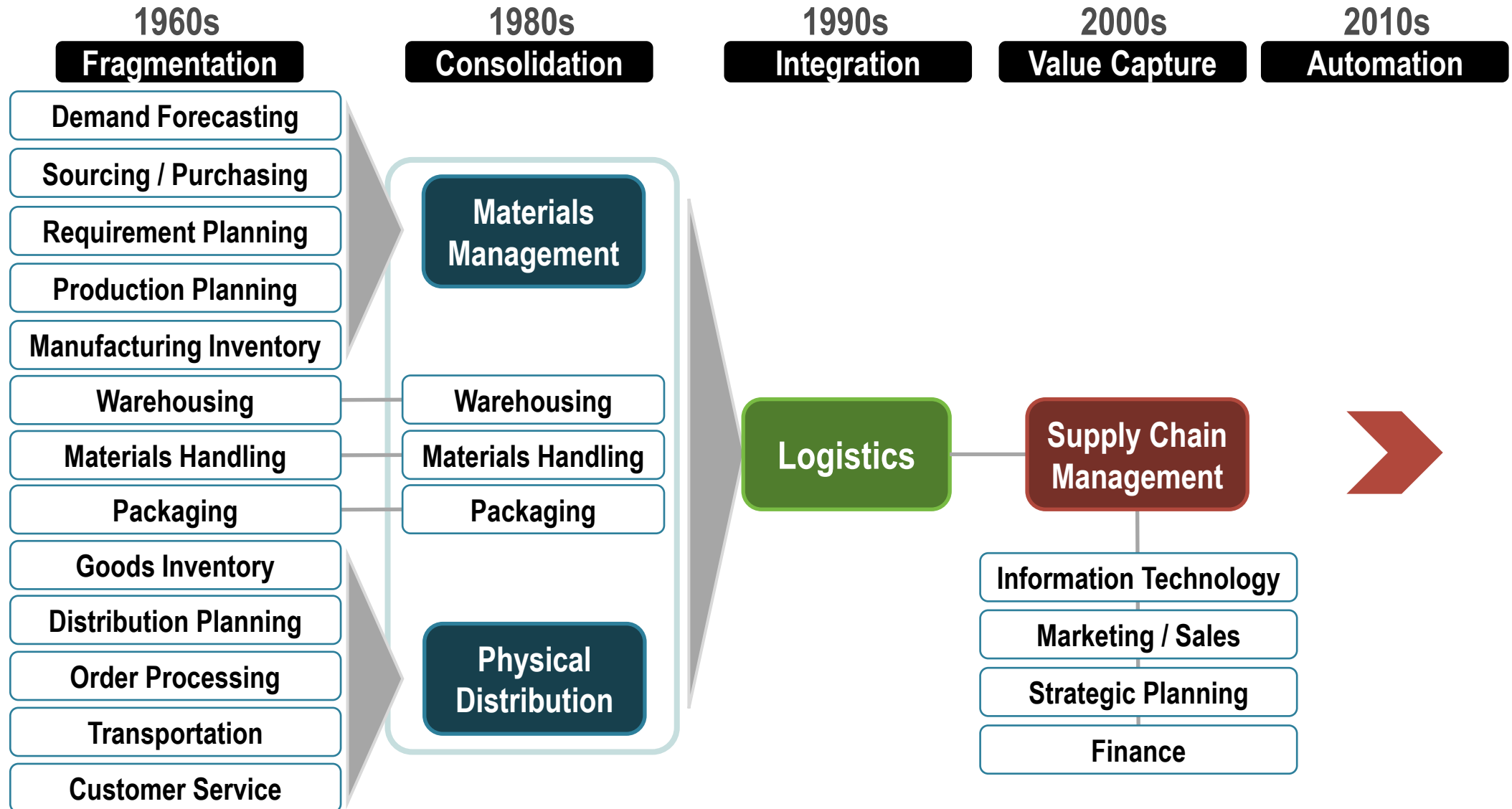
Global Logistics Costs by Function and Mode, 2018



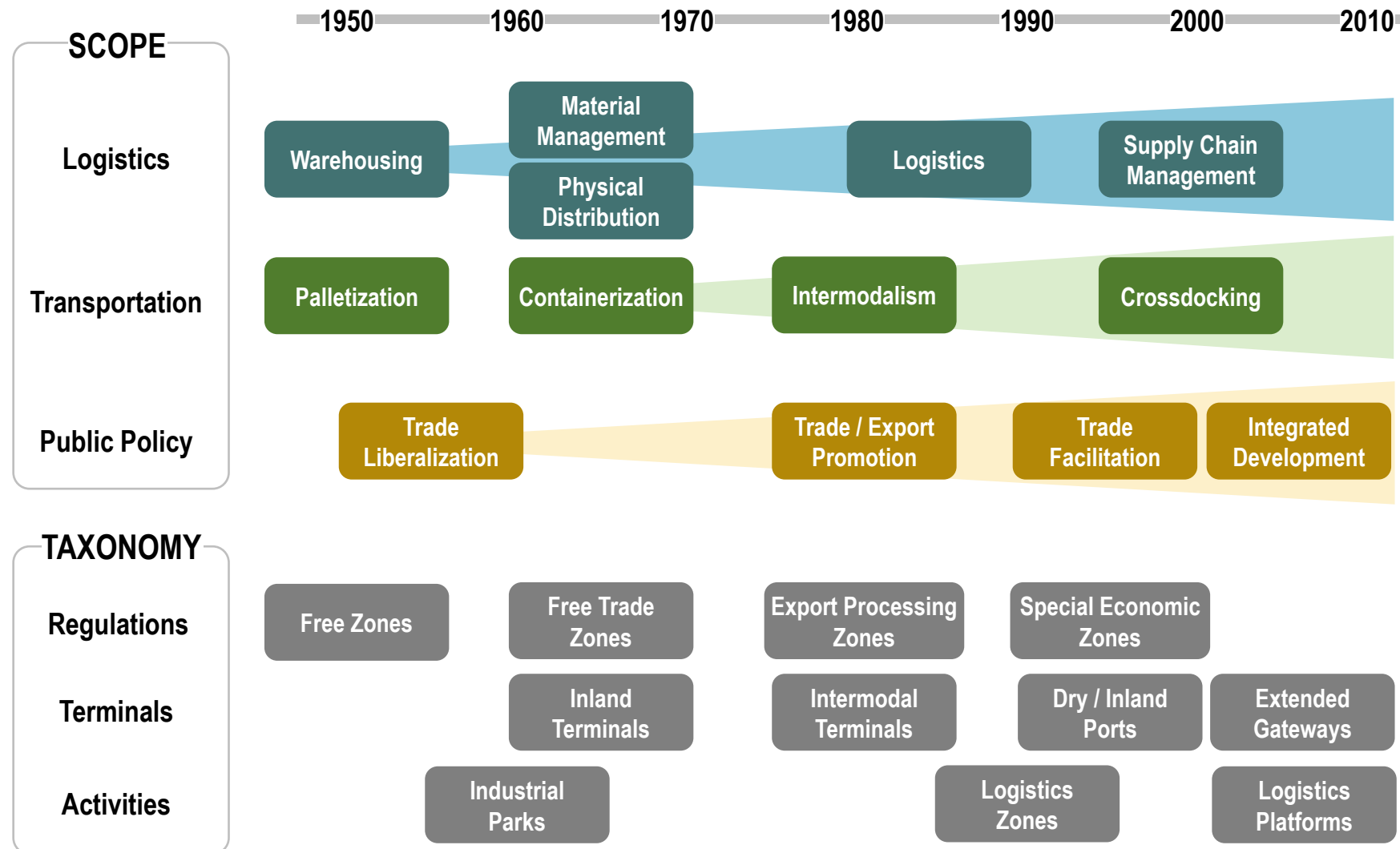
Logistics Costs, United States, 1980-2020 (in billions of \$)



The Evolution of Logistics

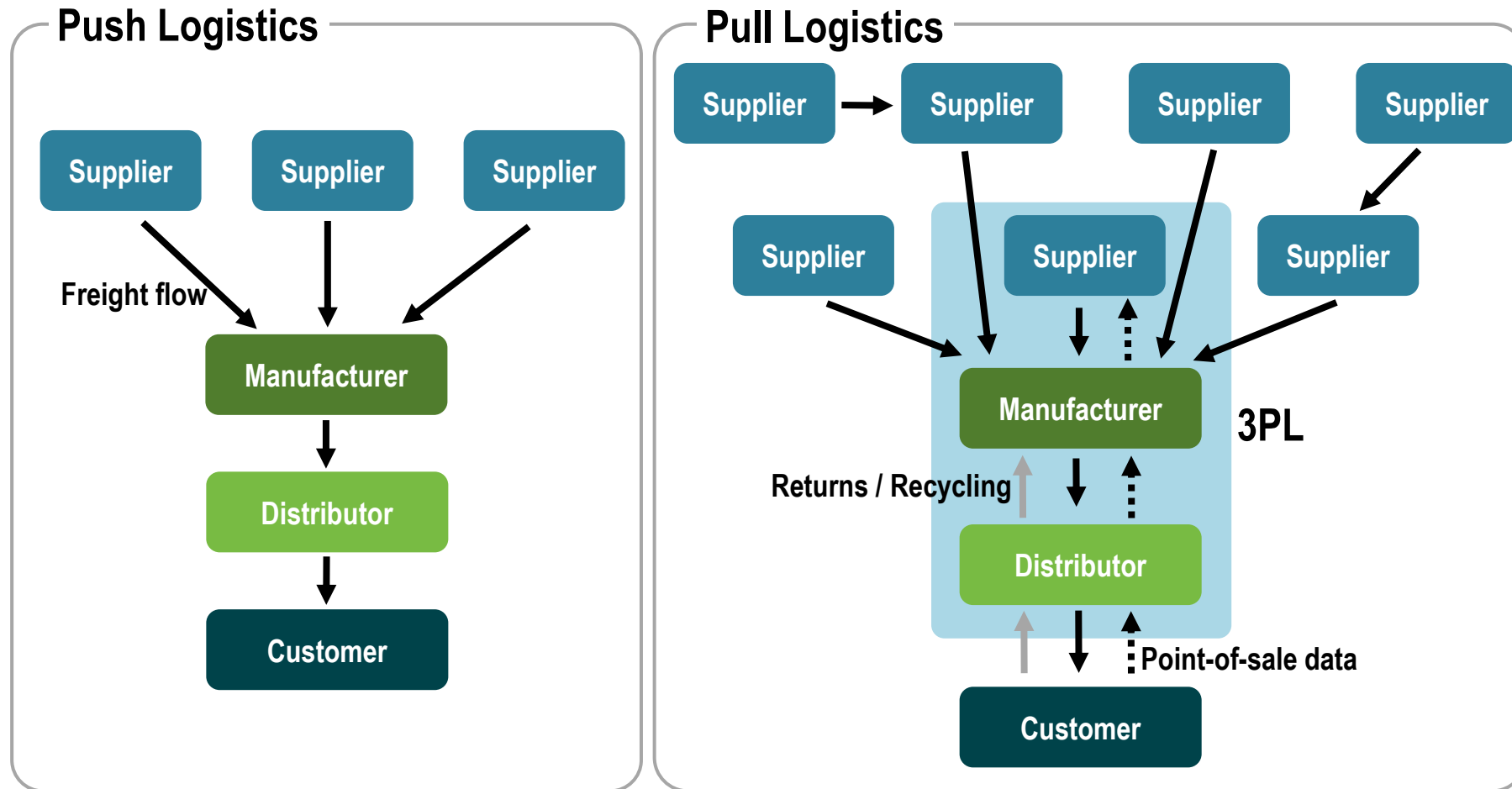


The Evolution of the Scope and Taxonomy of Logistic Areas

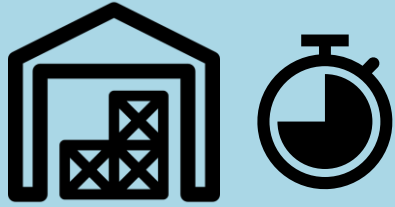


Anticipation Stock • Cycle Stock • Safety Stock • Pipeline Stock •
Decoupling Stock

From Push to Pull Logistics



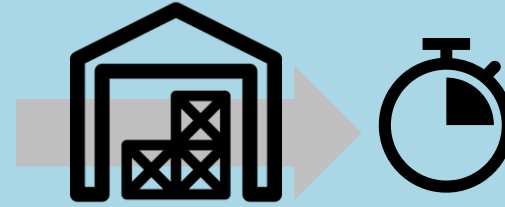
Warehouses and Distribution Centers



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.

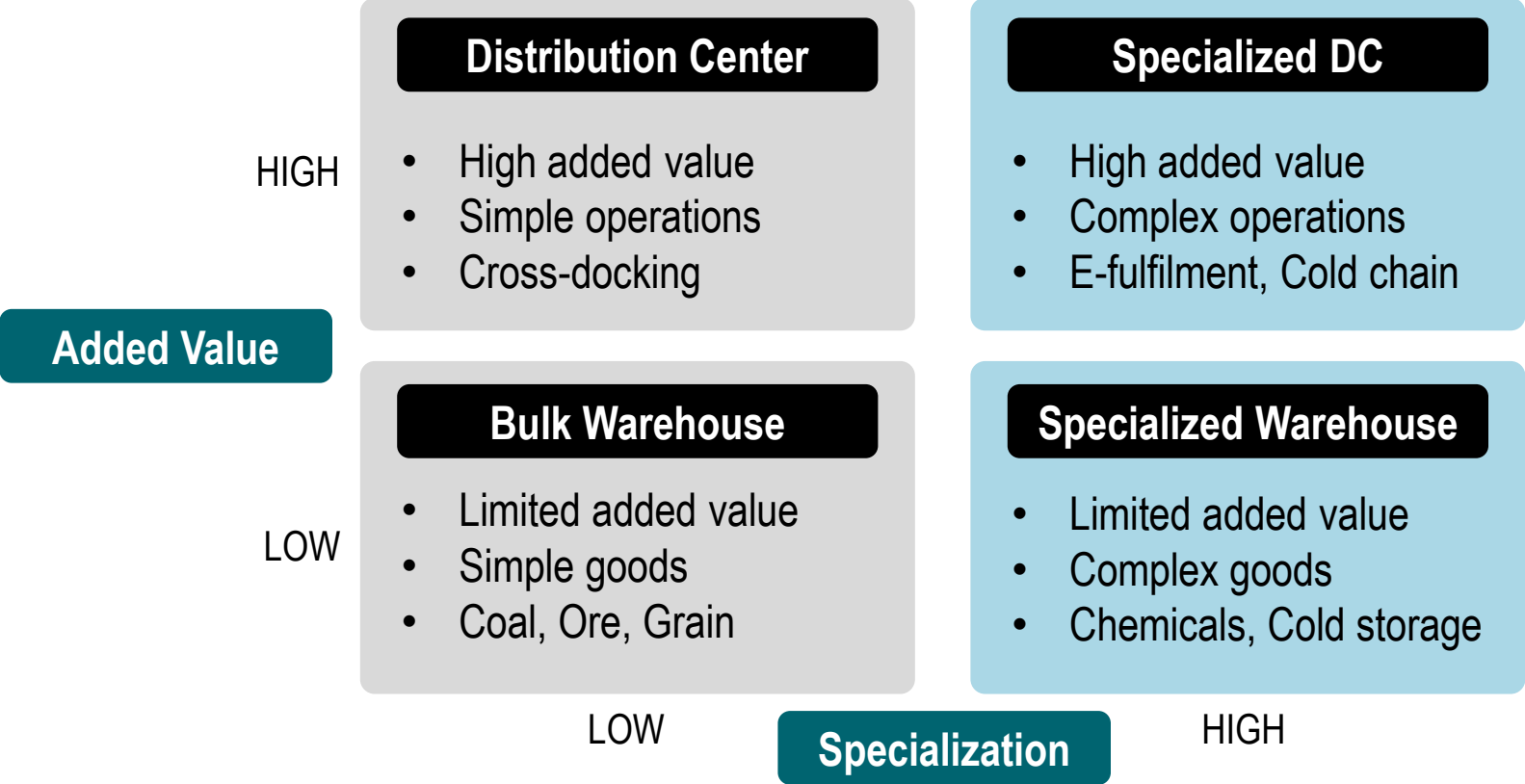


Distribution Center

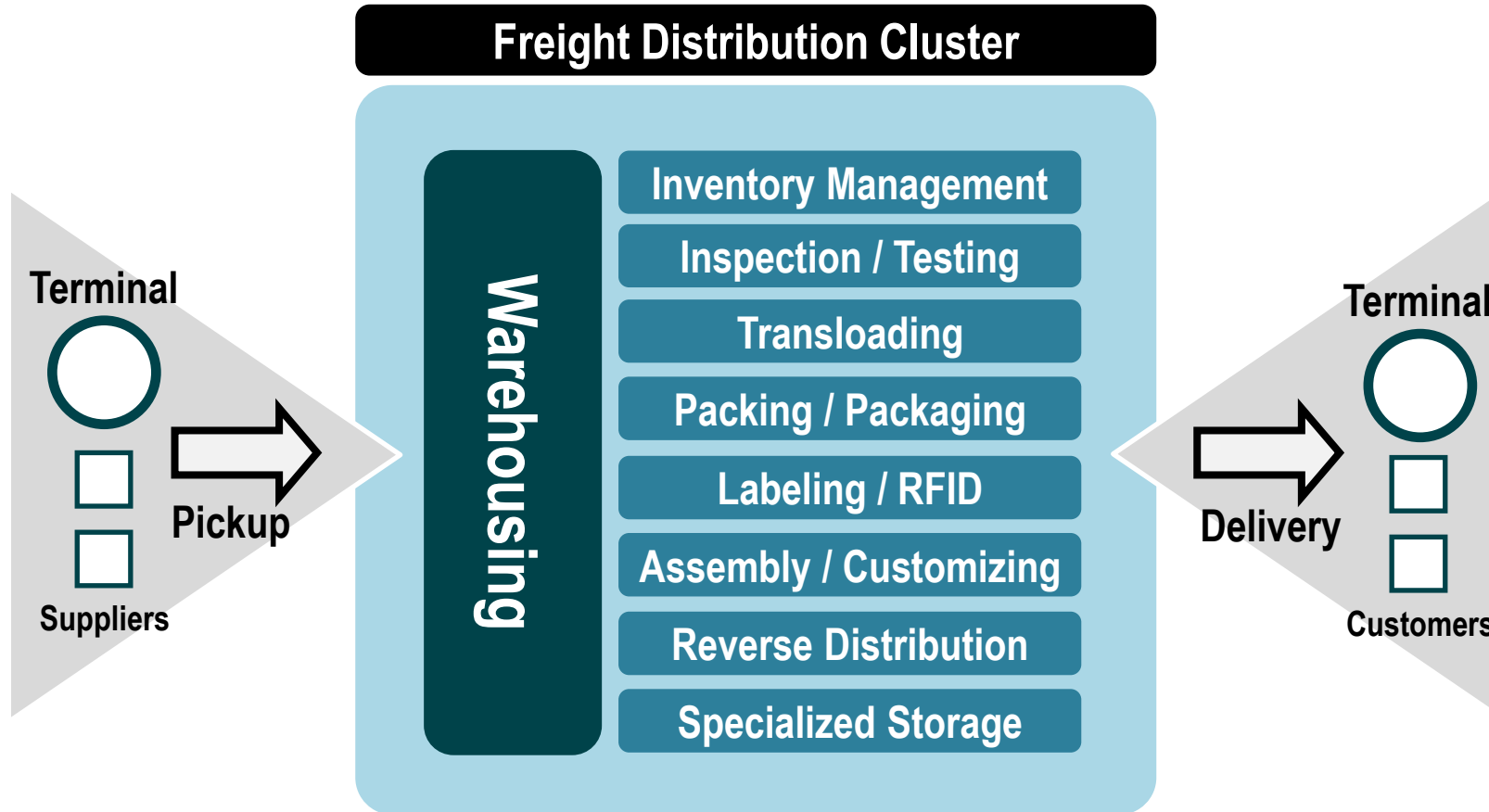
Throughput

- 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.

