

The Geography of Transport Systems

FIFTH EDITION

Jean-Paul Rodrigue

Applications and Case Studies – Part I (Socioeconomic Issues)

APPENDIX B

Copyright © 1998-2021, Jean-Paul Rodrigue, Dept. of Global Studies & Geography, Hofstra University, Hempstead, NY, 11549 USA.

Jean-Paul.Rodrigue@hofstra.edu

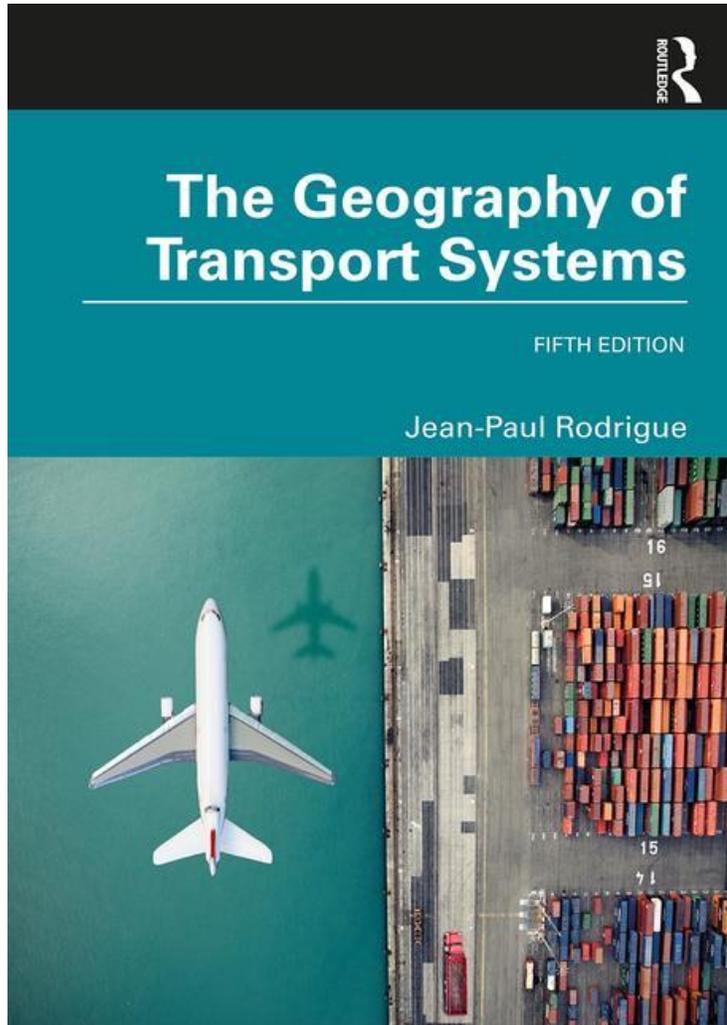
You may use the figures within for educational purposes only. No modification or redistribution permitted.
For more information: <https://transportgeography.org/>

Usage Conditions

- DO NOT COPY, TRANSLATE OR REDISTRIBUTE THIS DOCUMENT.
- The contents of this document can be freely used for personal or classroom use ONLY.
- Although the material contained in this document is freely available, it is not public domain. Its contents, in whole or in part (including graphics and datasets), cannot be copied and published in ANY form (printed or electronic) without consent.
- If you have accessed this document through a third party (such as a content farm), keep in mind that this party is illegally redistributing this content. Please refer to the true source (<https://transportgeography.org/>) instead of the third party.
- Permission to use any graphic material herein in any form of publication, such as an article, a book or a conference presentation, on any media must be requested prior to use.
- Information cited from this document should be referred as: Rodrigue, J-P et al. (2018) The Geography of Transport Systems, Hofstra University, Department of Global Studies & Geography, <https://transportgeography.org/>.