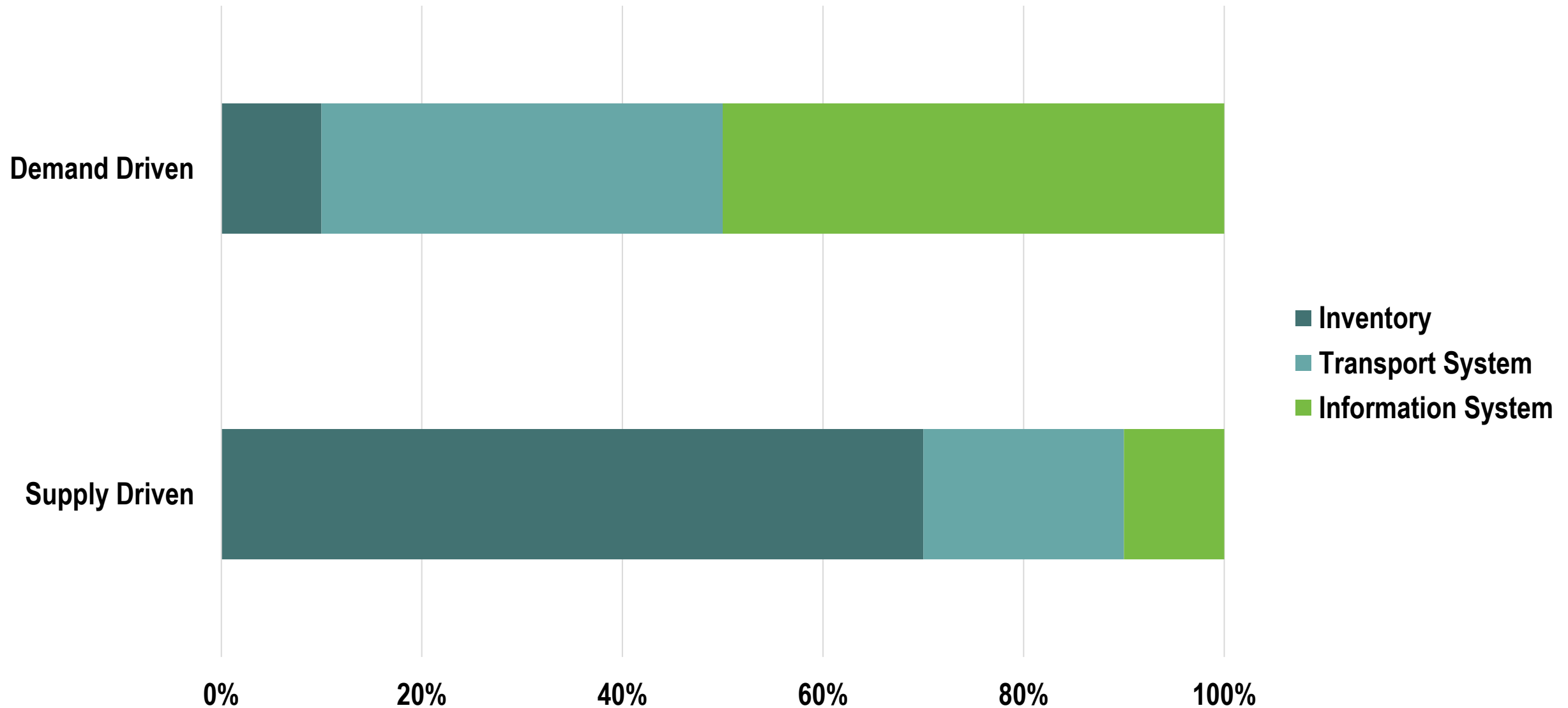
A Typology of Warehousing



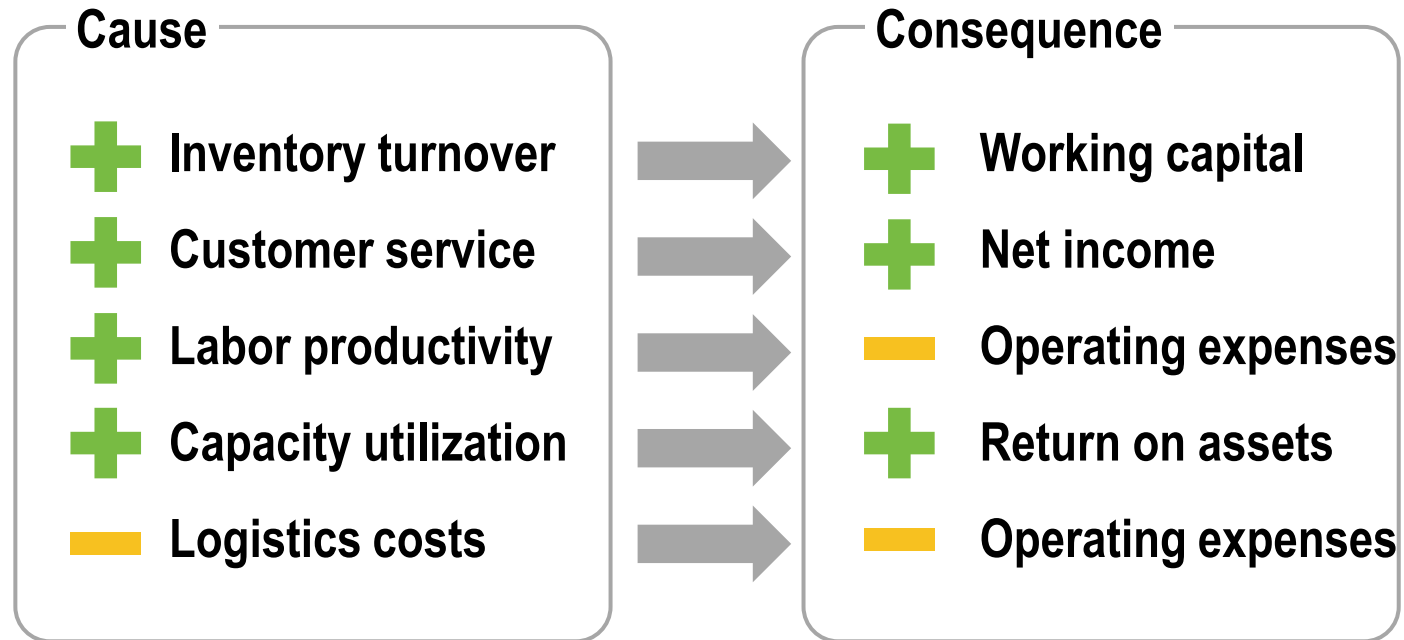
Value-added Activities Performed at Freight Distribution Clusters



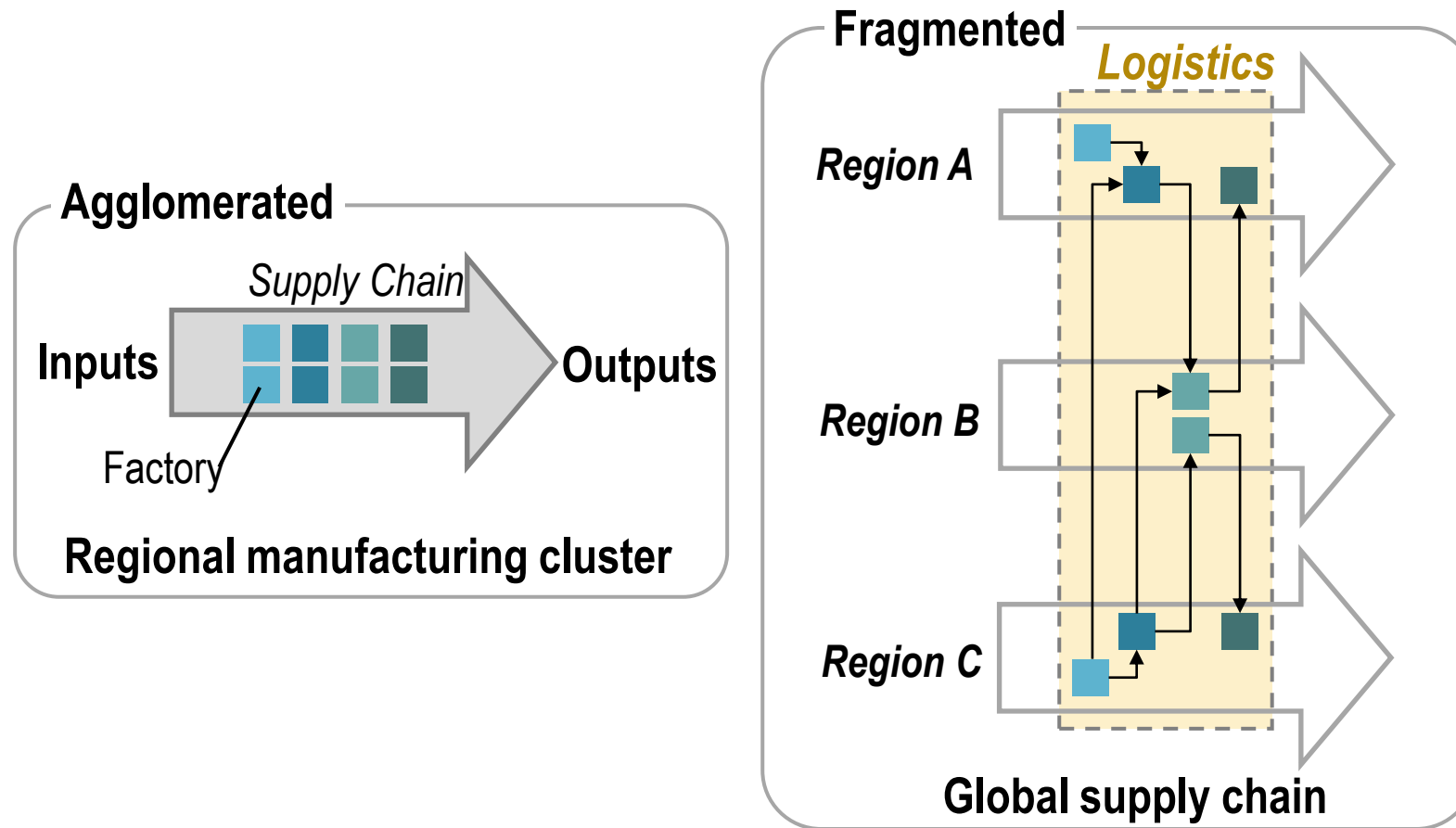
Changes in the Relative Importance of Logistical Functions in Distribution Systems



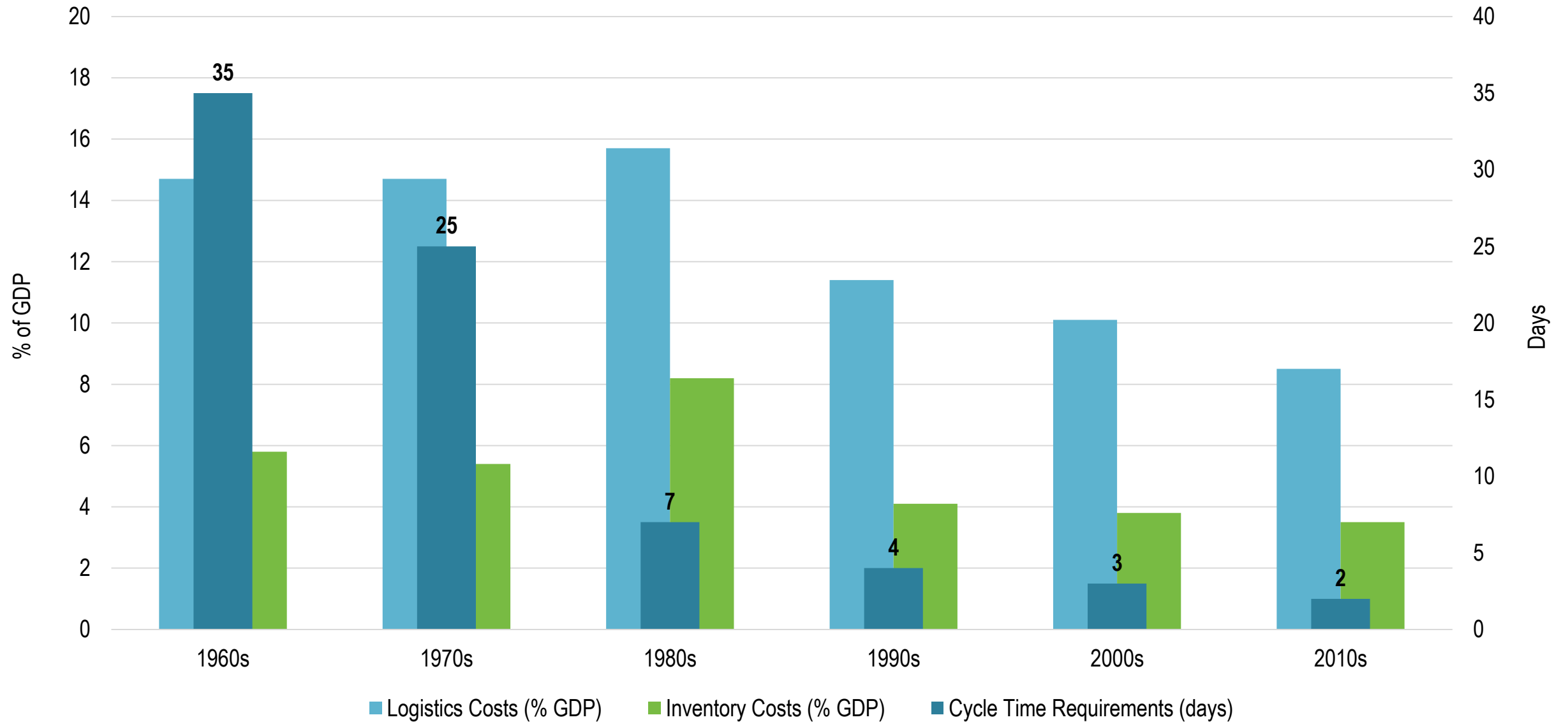
Benefits of Demand-Driven Supply Systems



Fragmentation of the Production System and the Logistics Industry



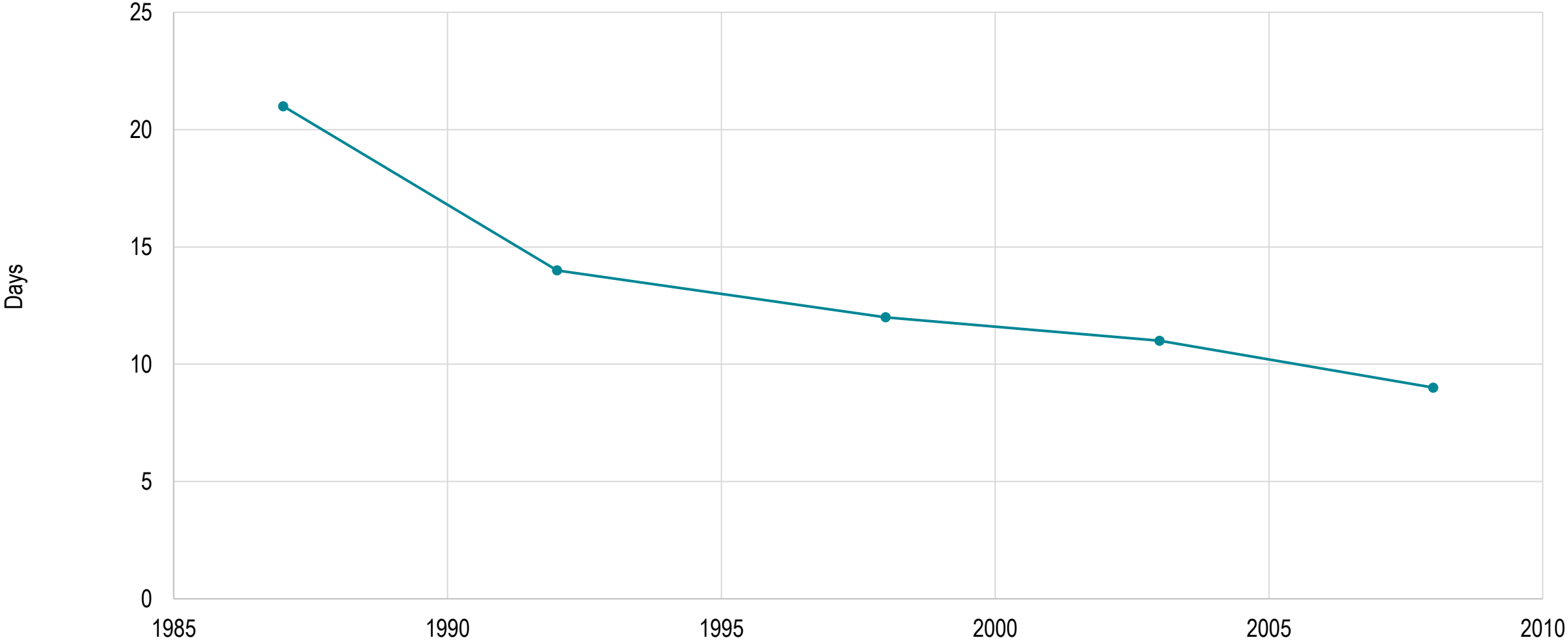
Logistical Improvements, Manufacturing Sector, 1960s to 2010s



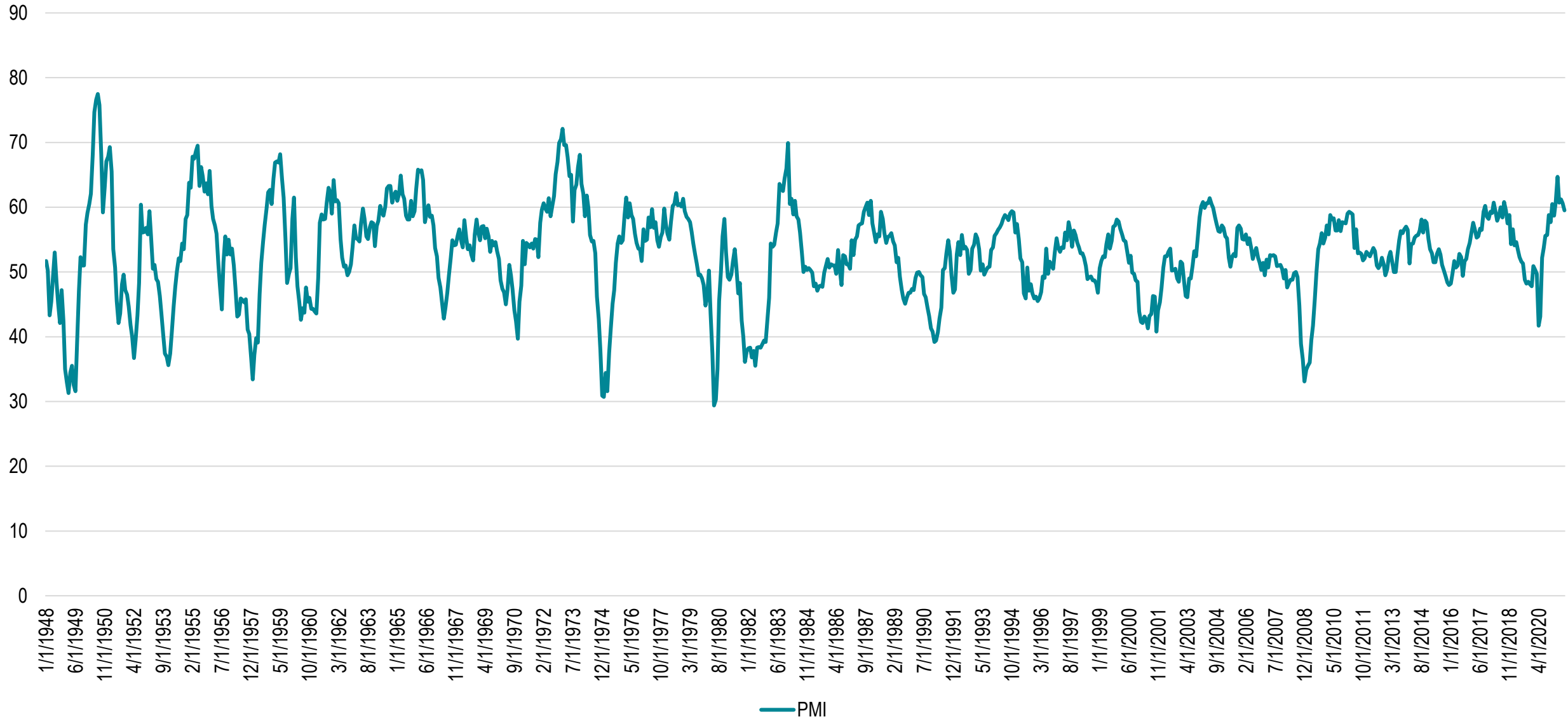
Some Issues in Supply Chain Management

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

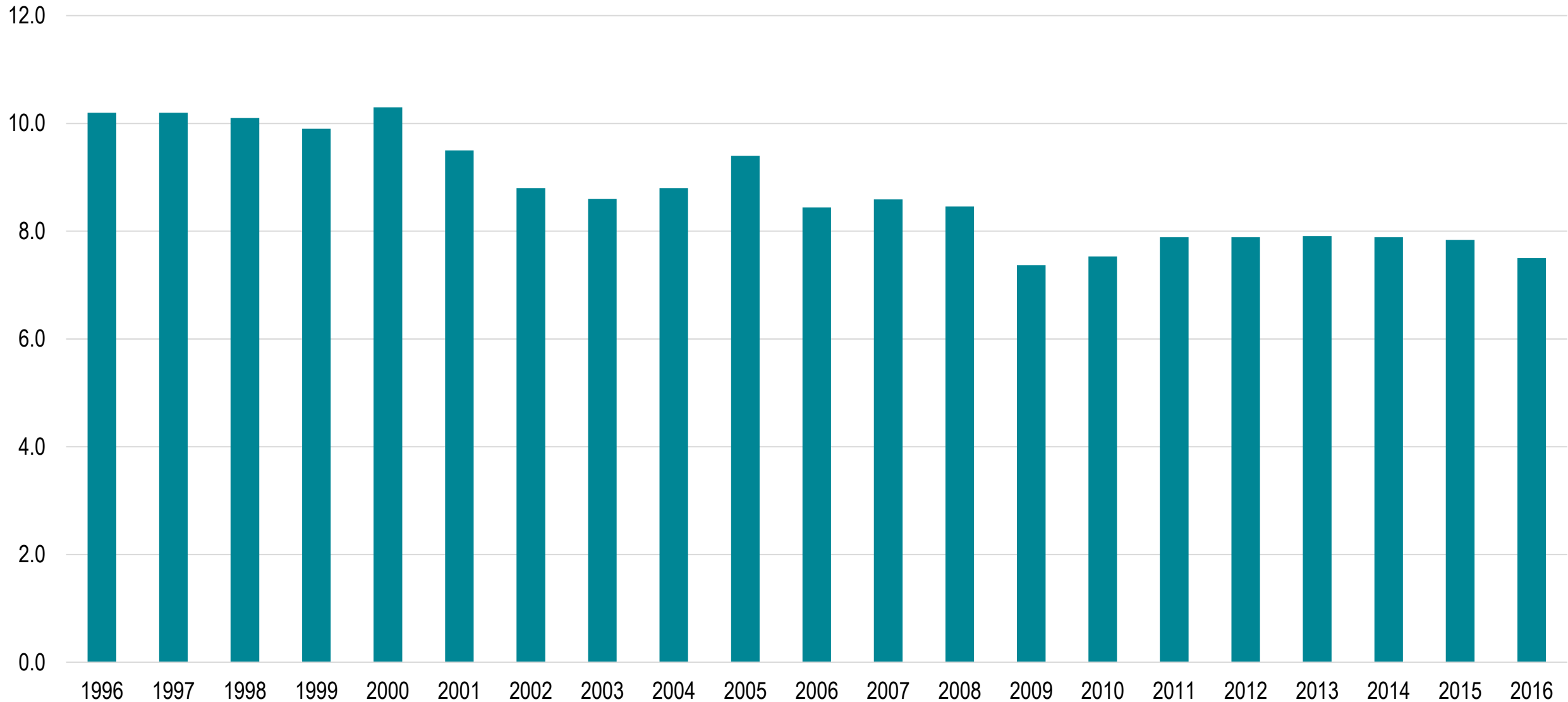
Average Order Lead Times of European Manufacturers, Wholesalers, and Retailers



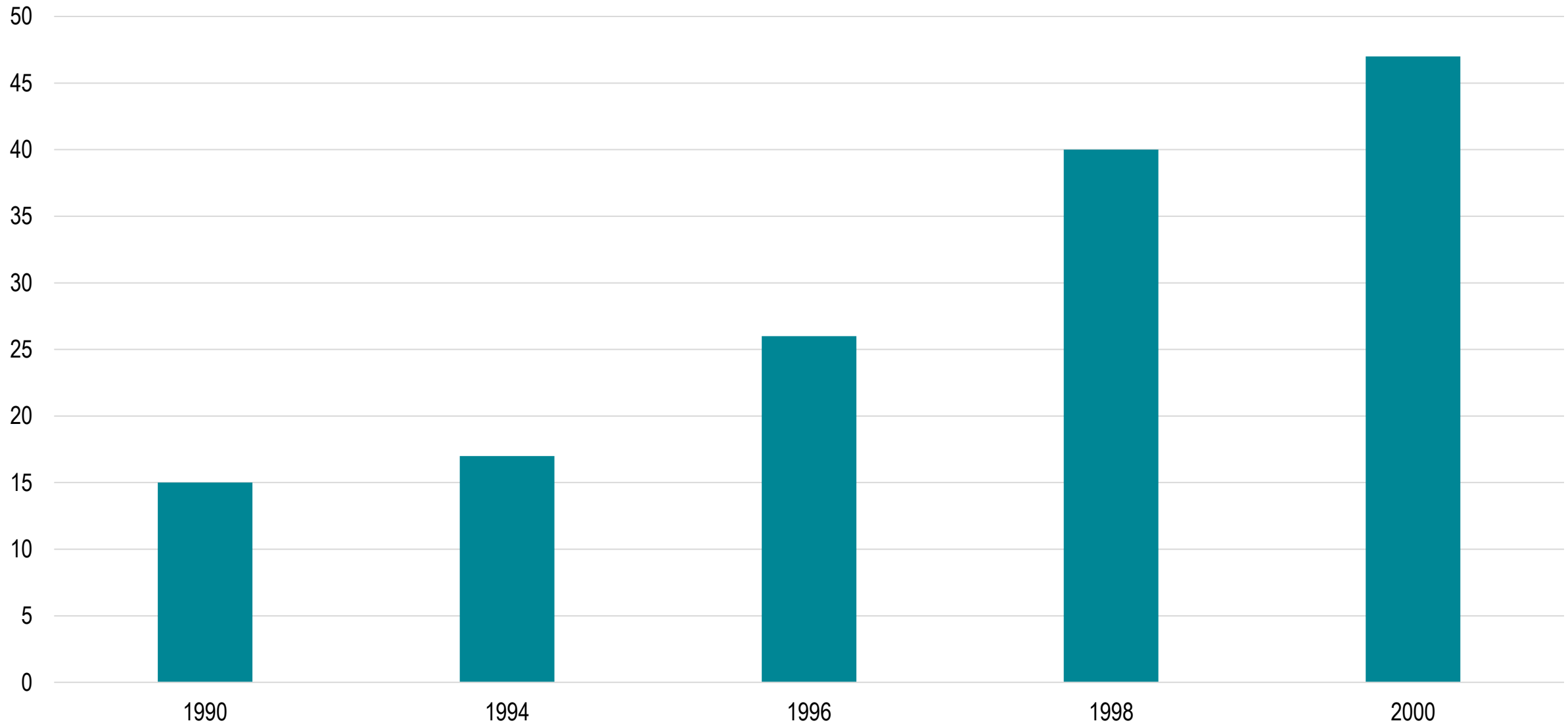
Purchasing Managers Index, 1948-2021



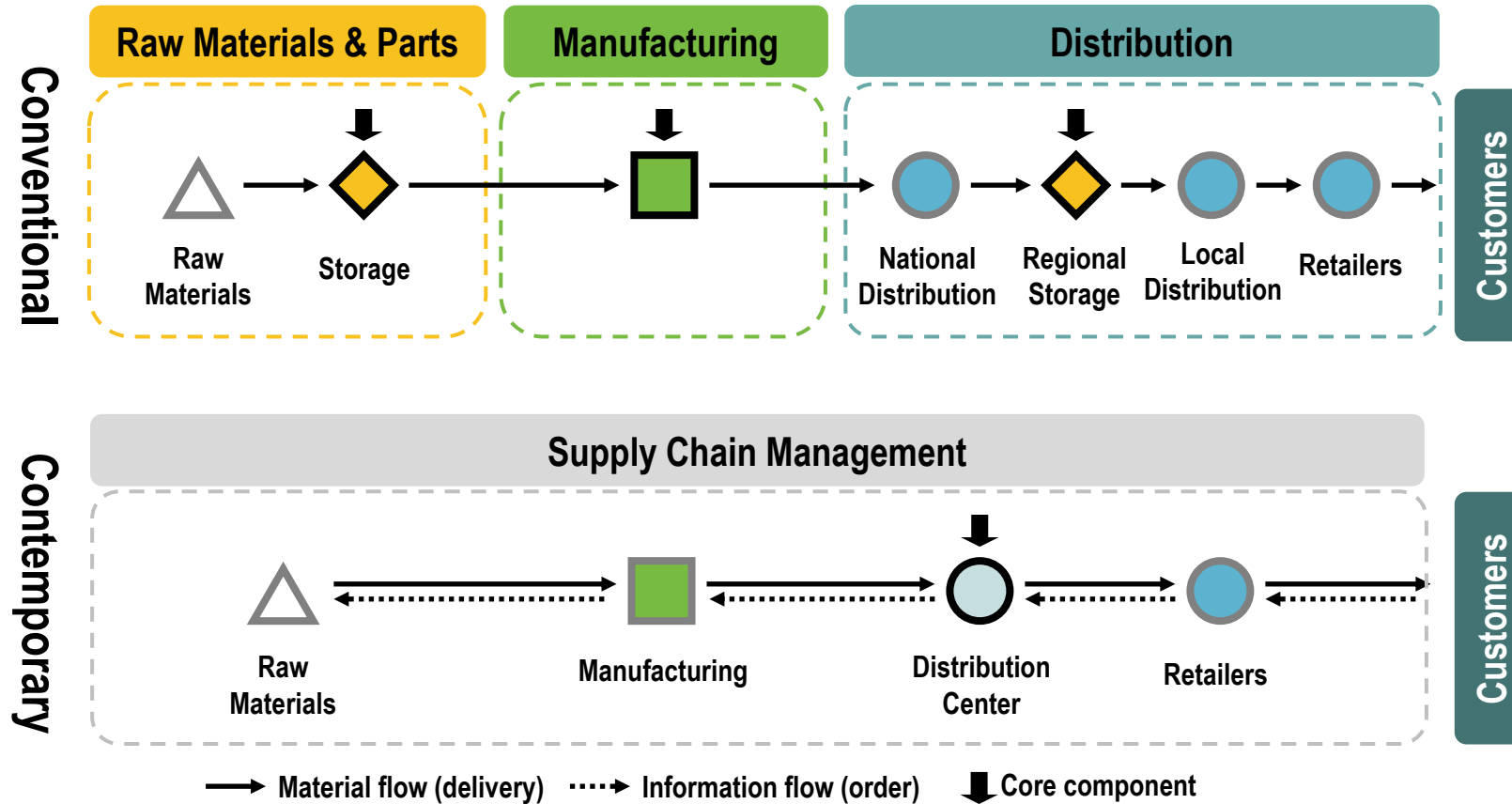
Logistics Costs as % of GDP



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



Conventional and Contemporary Arrangement of Goods Flow



Logistical Activities Related to Containerization

Container Management



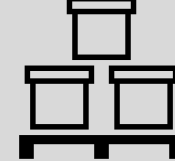
- Broking/Leasing.
- Inventory management.
- Transport routing.
- Container tracking.

Container Transportation



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

Cargo Handling



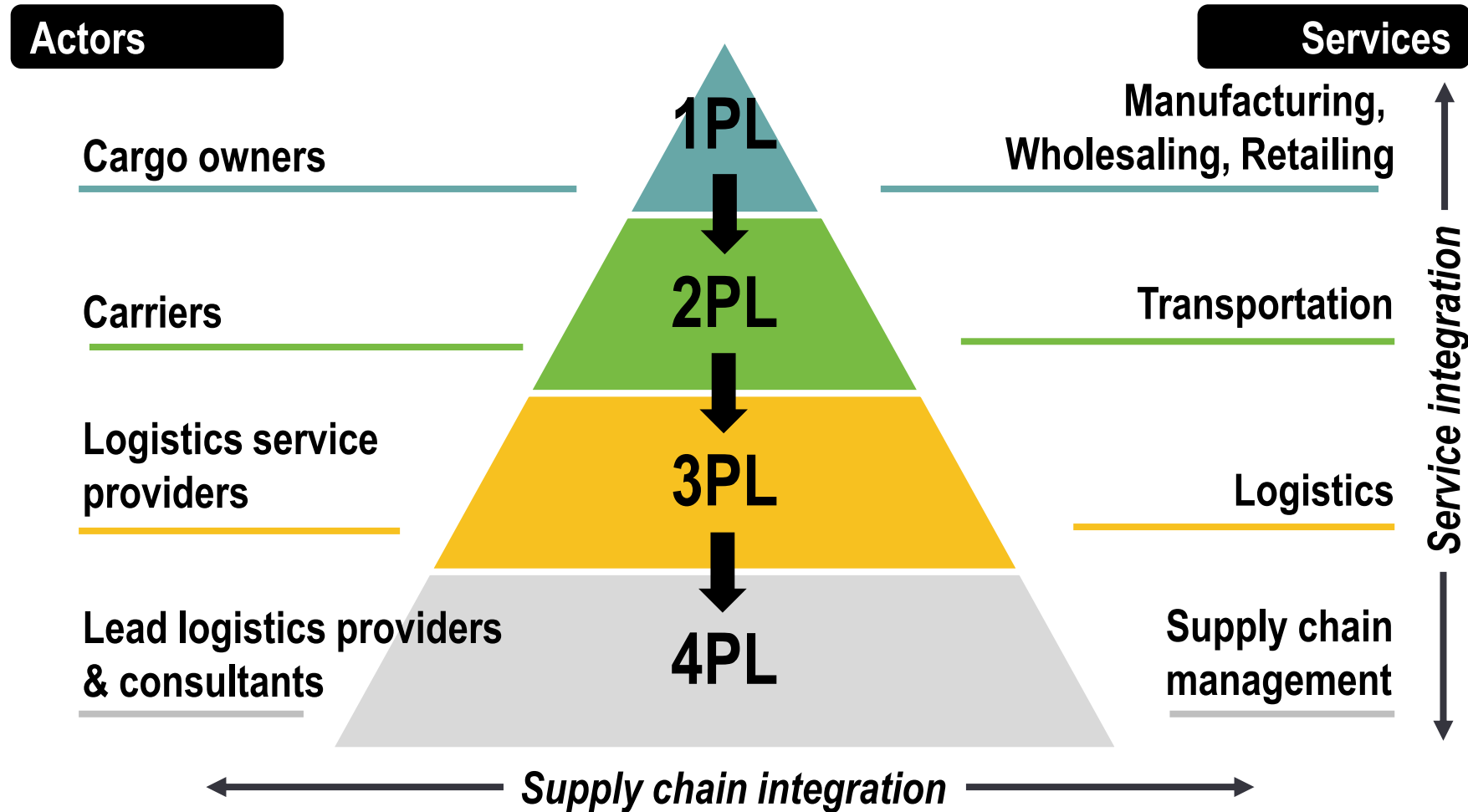
- Loading (Packing, Palletizing and Bundling).
- Transloading (Re-bundling).
- Unloading (Unbundling, de-palletizing and Unpacking).

Container Maintenance



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

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]

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



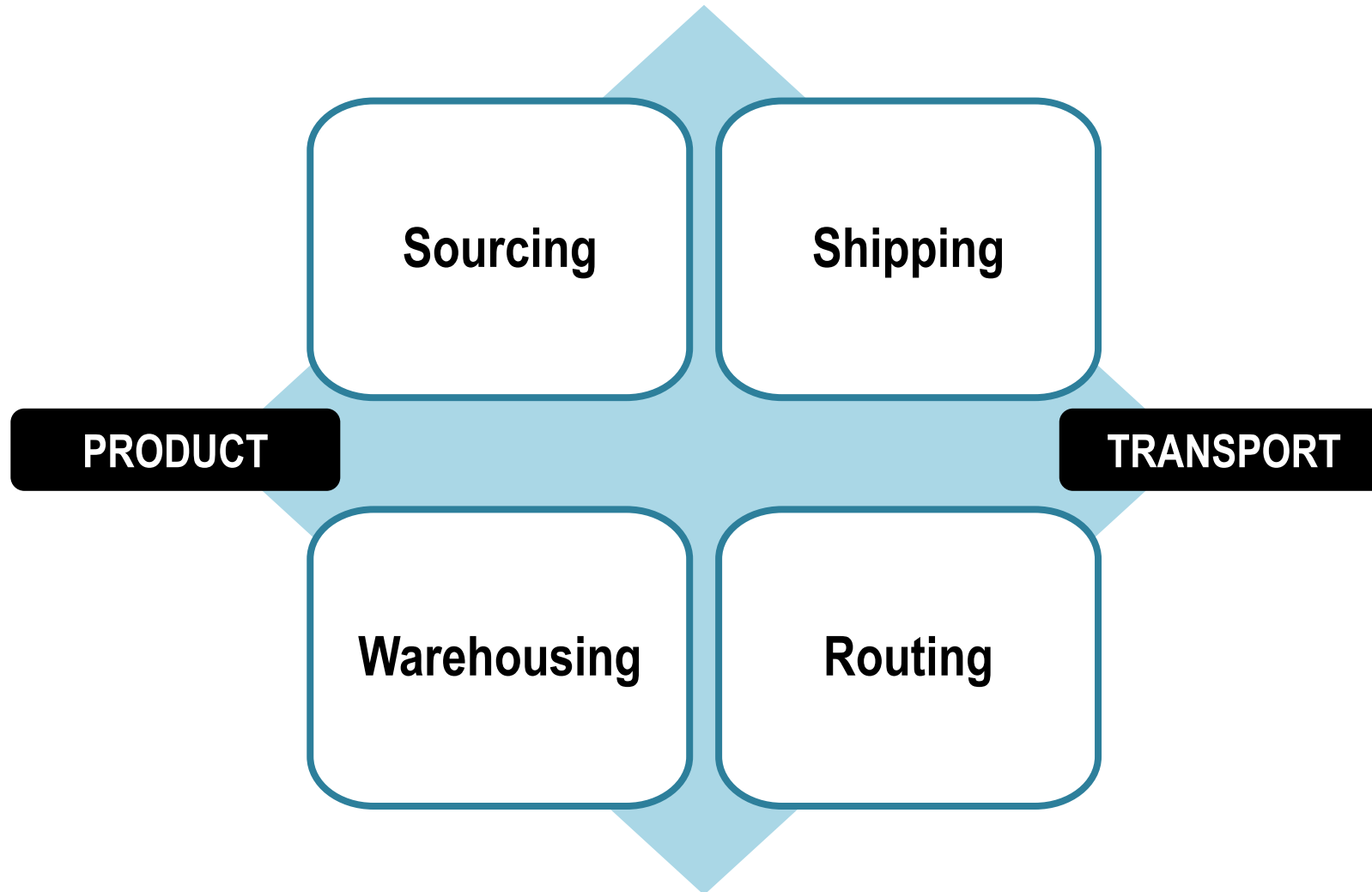
Manufacturers and retailers are focusing on their core business and outsourcing logistics services to specialized firms.

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



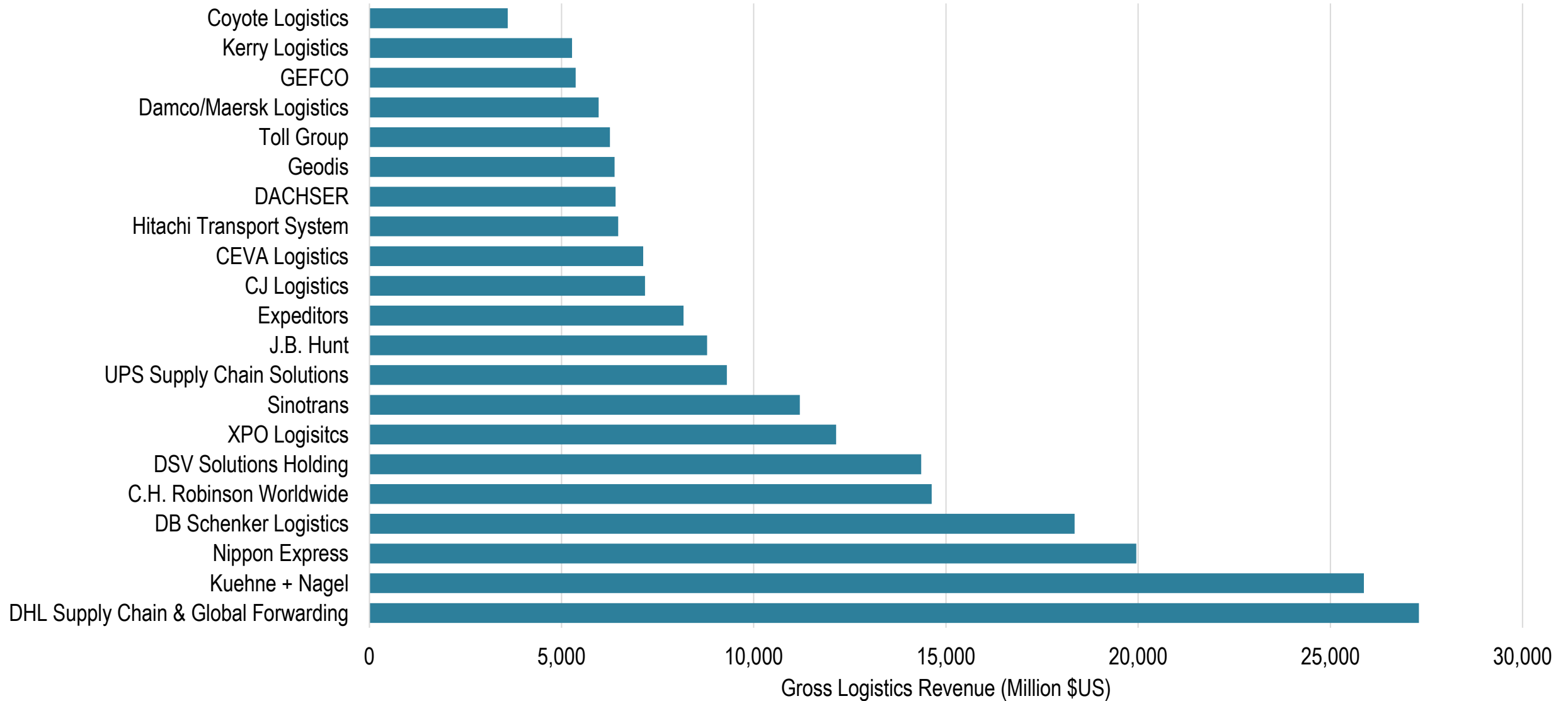
Services Offered by Third and Fourth Party Logistics Service Providers