Table of Contents

- Transportation and Mega-Urban Regions
- Transcontinental Bridges
- Transport Corridors in North America
- High Speed Trains
- Mega Airport Projects
- International Tourism and Transport
- Petroleum: A Transportation Resource

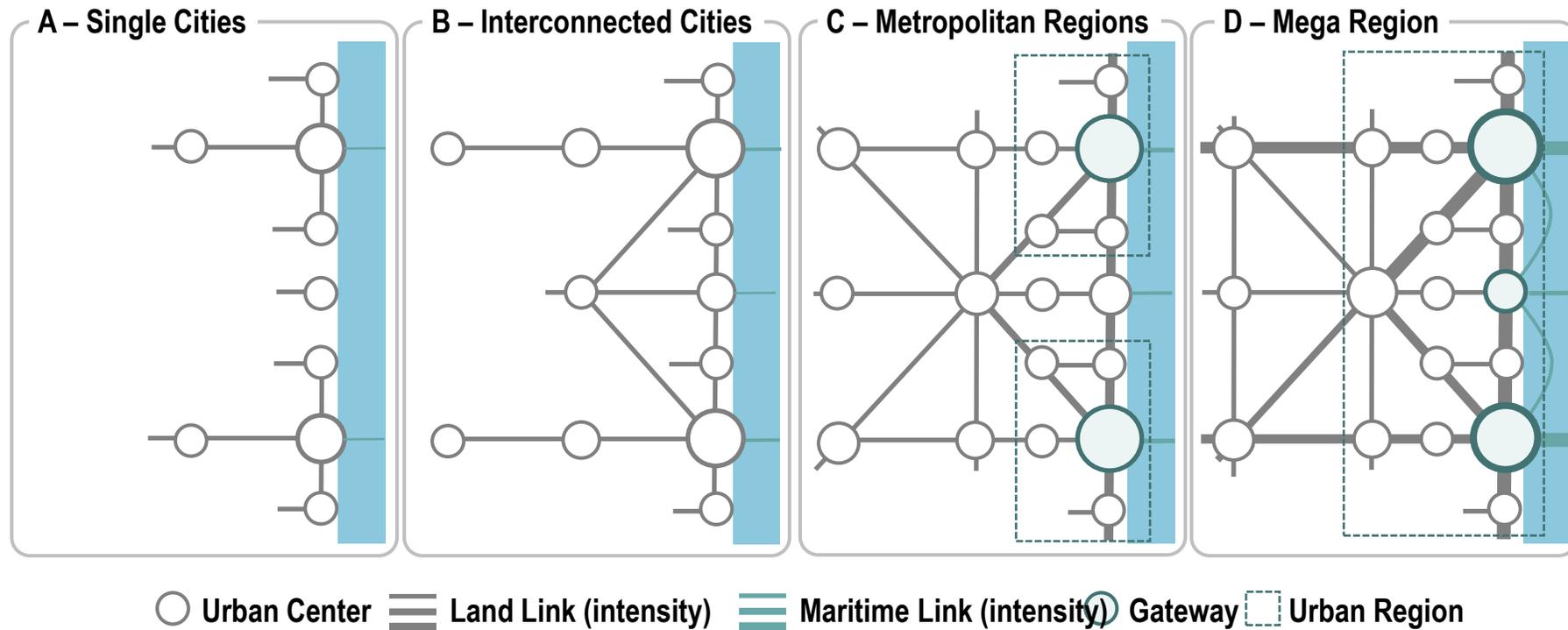


Transportation and Mega-Urban Regions

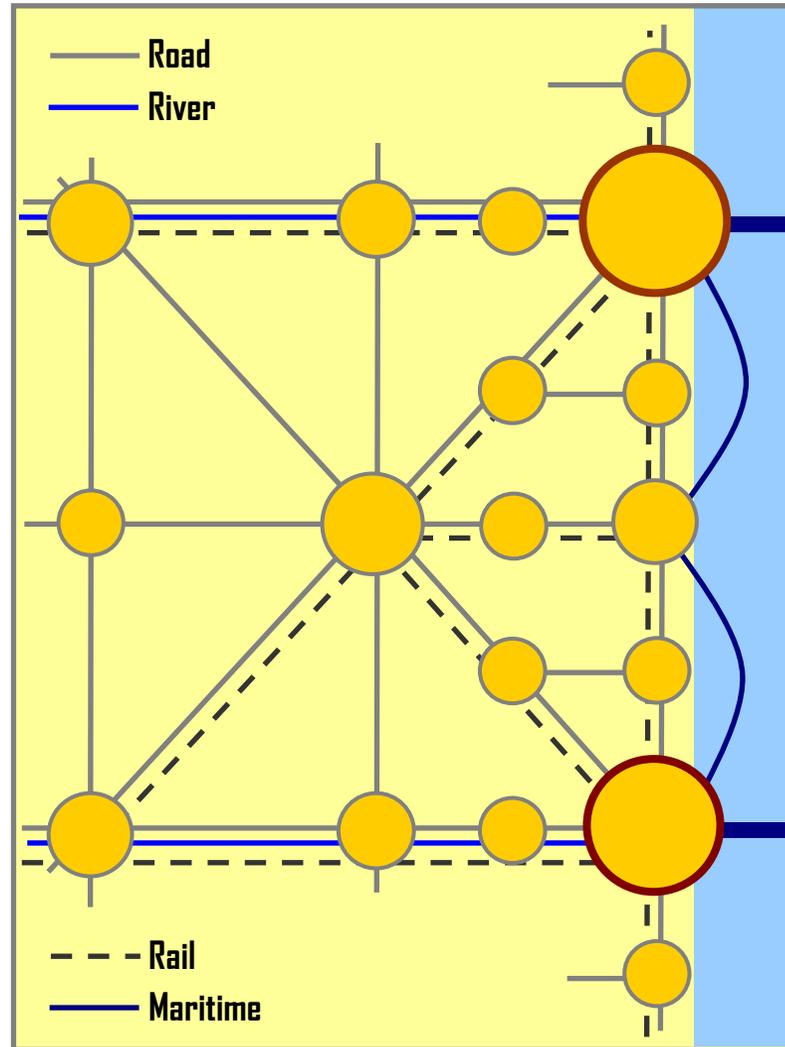
Globalization and Urbanization

	Mercantile Era	Industrial Era	Contemporary Era
Technology and Processes	New transport technology: long distance ships, sextant, etc.	Steam power; Railroad; Steamships; Machine fabrication	New transport and communication technologies; Information-rich production technologies
Supporting Principles	Cartography (navigation); New means of payment (credit): precious metals, financial Innovations (accounting & banking).	Economies of scale; Vertical integration of production; Factory systems; Assembly line Labor unions; Property rights; Central banking; Currency; Monetary policies; Compulsory education.	Economies of scope ; Trade liberalization; Logistical innovations to facilitate flows of goods, services, capital, and information.
Spatial Structure	Division of labor brings increasing urbanization; Size of major cities increases.	Massive urbanization; Average town size increases; Structural issues (housing, infrastructure, spatial organization); Social issues (unemployment, health, welfare, education).	Urban regions competing globally; Relatively fast economic changes causing local dislocations; Rise of large urban regions around major cities connected to the global economy.