3PL ►

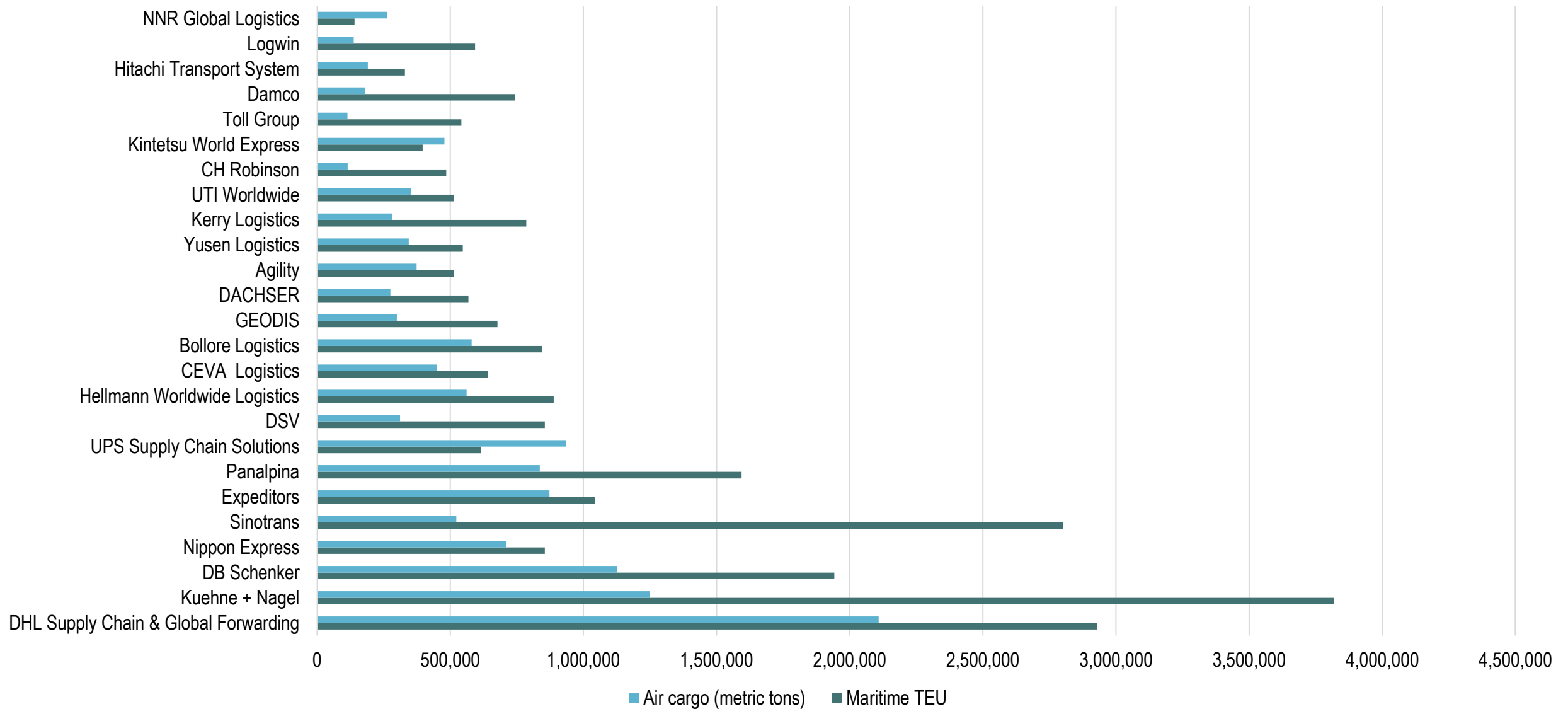
◀ 4PL

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			

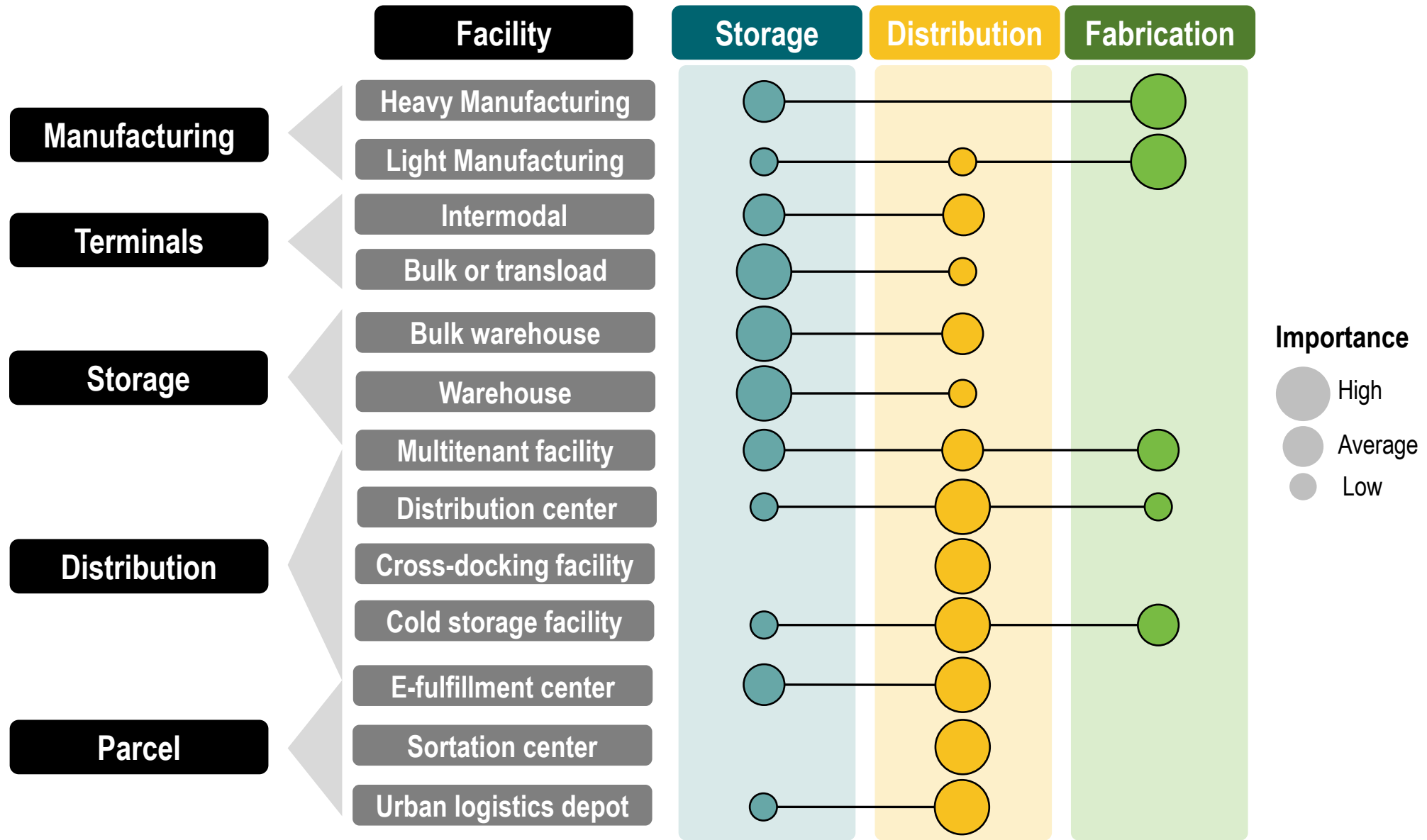
World's Largest Third-Party Logistics Providers, 2019



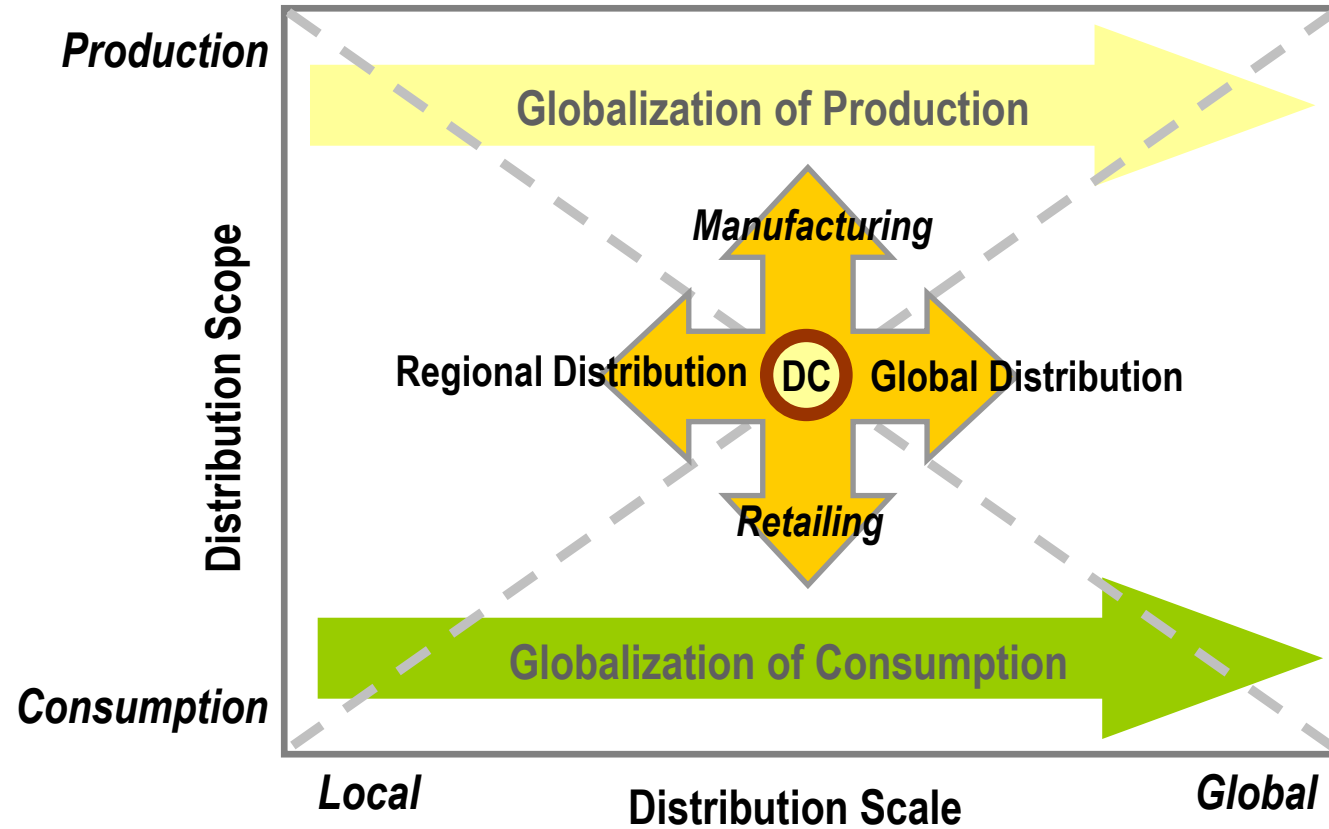
World's Largest Freight Forwarders, 2015



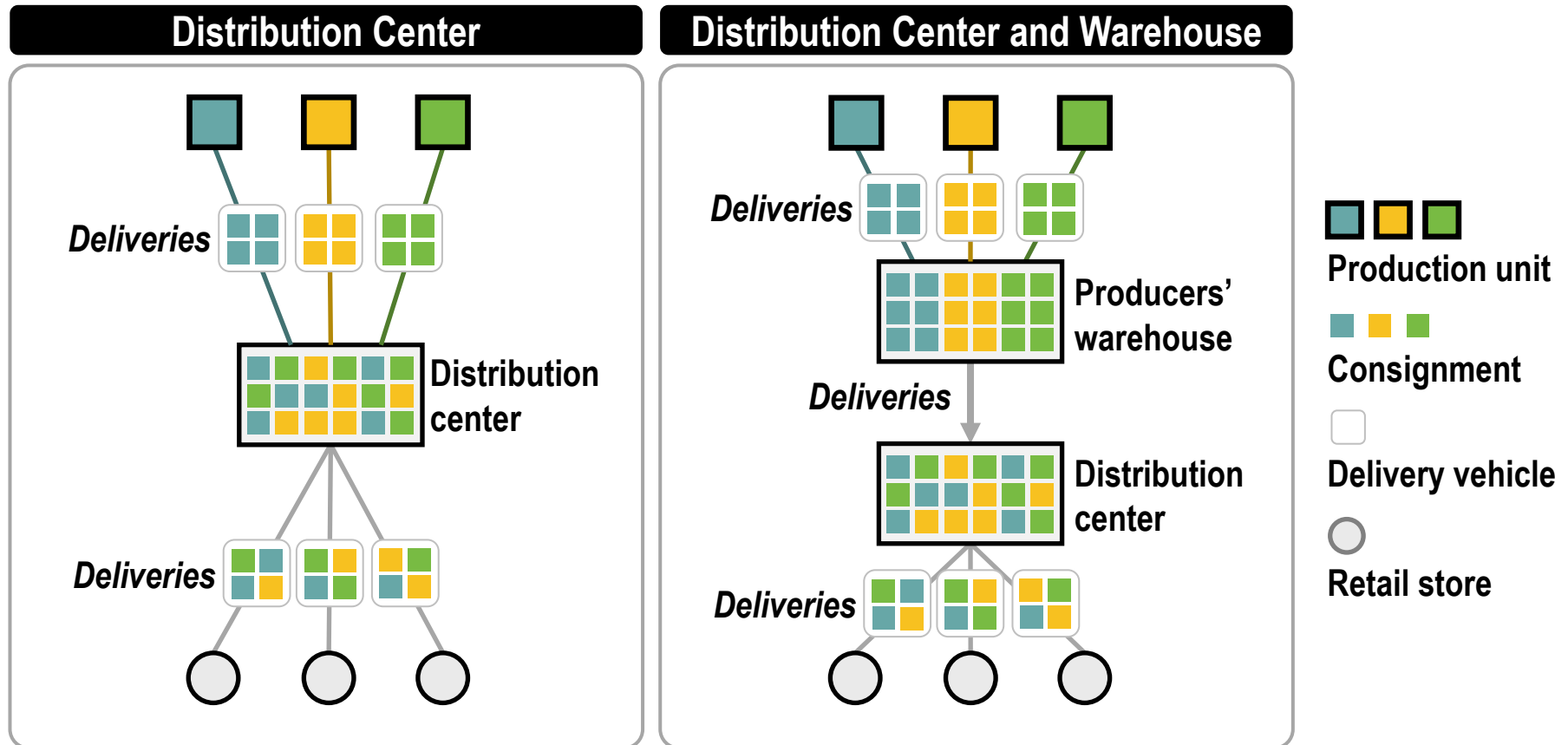
Types of Freight Facilities



Nodes and Freight Distribution



The Role of Distribution Centers and Warehouses



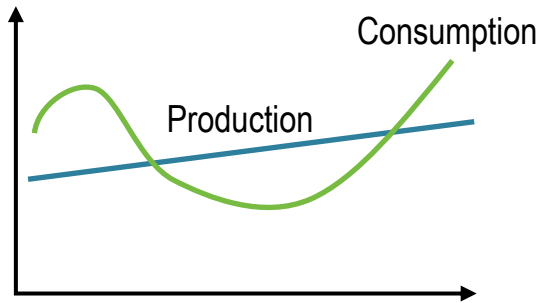
Asynchronism and Distribution Centers

TIME

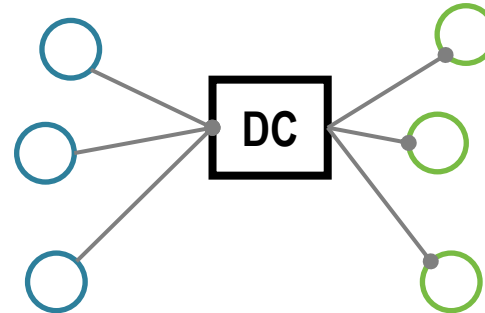
Fluctuations

Seasonality

Production and Consumption



Supply and Demand



NETWORK

Combination

Cross-docking

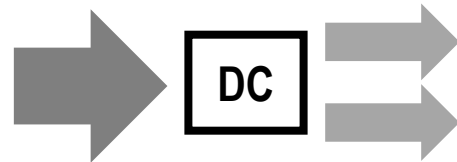
SIZE

Consolidation

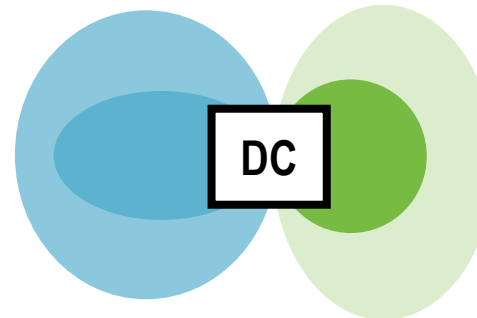
Deconsolidation

Transloading

Load unit



Market Areas

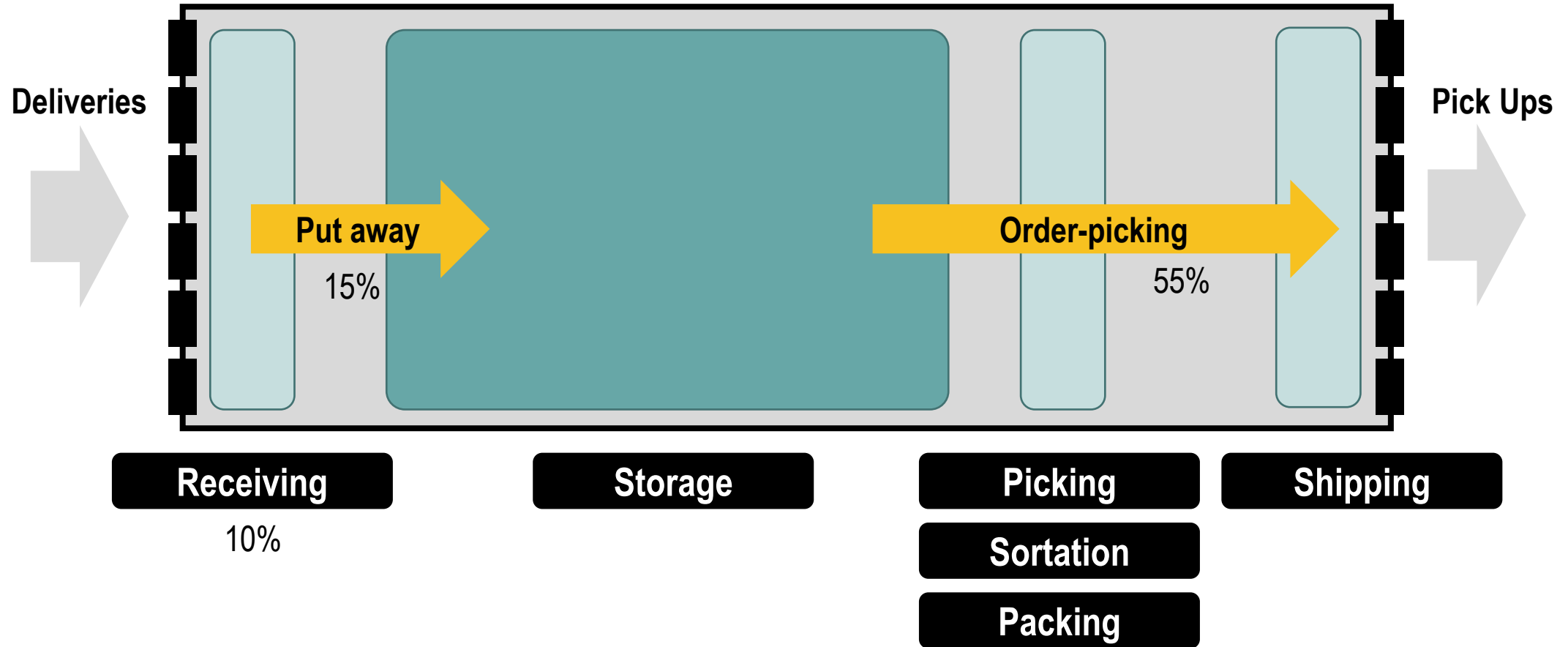


SCALE

Access

Interface

Main Warehousing Operations



Location and Design Criteria for Distribution Centers

Cost	Price sensitivity	Price per square foot; Operation costs.
Size	Consolidation	More throughput and less warehousing.
Facility	High clearance; Separate loading and unloading bays	Improved stacking density (from 20 to 80 feet); More doors for sorting efficiency; Potential for cross-docking.
Land	Massification	Parking space for trucks (often not necessary due to high throughput); Space for expansion.
Connectivity	Proximity to highways	Constant movements (pick-up and deliveries) in small batches (often LTL); Access to corridors and markets; Co-location with rail, air and port terminals.
Accessibility	Market access	Shorter lead times; Less than 48 hours service window.
IT	Automation and Integration	Sort parcels; Control movements from receiving docks to shipping dock; Management systems controlling transactions.

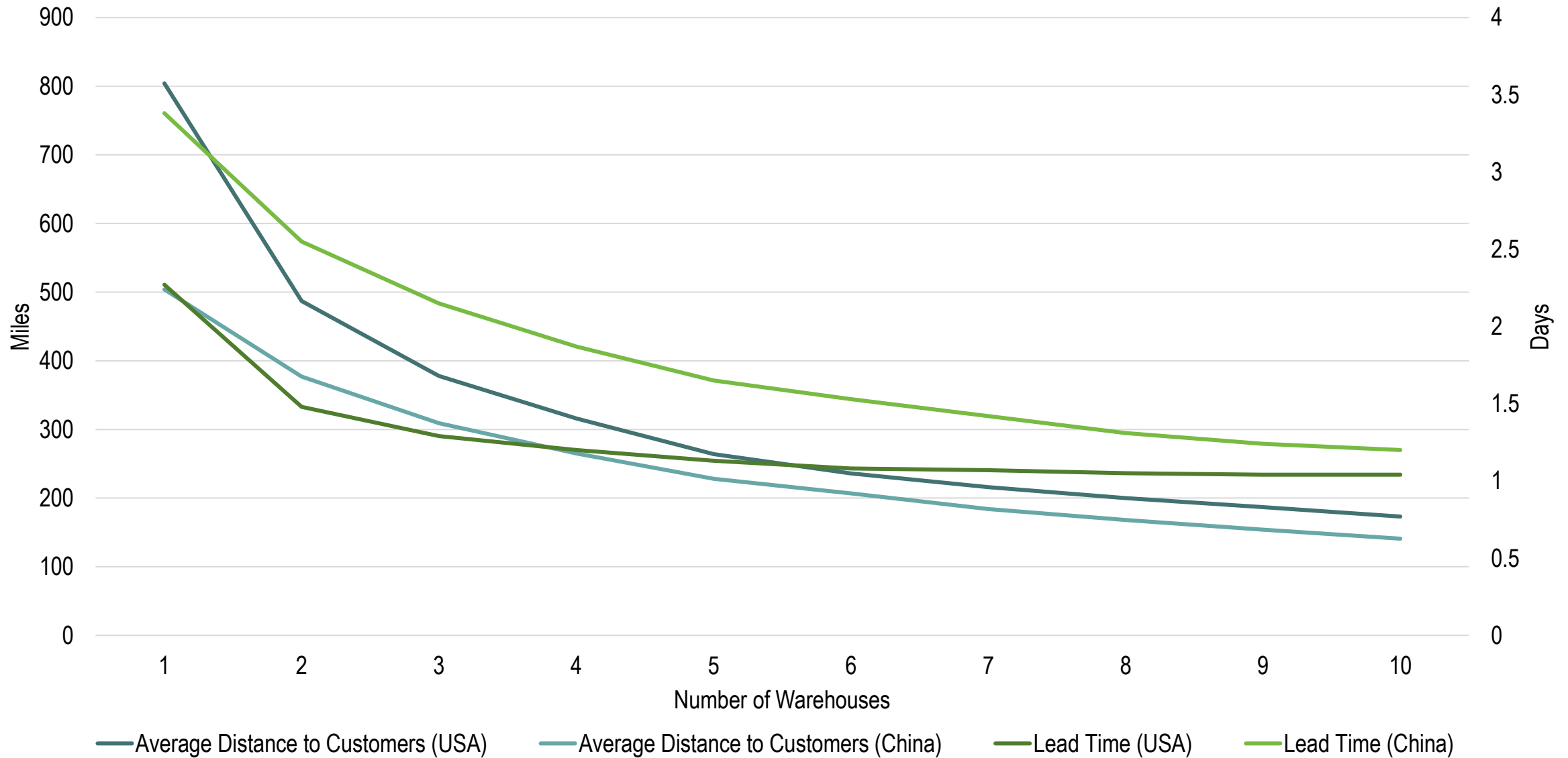
Location and Design Criteria for Distribution Centers

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.

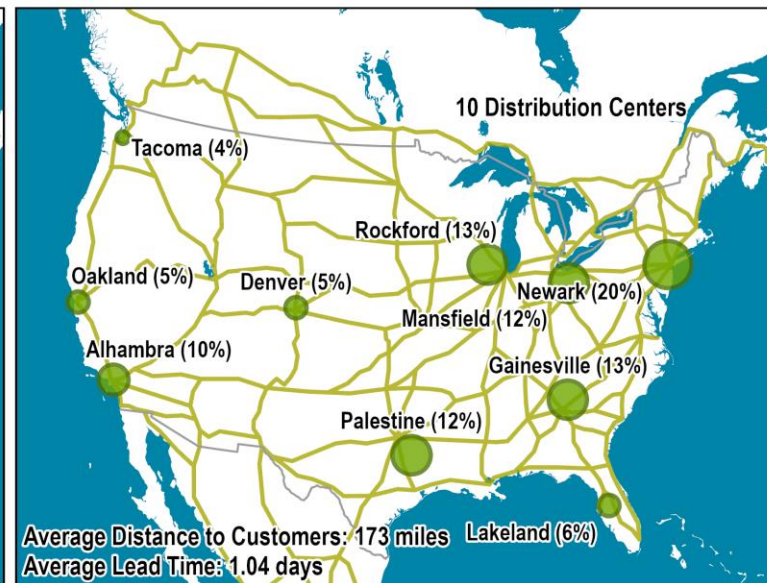
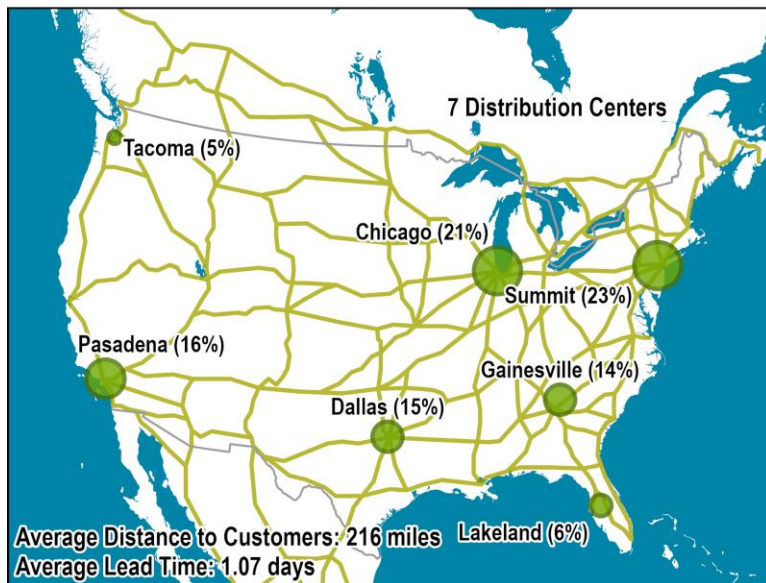
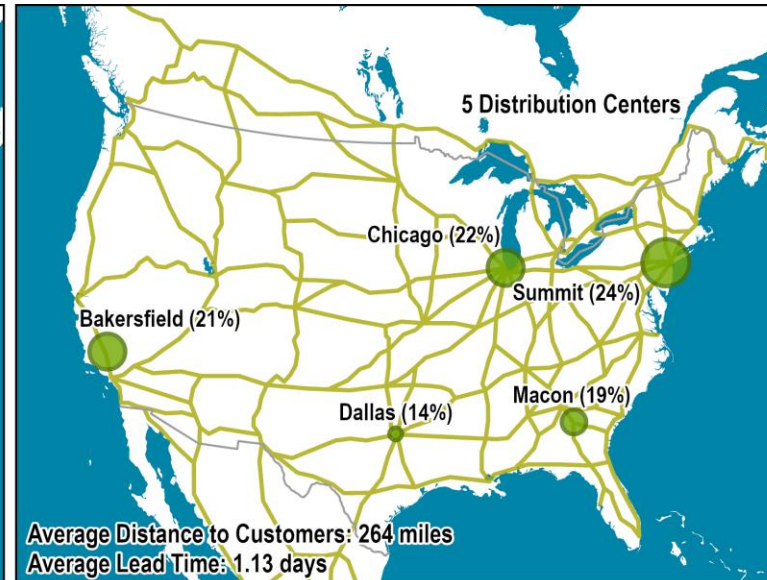
Typology Criteria of Agglomerations of Logistical Activities

Accessibility	
Internal Structure	
Function	
Governance	

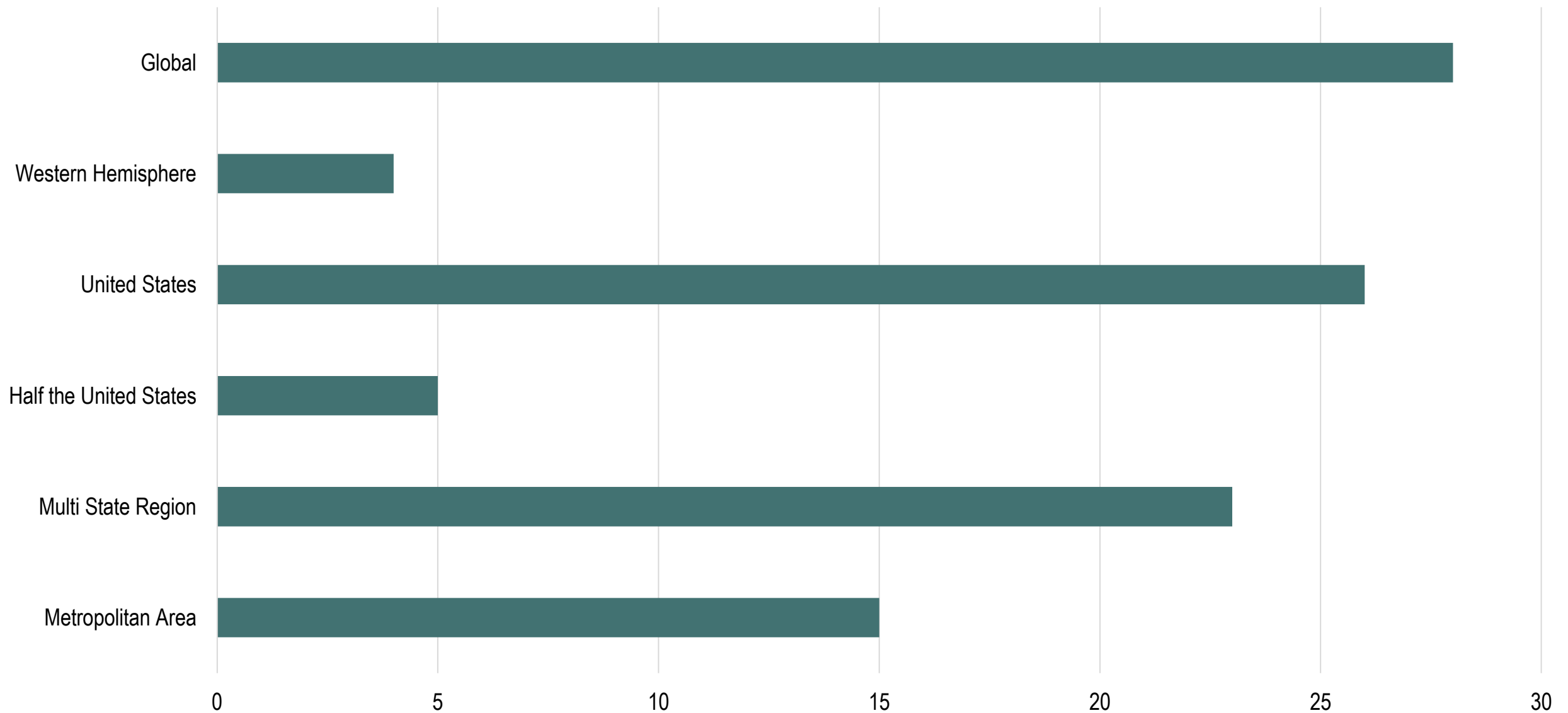
Basic Operational Characteristics by Number of Warehouses, United States and China, 2009



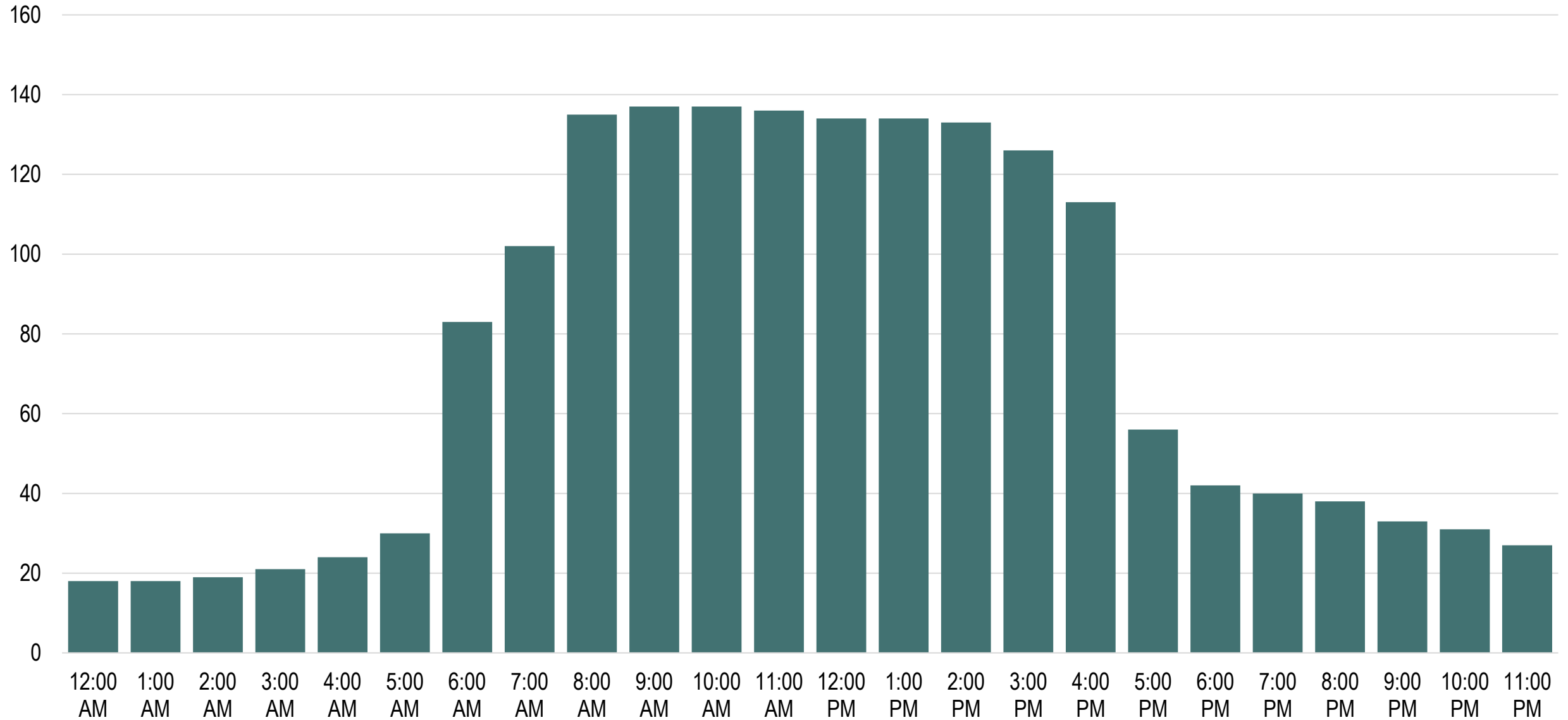
Optimal Location and Throughput by Number of Freight Distribution Centers



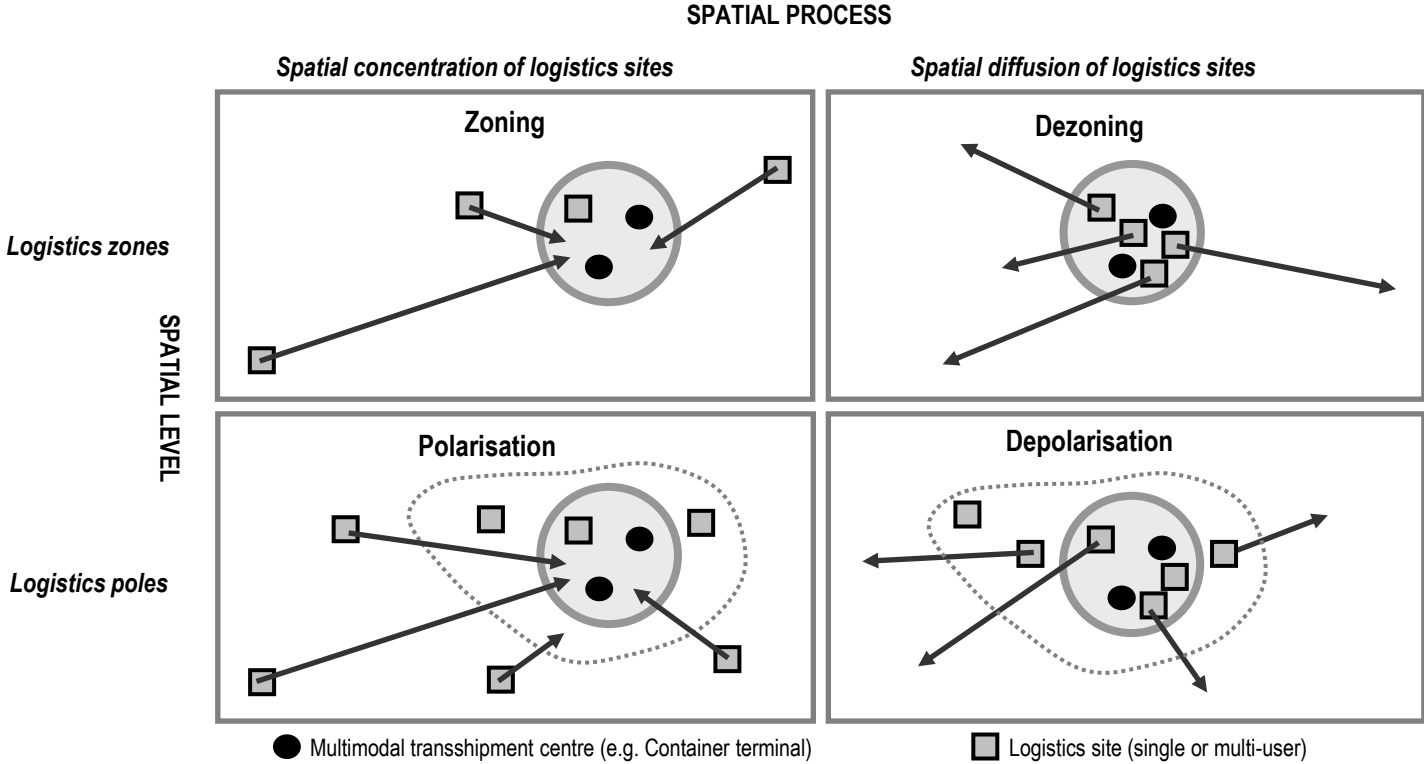
Market Area of Distribution Centers Located in the United States, 2012