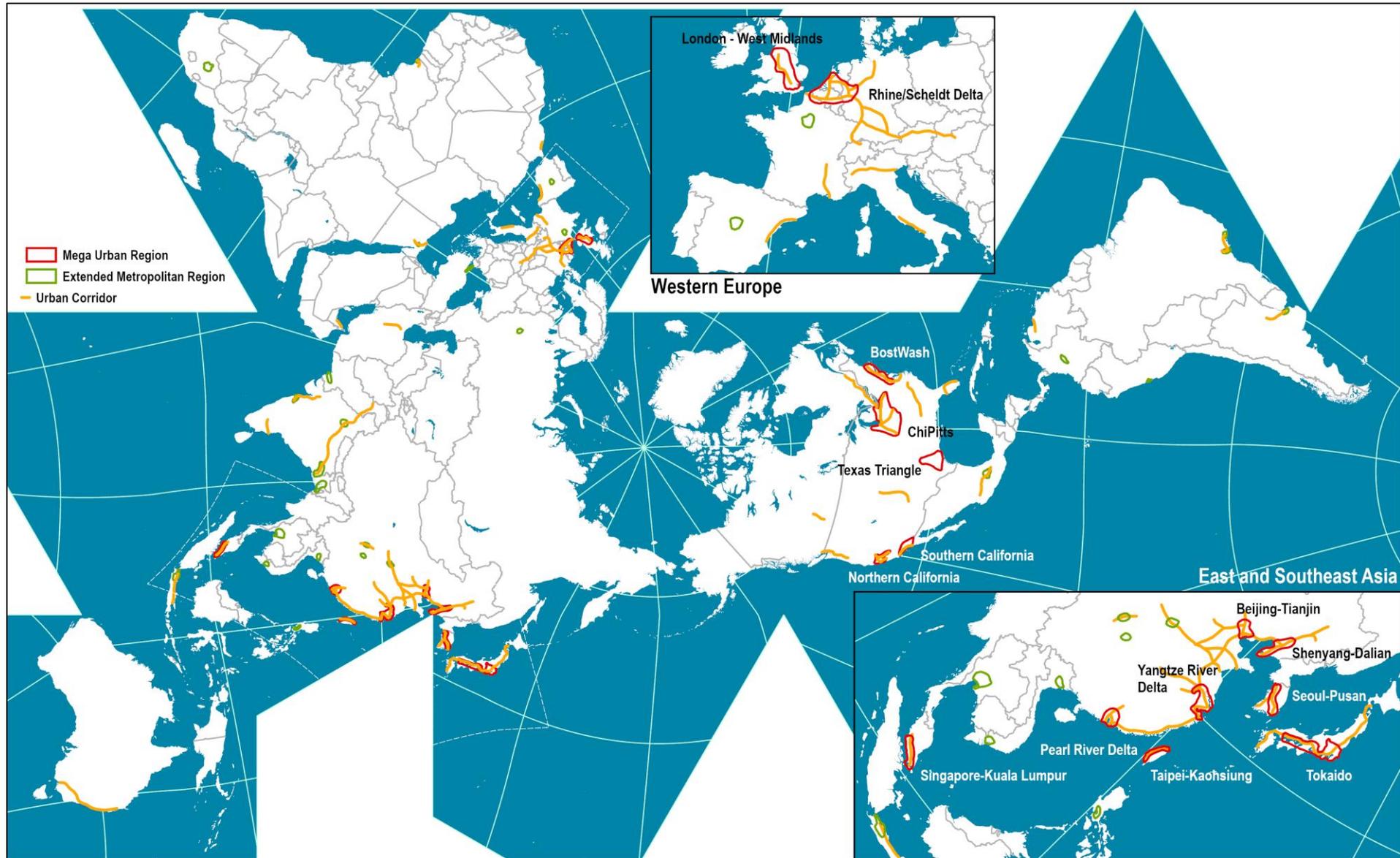
Mega-Region Development



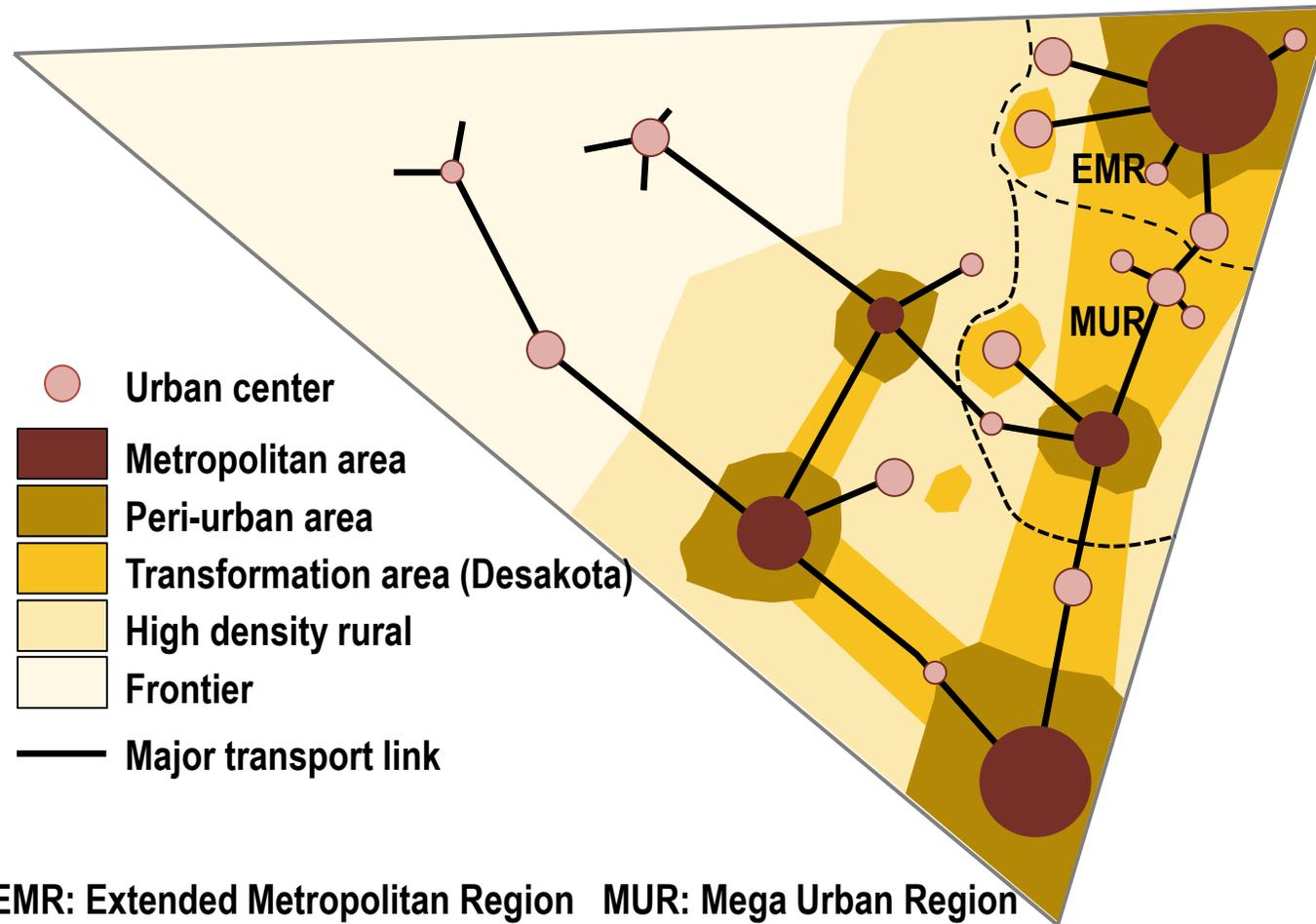