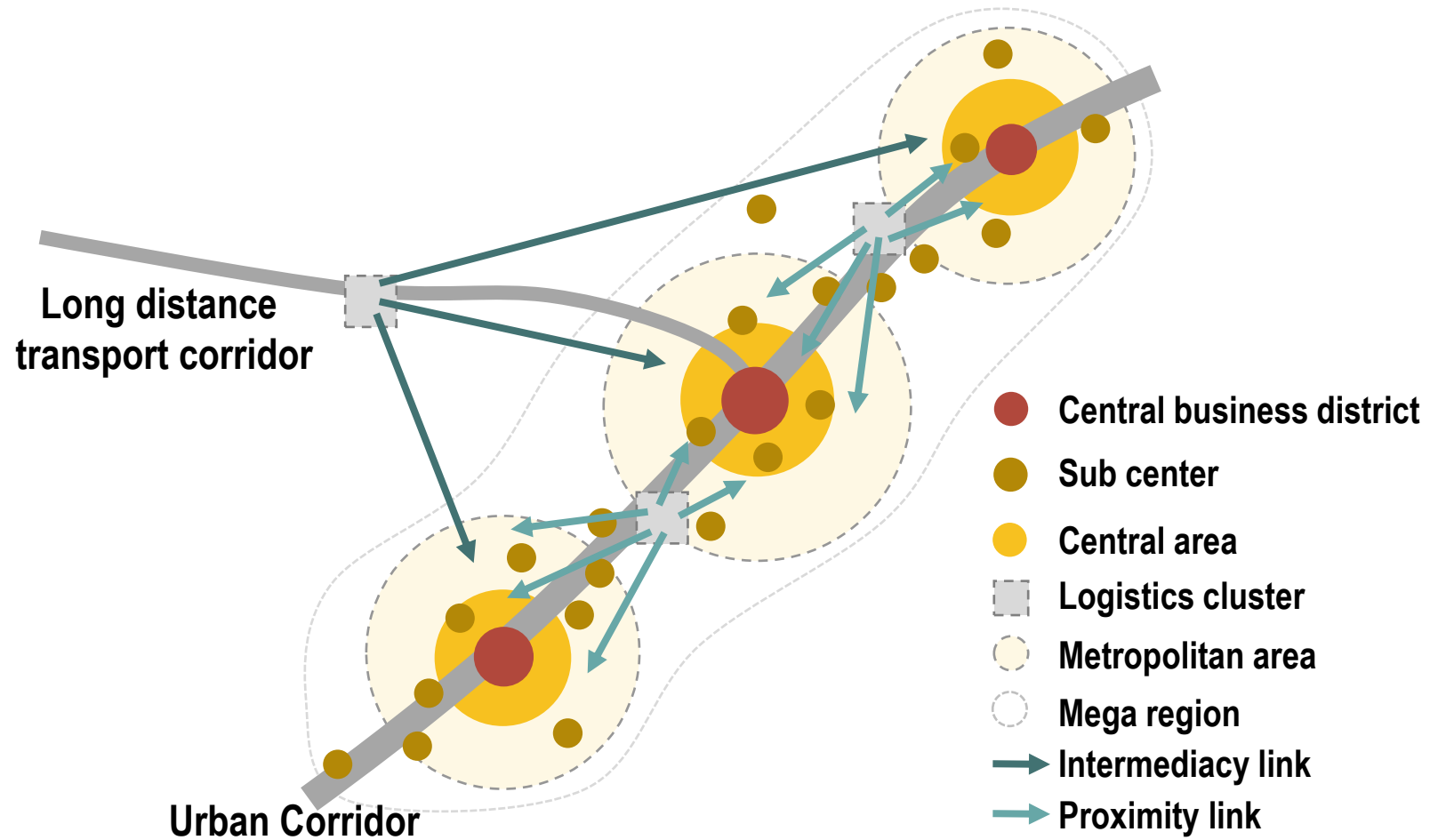
Operating Hours of Distribution Centers



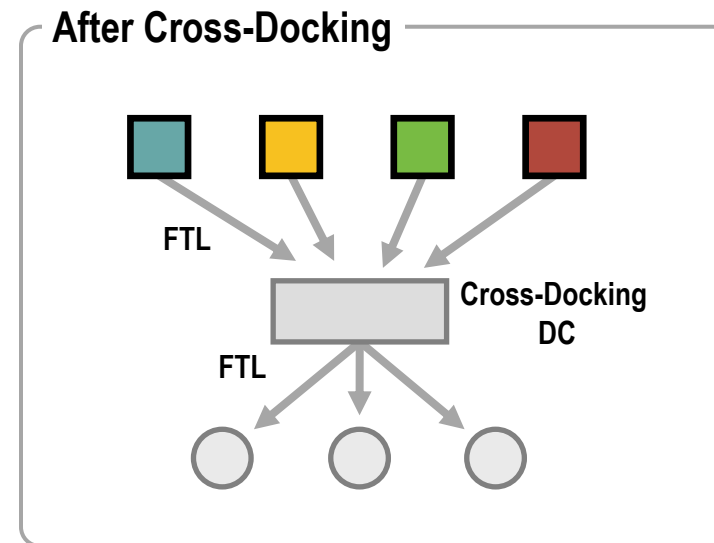
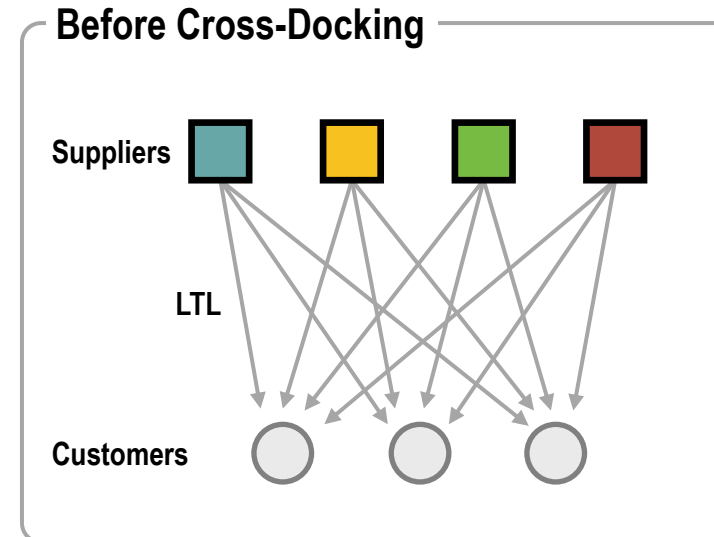
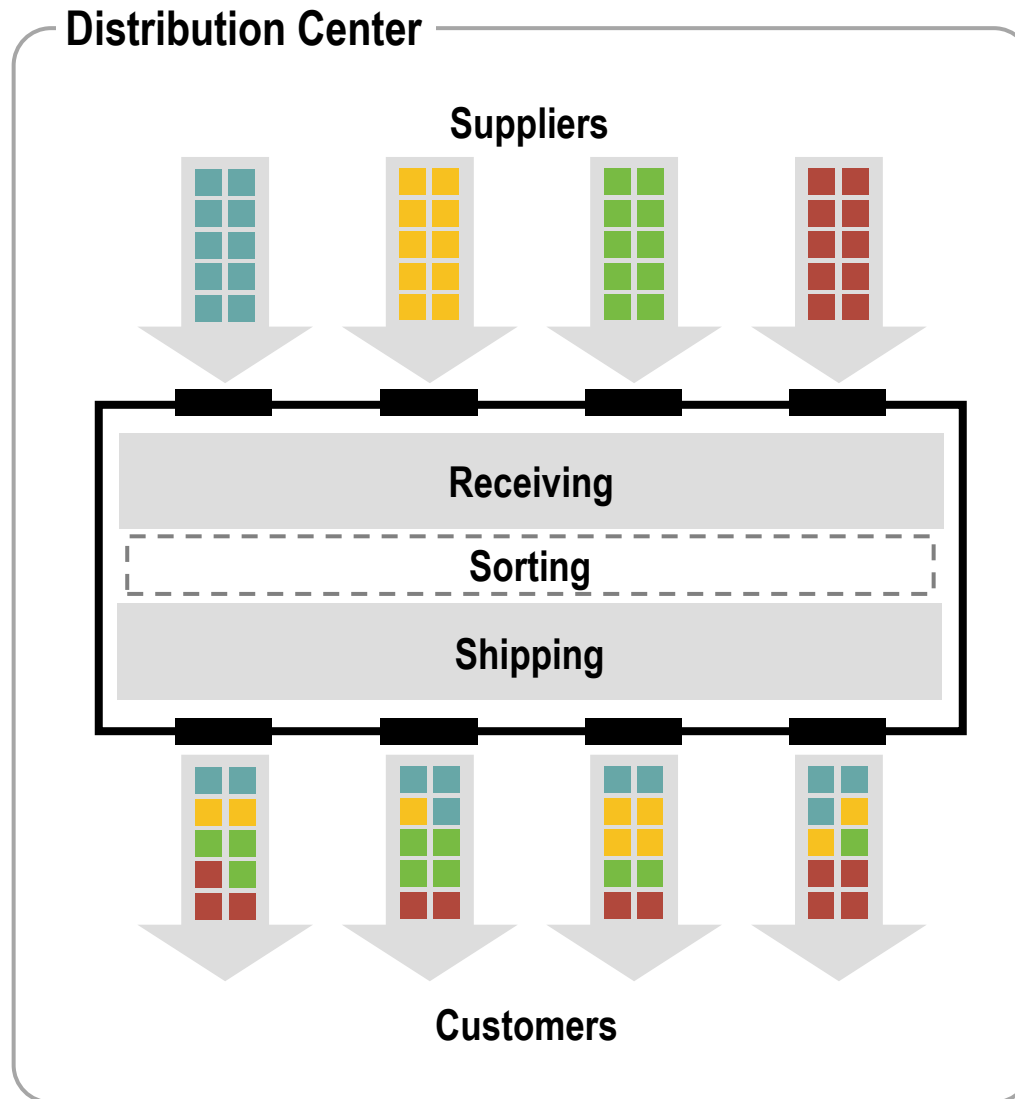
A Typology of Spatial Dynamics in the Location of Logistics Sites



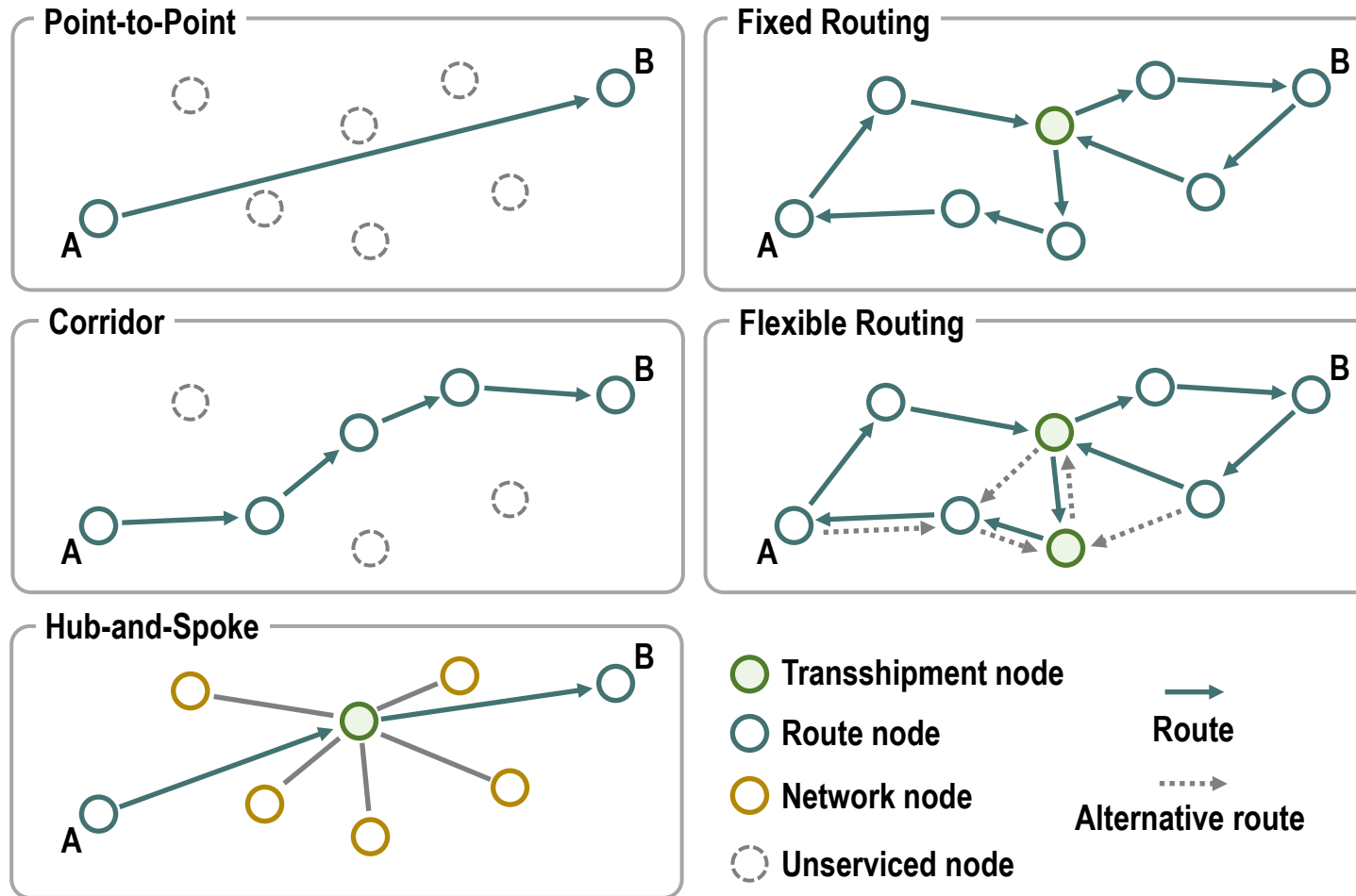
Proximity and Intermediacy for Distribution Clusters



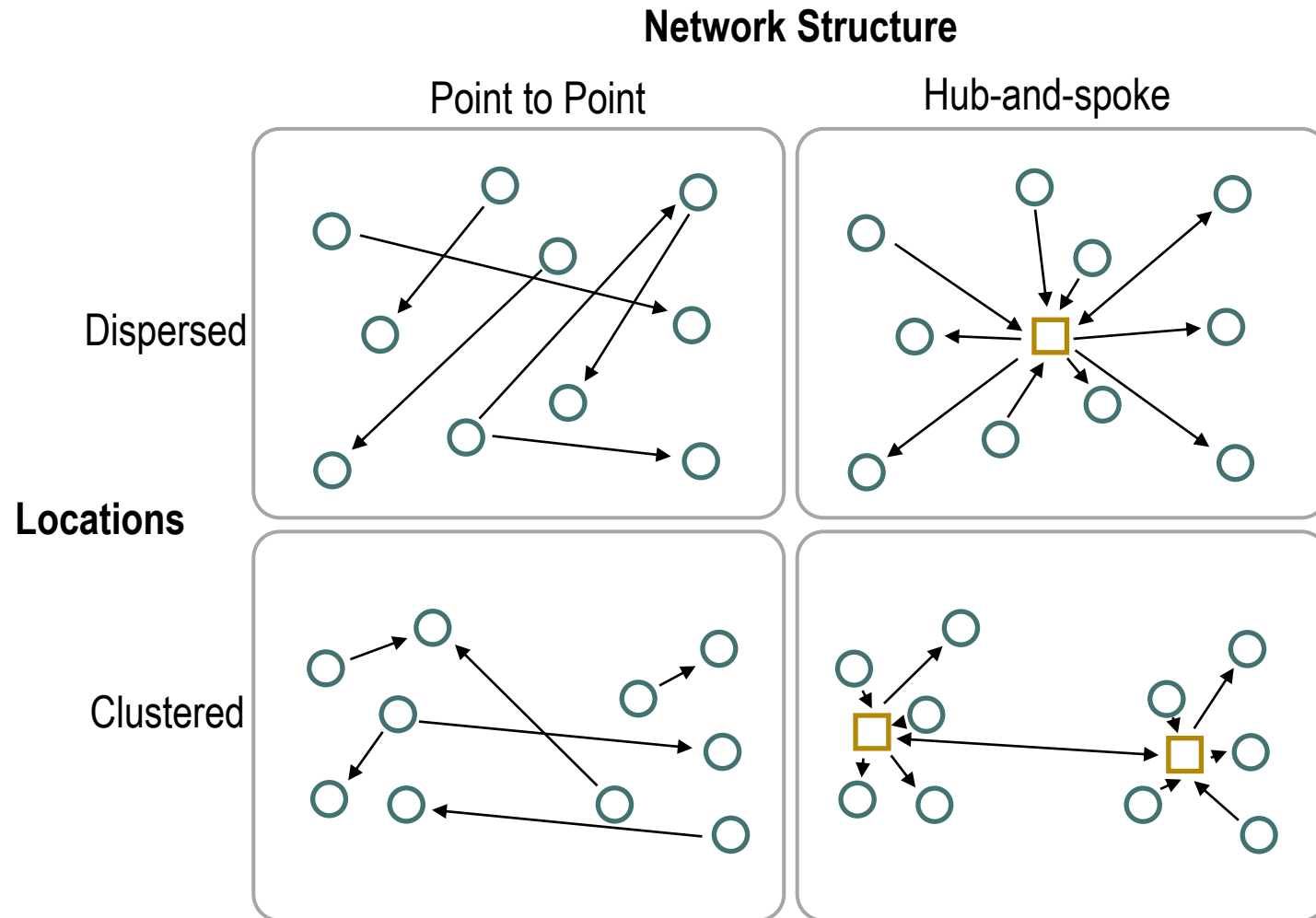
Cross-Docking Distribution Center



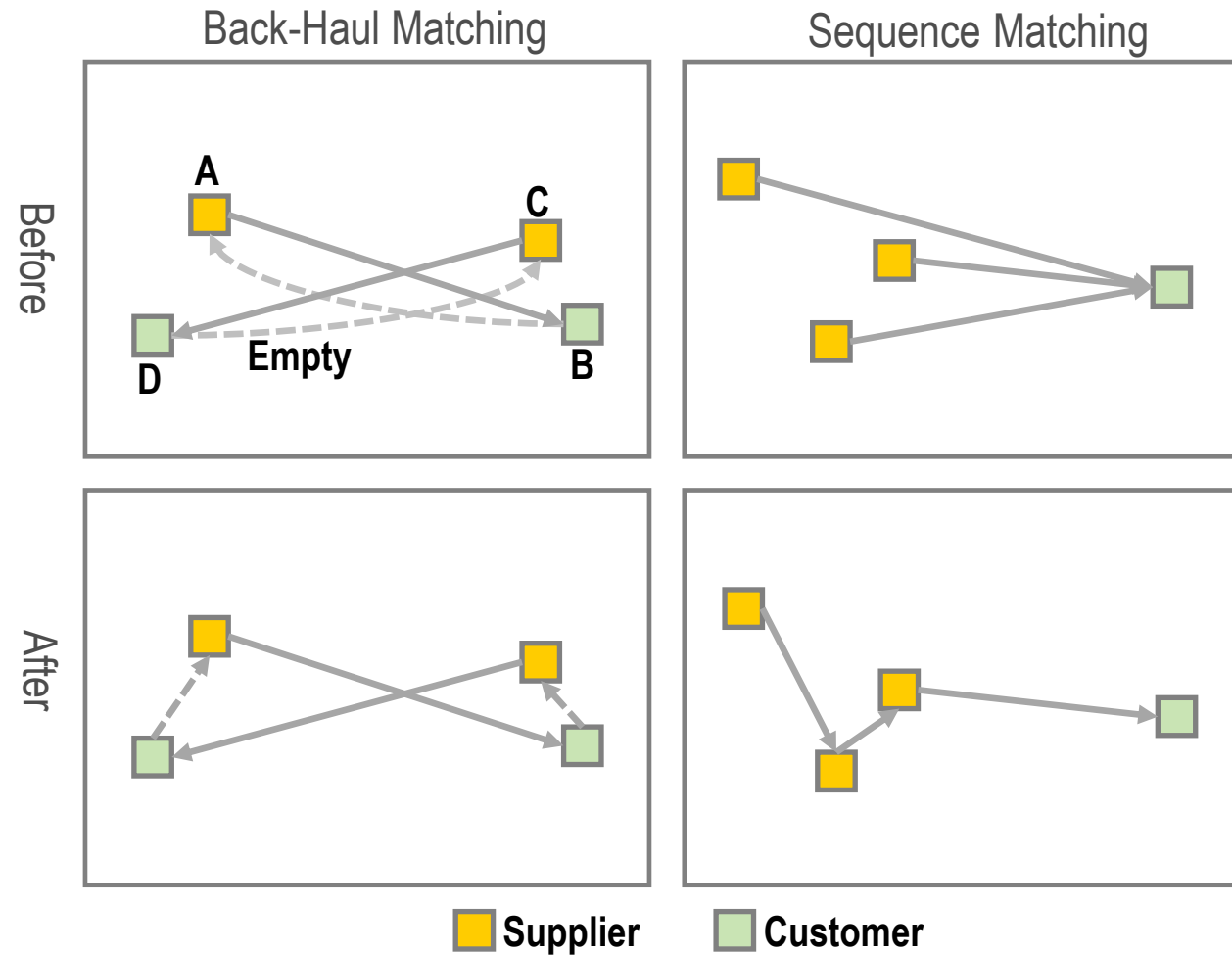
Freight Distribution and Network Strategies



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.

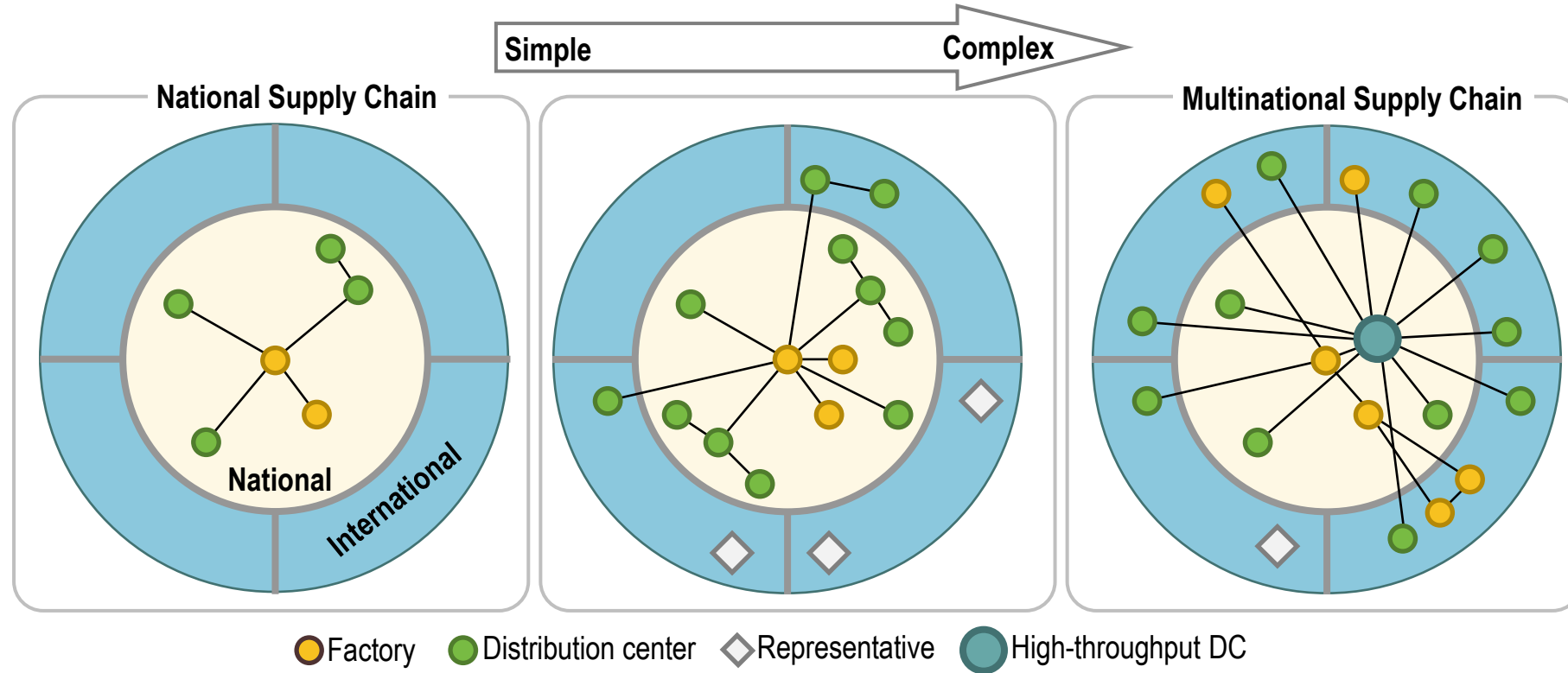
Efficient packaging

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

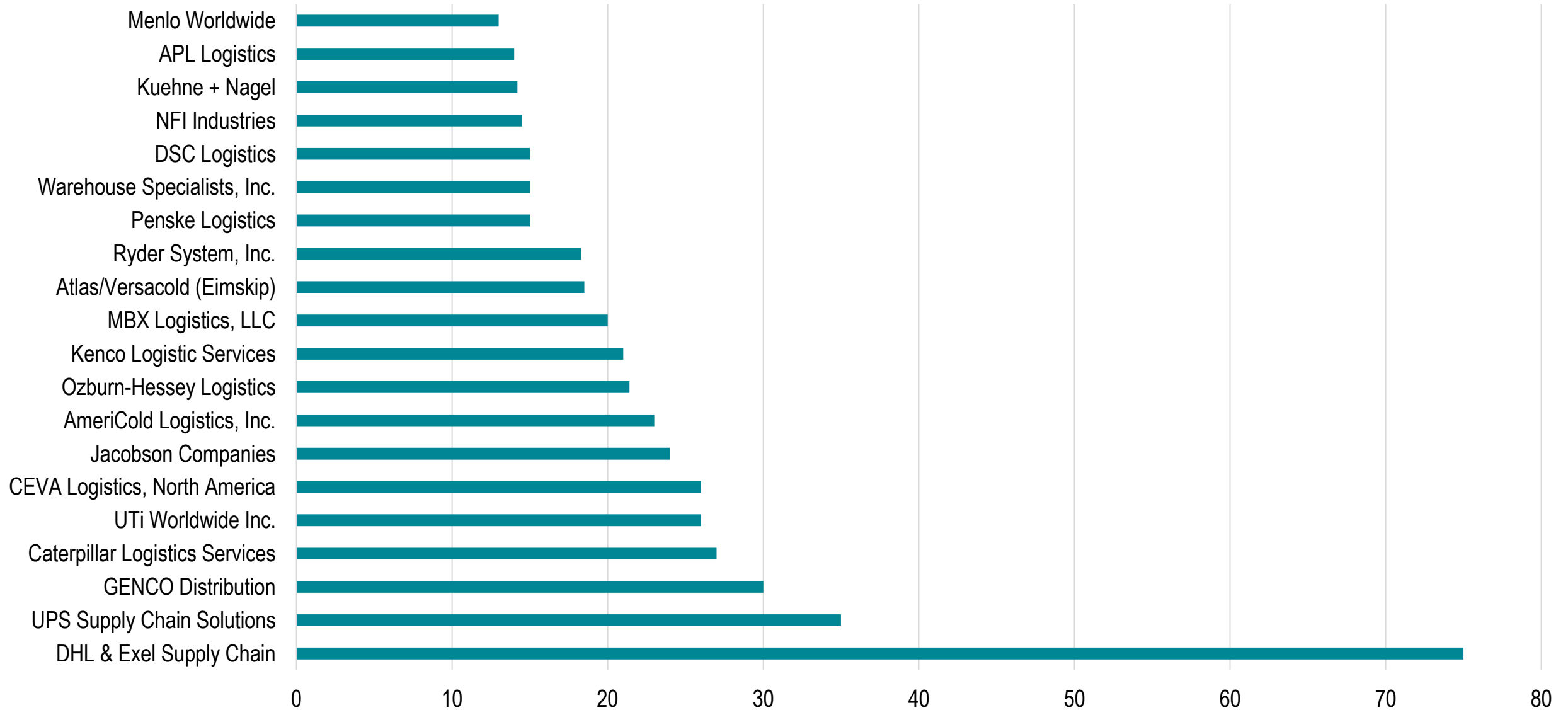
Modal shift

Use a mode that is less impacted by congestion.