Modal Corridors in Mega Regions

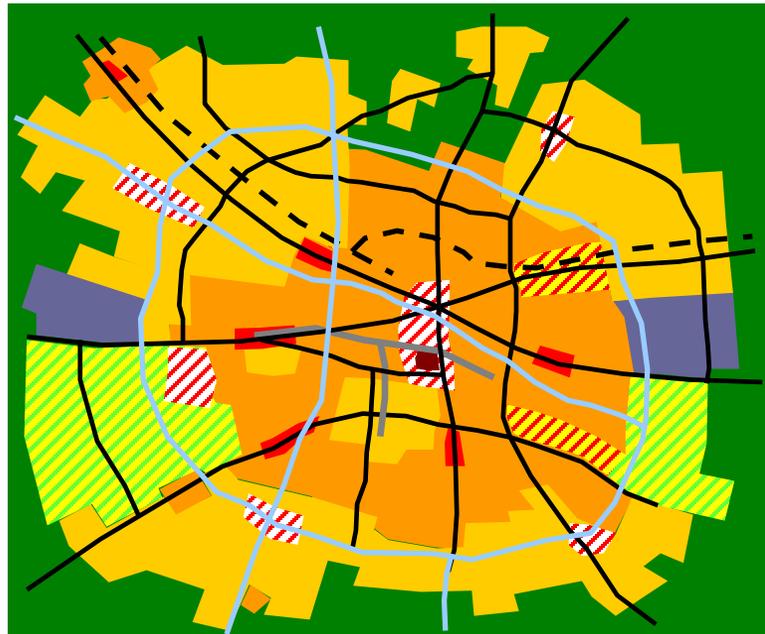
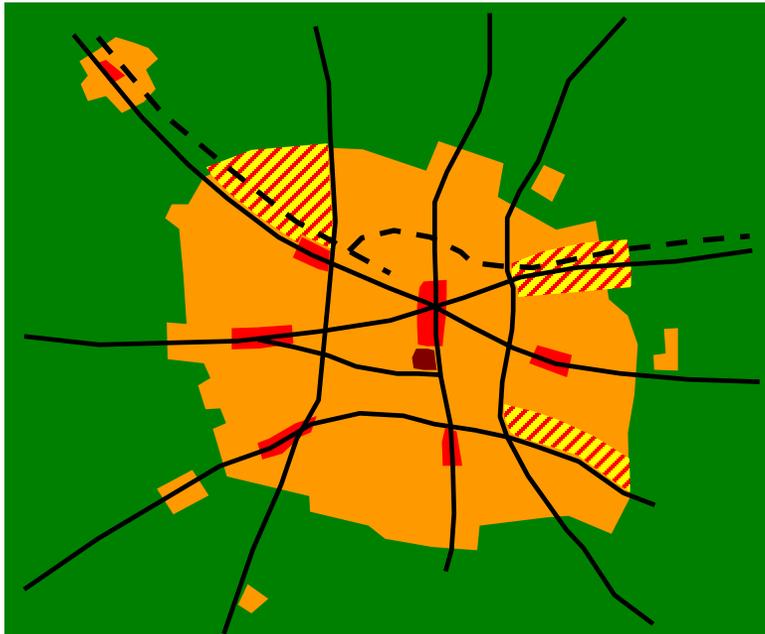


World's Largest Urban Regions



Urban Spatial Pattern in East Asia



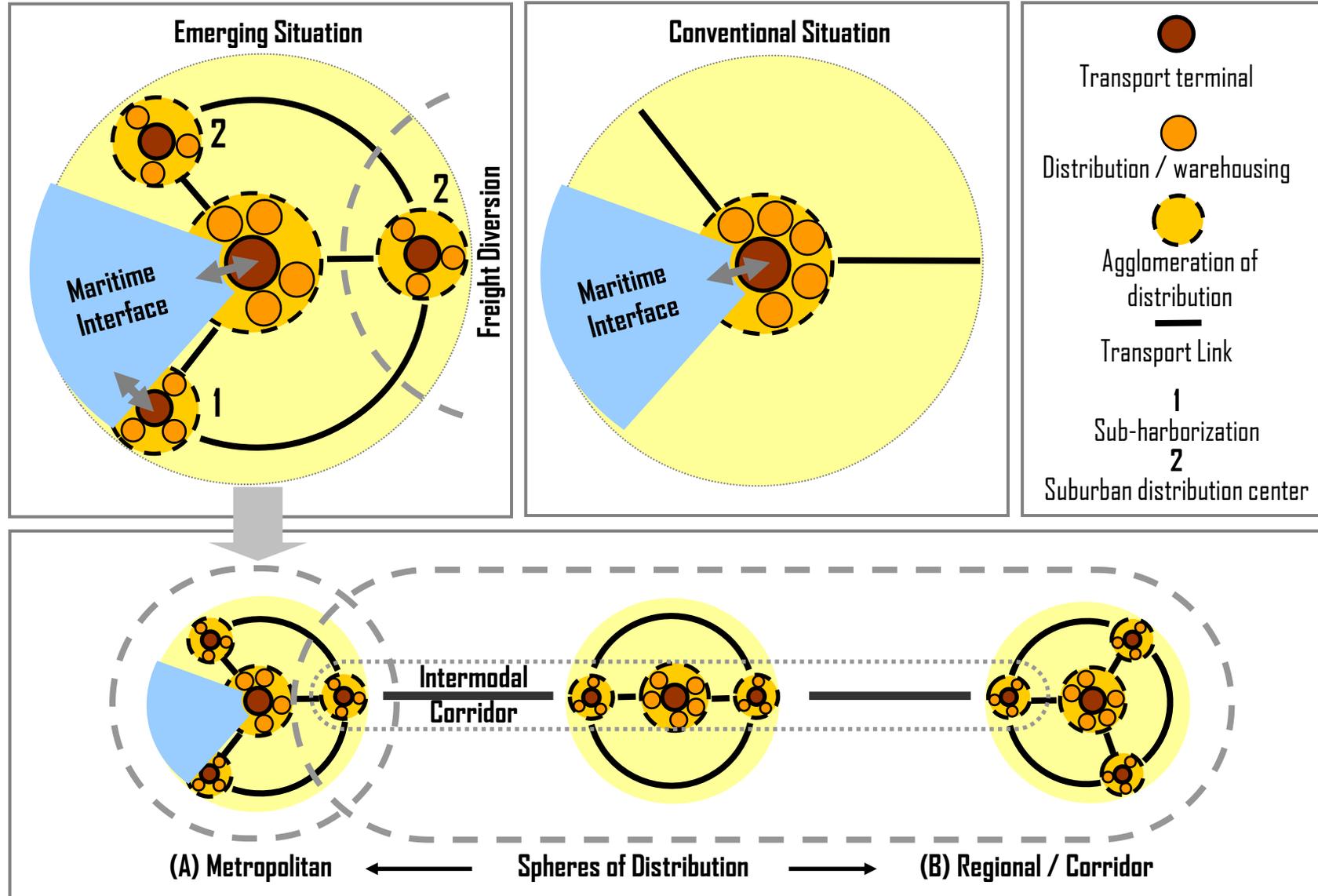


Land Use

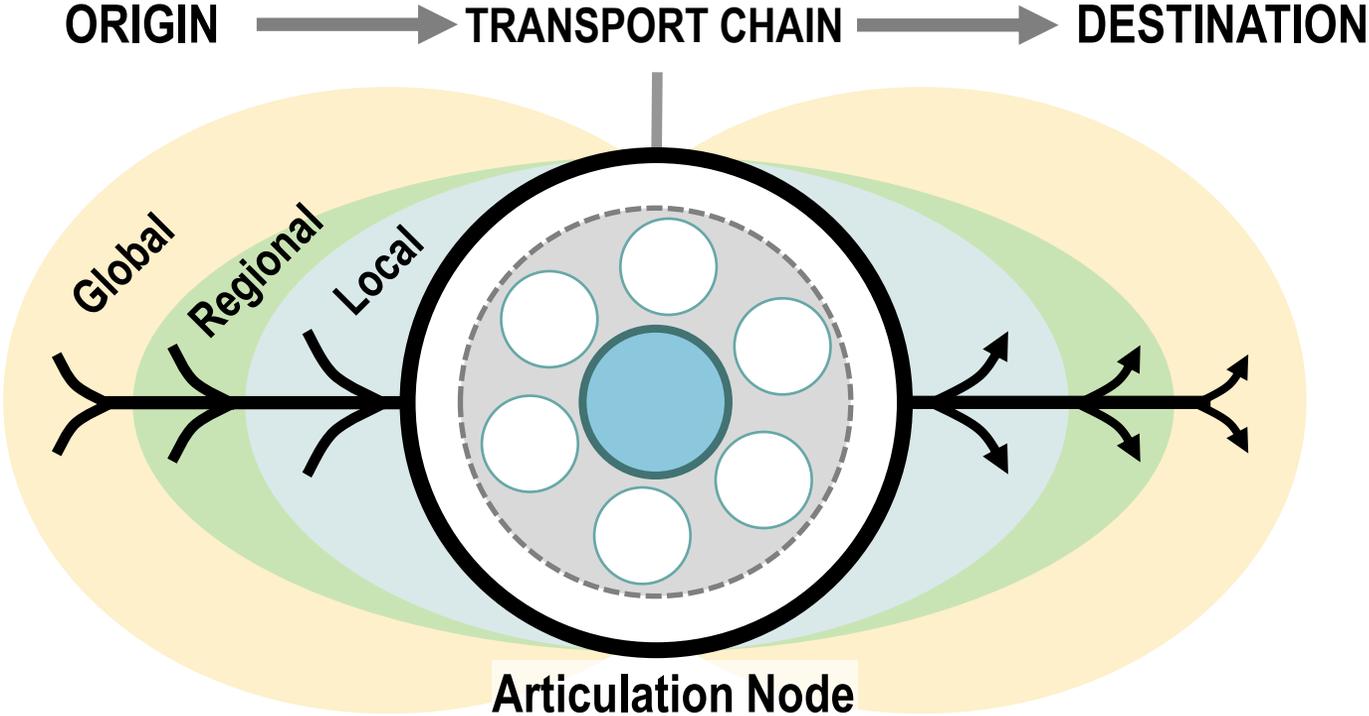
-  "Center of power"
-  Commercial / Institutional
-  Compact Transit-oriented
-  Labor intensive industrial
-  High density agricultural
-  Compact motorized
-  Administrative / commercial
-  New industrial activities Development zones
-  Terminals / logistical