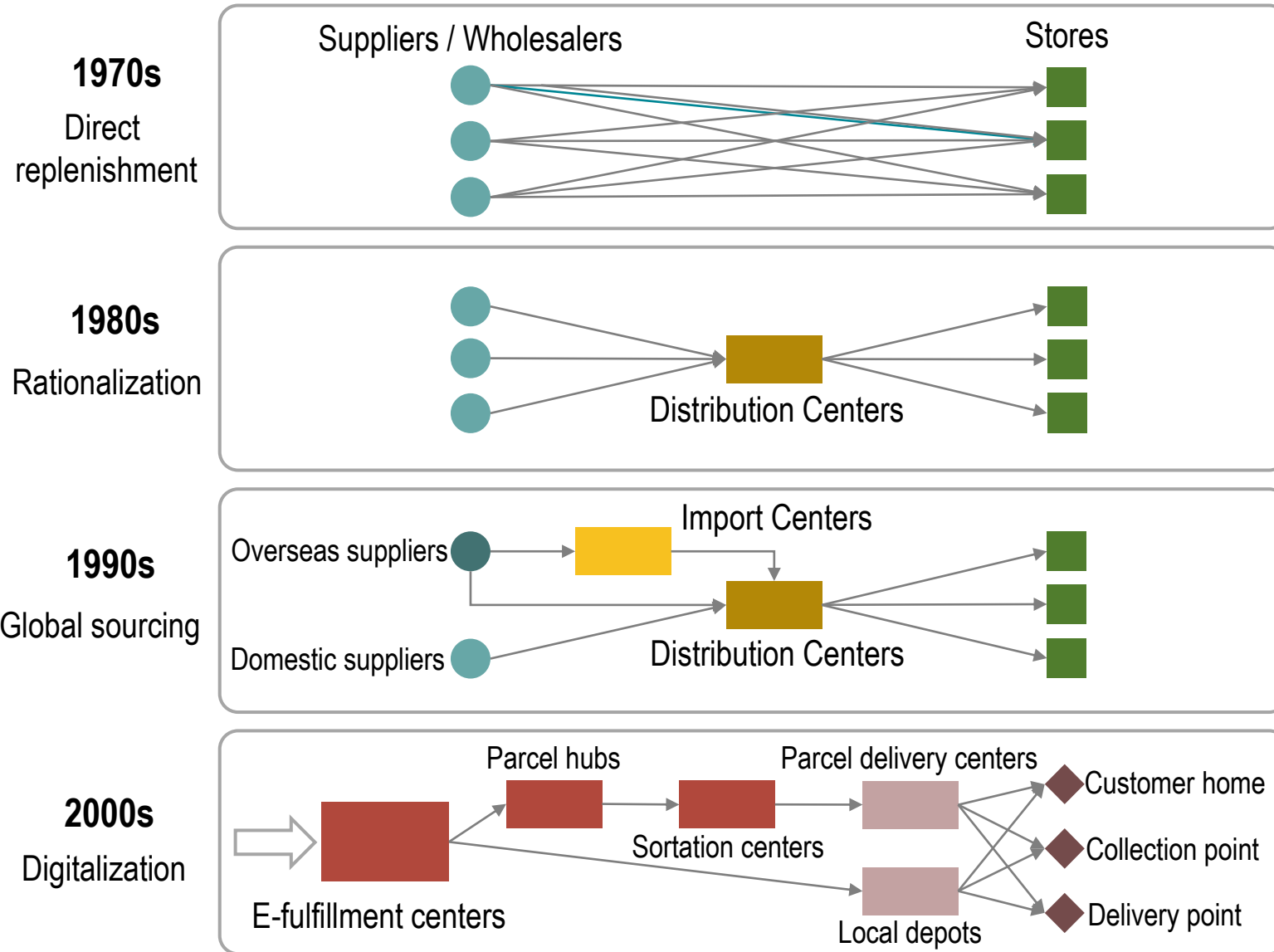
Complexity of the Supply Chain



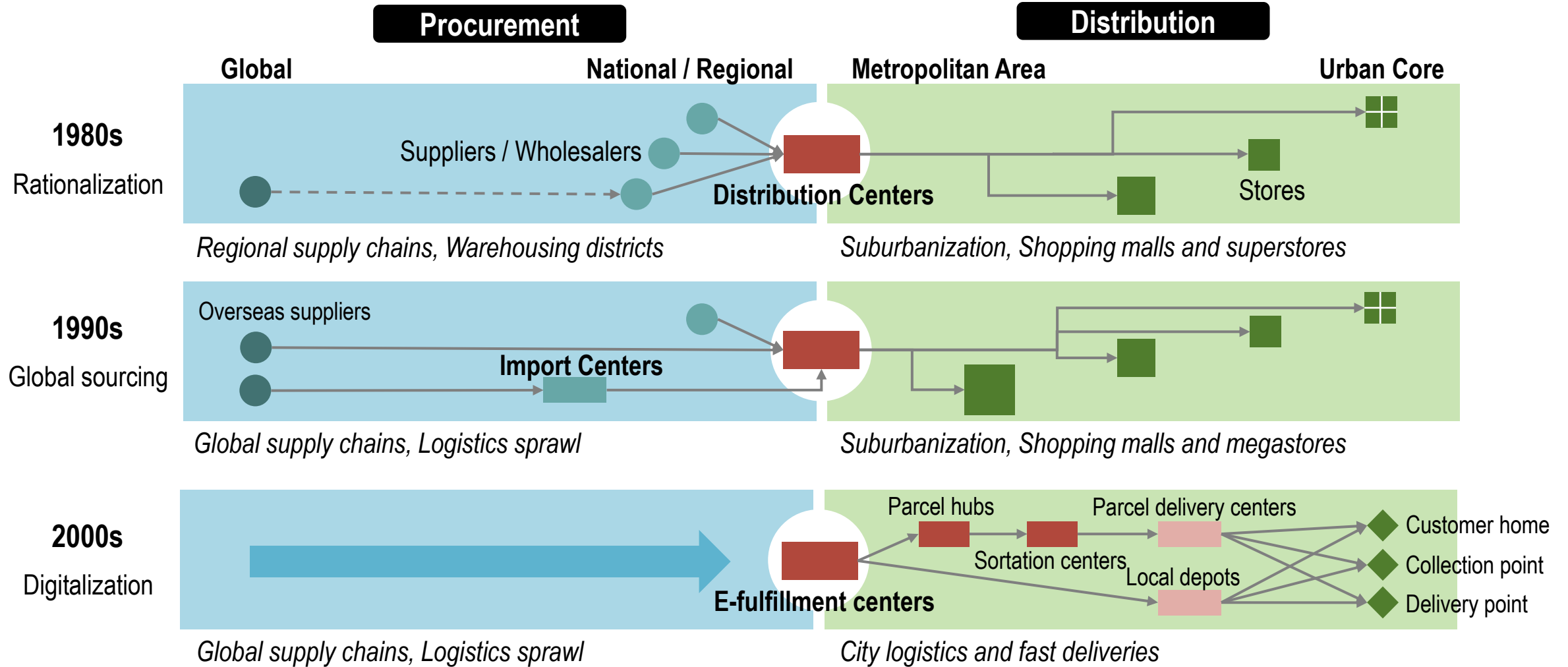
20 Largest North American Warehouse Operators, 2007



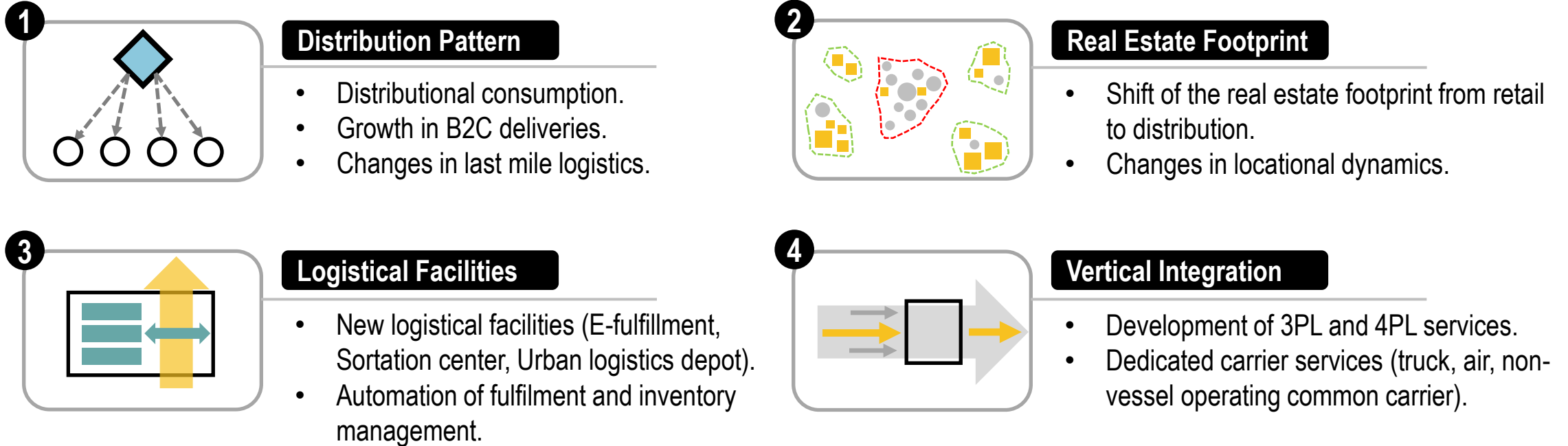
The Evolution of Retail Logistics



The Evolution of Retail Logistics

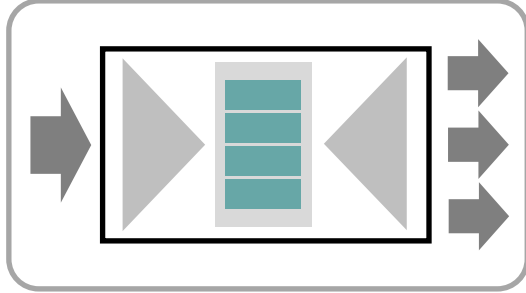


The Impacts of E-commerce on Freight Distribution



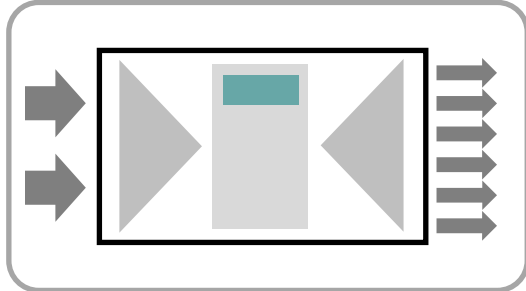
Logistics Facilities Supporting E-commerce

Inbound Cross Dock



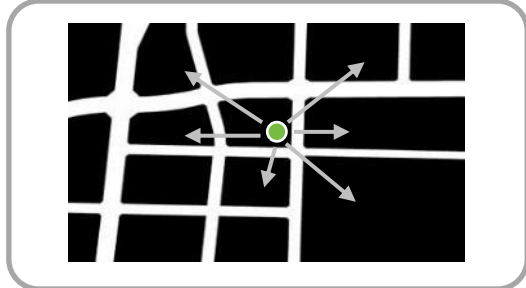
- Large-sized.
- Receiving containers and holding inventory.
- Double side cross-docking configuration.
- Close to intermodal terminals.

Sortation Center



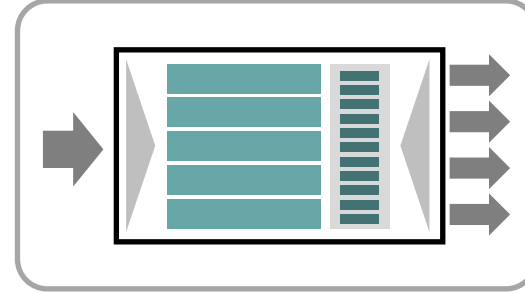
- Large-sized.
- Cross-docking configuration for loading trucks.
- Automated and semi-automated sortation.
- Accessibility to regional distribution.

Local Freight Station



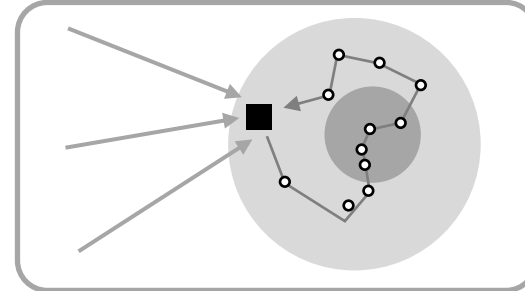
- Small or micro-sized.
- Store-like facility (pickup location).
- Locker banks (freight station).
- High density neighborhood locations.

E-Fulfillment Center



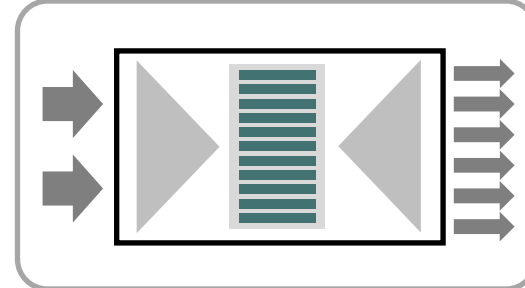
- Large-sized.
- Single side cross-docking configuration common.
- High racks automated storage.
- Item specialization.
- Access to a major parcel hub.

Delivery Station



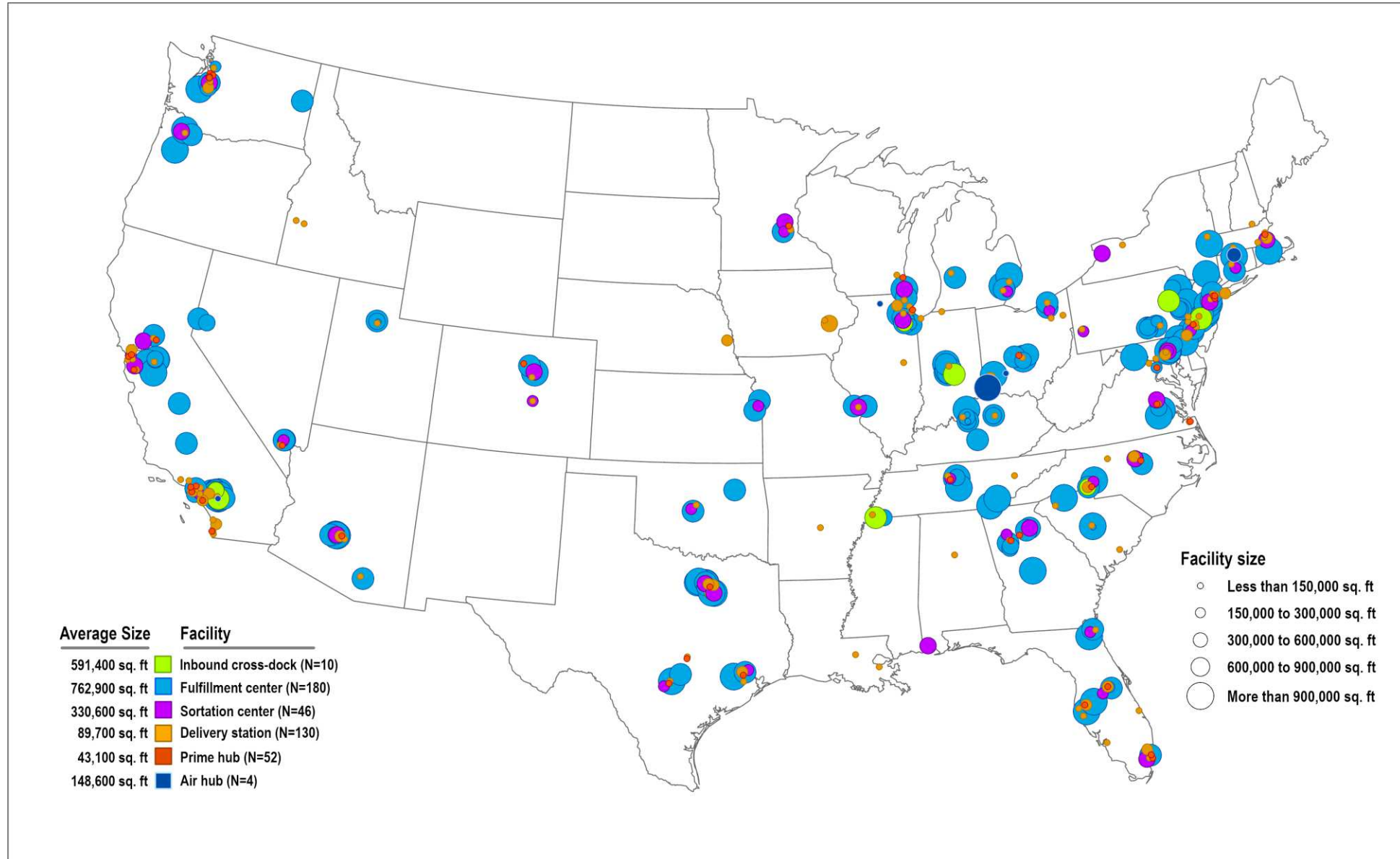
- Medium to small-sized.
- Cross-docking configuration for loading delivery vehicles.
- Periphery of metropolitan areas.

Fast Delivery Hub

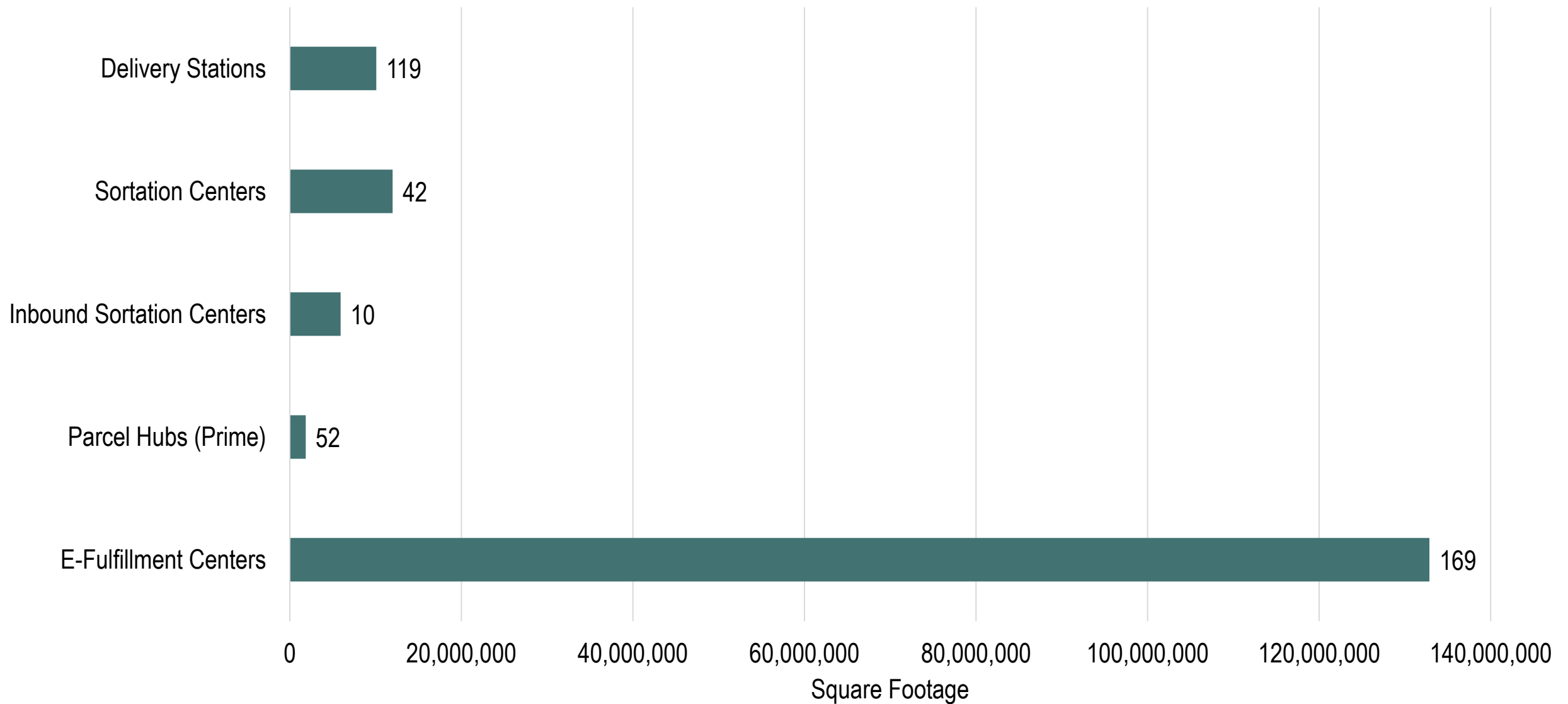


- Small to medium-sized.
- Near large metropolitan areas.
- Limited inventory of high demand items.
- Some co-location with e-fulfillment centers.

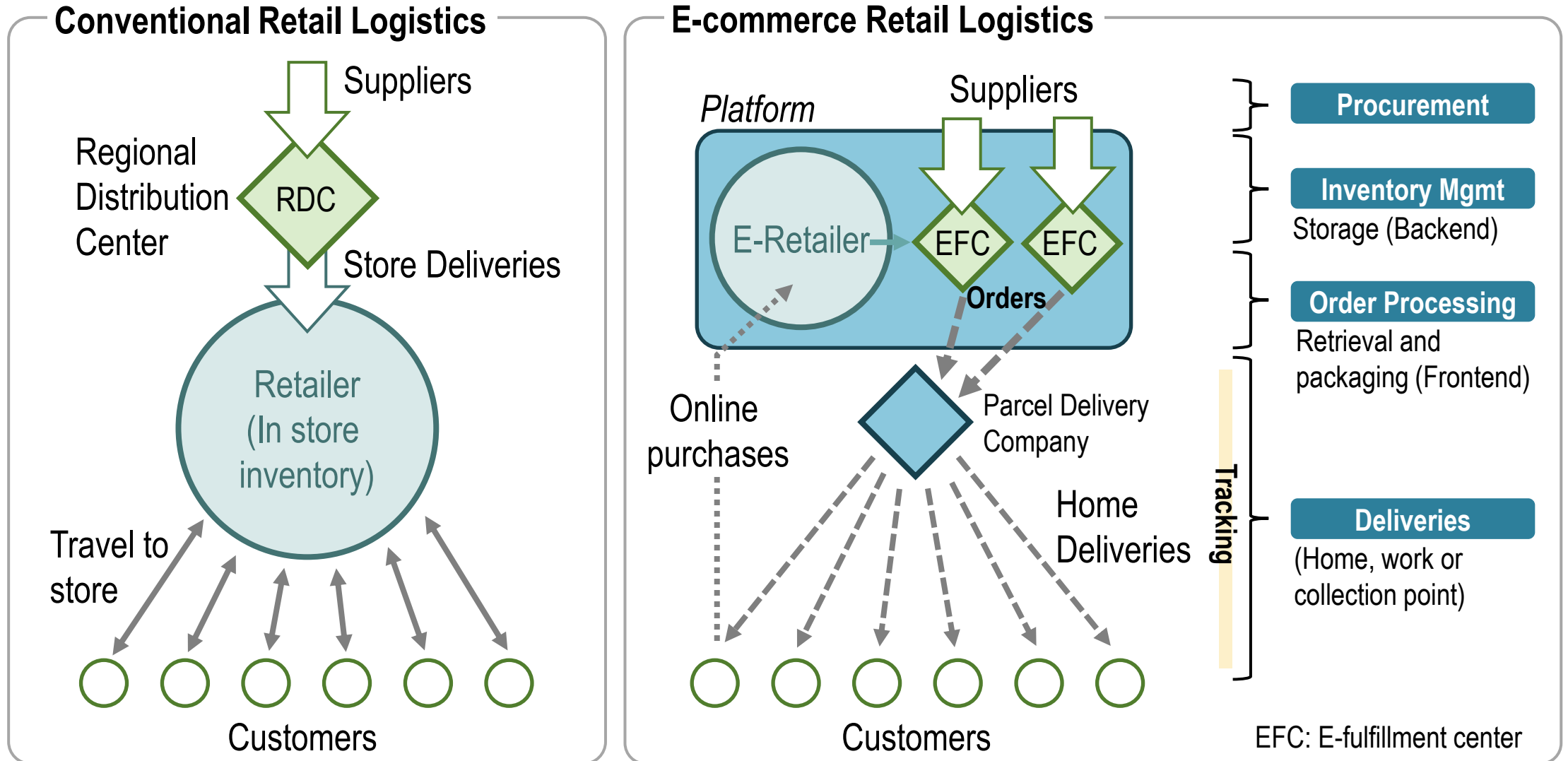
E-Commerce Facilities Operated by Amazon in the United States, 2019



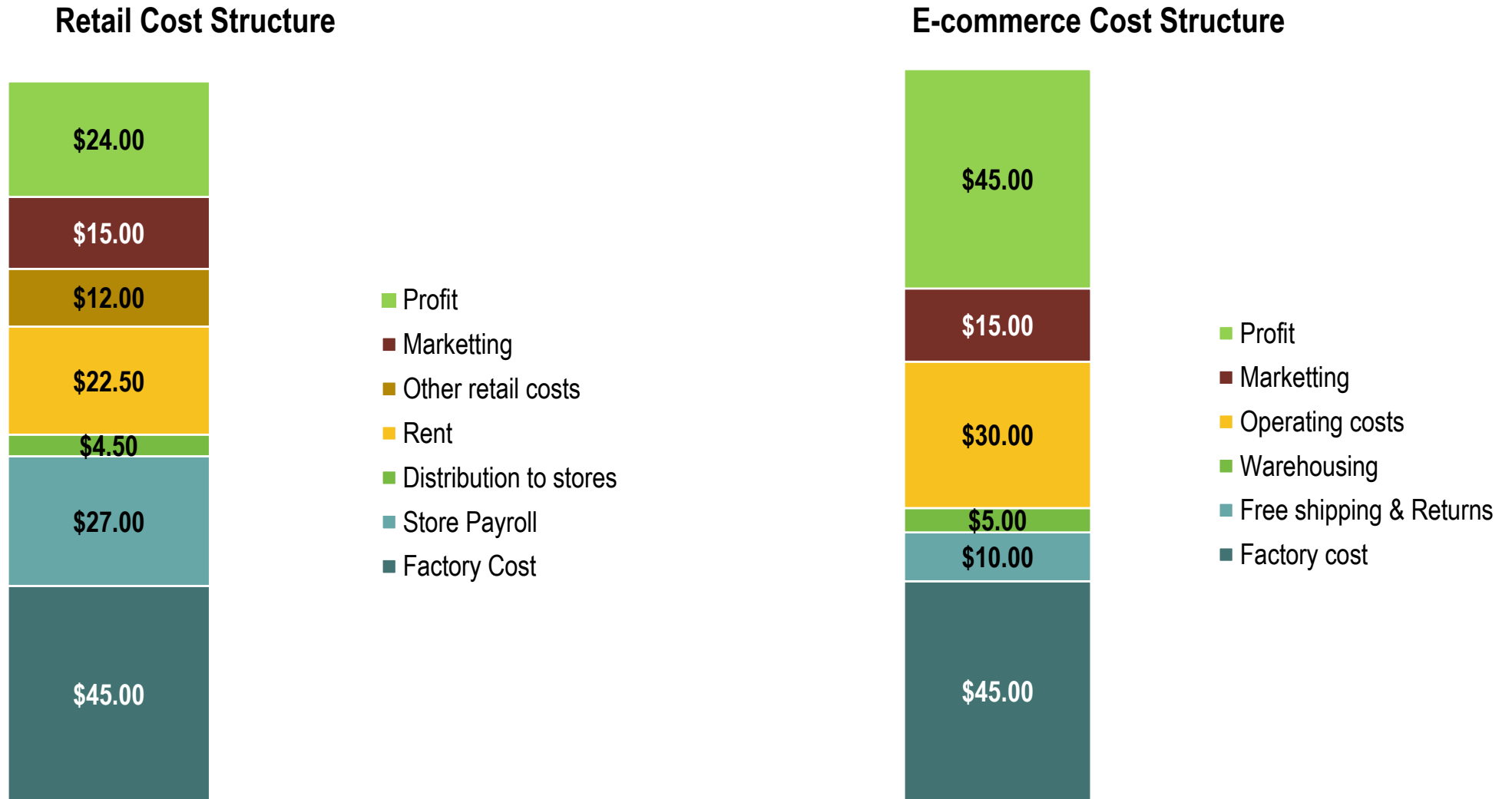
E-Commerce Facilities Operated by Amazon in the United States, 2018



Retail Logistics and E-commerce



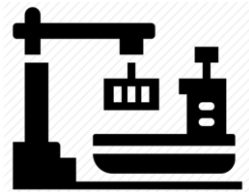
Comparison Between Retail and E-commerce Cost Structures for a \$150 Apparel Piece



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



Drayage

Congestion; chassis management



Warehousing

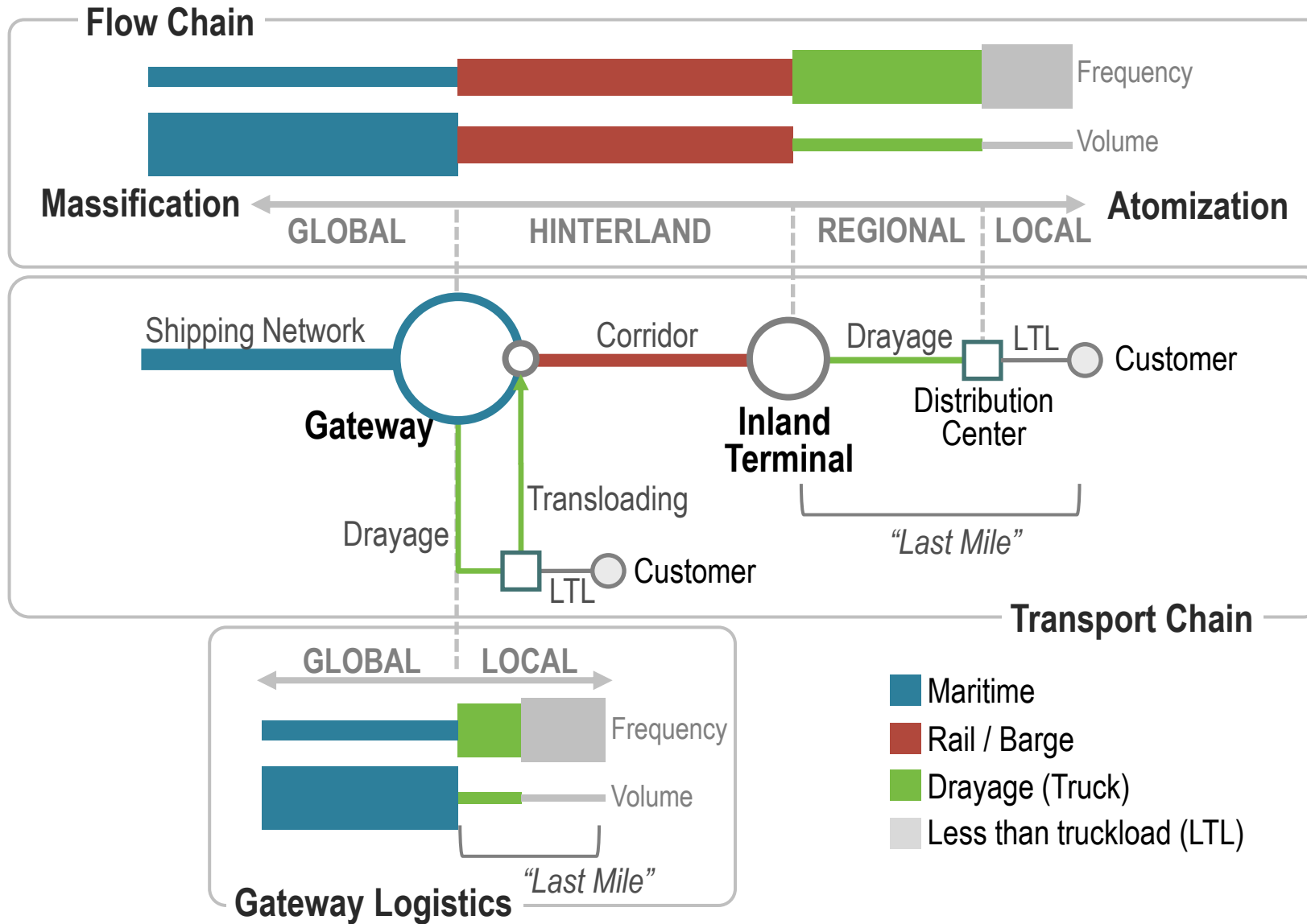
Inventory level; lead time; transloading



Deliveries

Congestion; parking

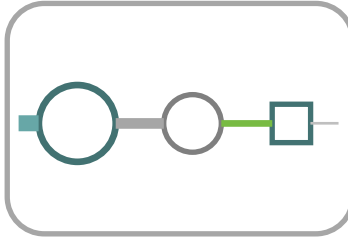
The "Last Mile" in Inland Freight Distribution



Main Elements in Supply Chain Integration

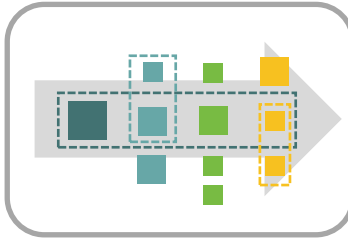
Element	Purpose
Infrastructure Integration	Improving connectivity and interoperability. Synchronizing terminals and distribution facilities to increase throughput and reliability.
Commercial Integration	Commercial agreements, mergers and acquisitions between companies along the supply chain. Involves service level and management. Vertical and horizontal integration of actors and processes.
Work Practices Integration	Organizational (managing labor as a group) and skills (managing individual workers) competencies to move cargo efficiently. Involves operational window, minimal service levels and essential services.
Information Integration	Interconnectedness of information systems. Involves asset tracking, status monitoring, customs facilitation, freight status information and transport network status information.
Regulatory Integration	Promote modal choice and avoid subsidized modal preference through the harmonization of regulation across jurisdictions.
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 sectors.
Customs and Security Integration	Harmonization of security procedures that protect cargo from theft or damage and protect the public from risks. Involves assessments of cargo contents, cargo integrity, route integrity and information integrity.

Main Elements in Supply Chain Integration and Connectivity



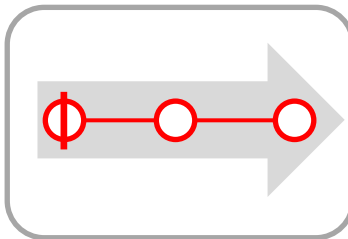
Transport Connectivity

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



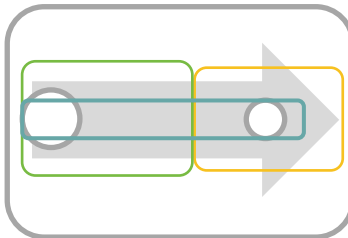
Commercial Integration

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



Customs and Security Integration

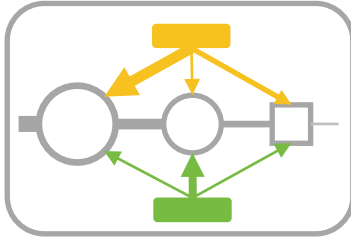
Moving cargo more efficiently across borders through prescreening and inspections.
Harmonization of customs and security procedures.
Assessments of cargo contents, cargo integrity, route integrity and information integrity.



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.

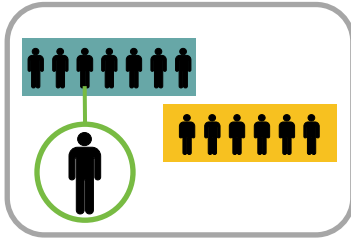
Main Elements in Supply Chain Integration and Connectivity



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.

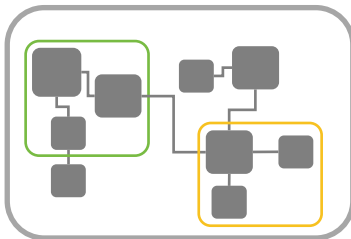


Work Practices Integration

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.

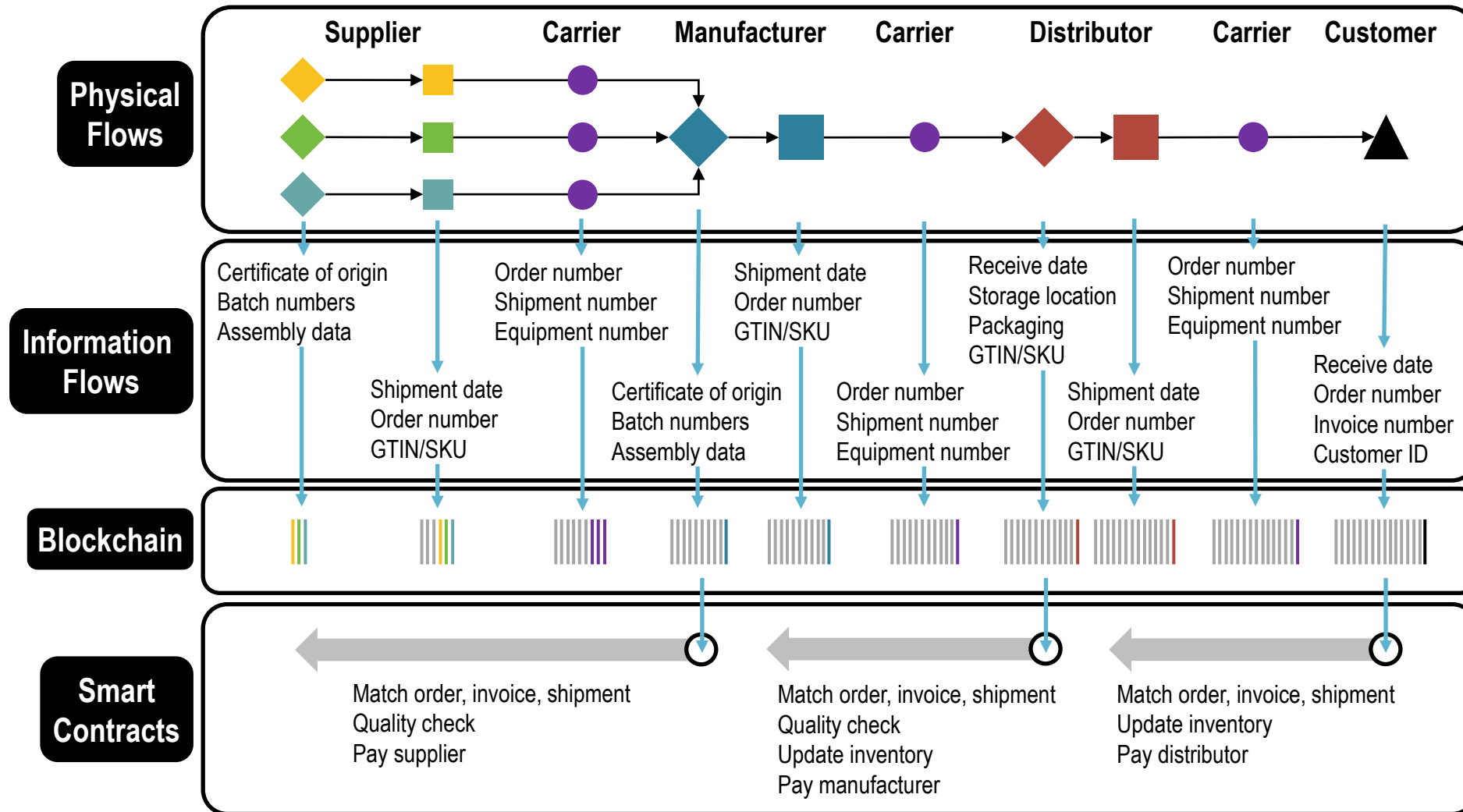


Information Systems Integration

Interconnectivity of information systems with blockchains.

Asset tracking, status monitoring, customs facilitation, freight status information and transport network status information.

Supply Chains and Blockchains



Expected Benefits of Blockchains on Supply Chains



Velocity of Supply Chains

Faster transactions.
Less latency, improving cash flow and inventory carrying costs.



Supply Chain Visibility (Tracking)

Track shipments along an intermodal transport chain and identify issues causing delays.
Create a market where service providers bid to handle “blocs”.



Supply Chain Security (Tracing)

See where, when and how a specific event took place (e.g. cold chain logistics).
Counterfeiting and the use of sub-par materials easier to detect.



Standards and Certification Compliance

Proof that cargo was handled by specific modes, carriers and distribution centers.
Calculate accurately energy use and environmental impacts (e.g. CO2 footprint) .