-  Main arterial
-  Rail
-  Freeway
-  Mass transit

Freight Distribution Centers along a Corridor

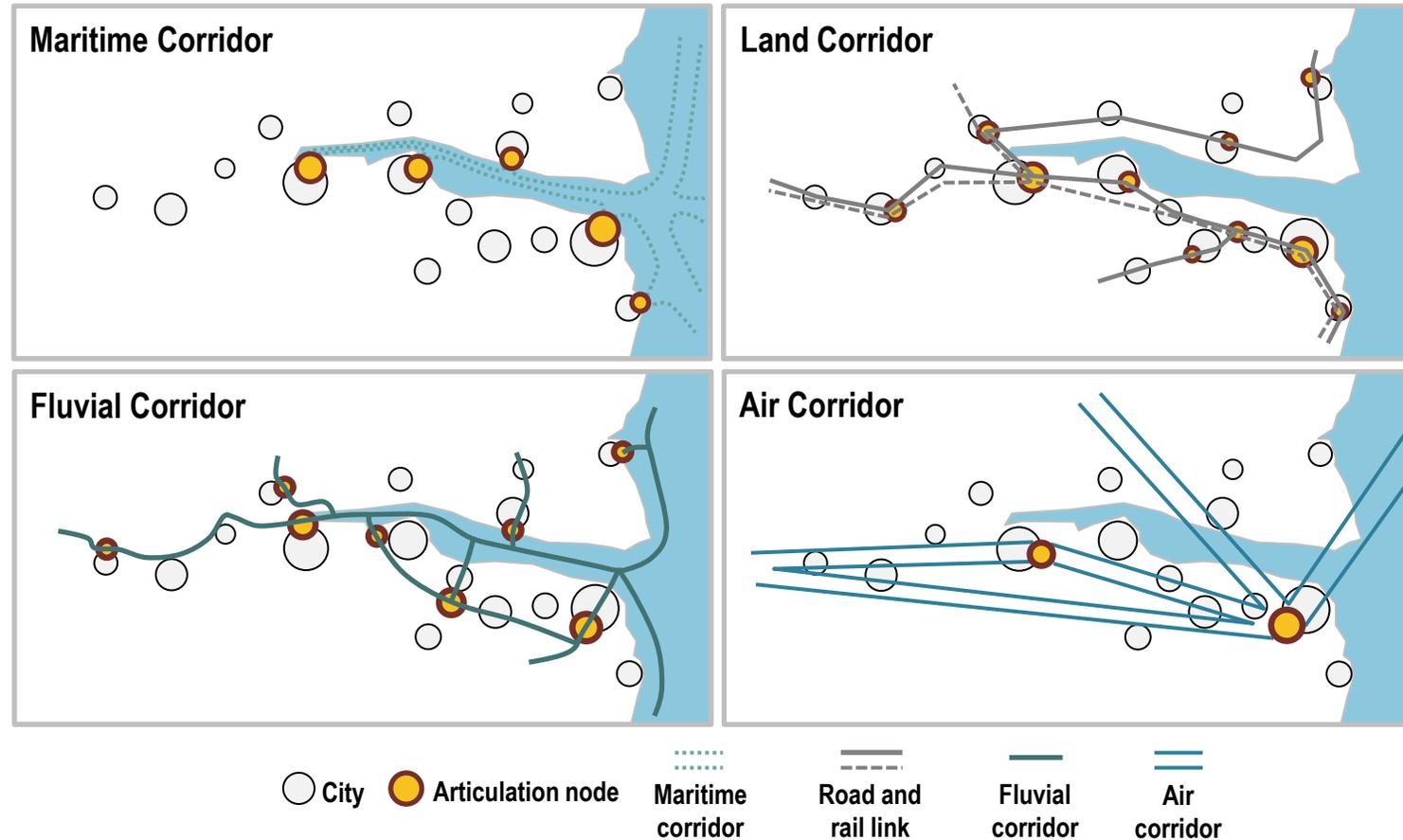


Articulation Node and Transport Chains

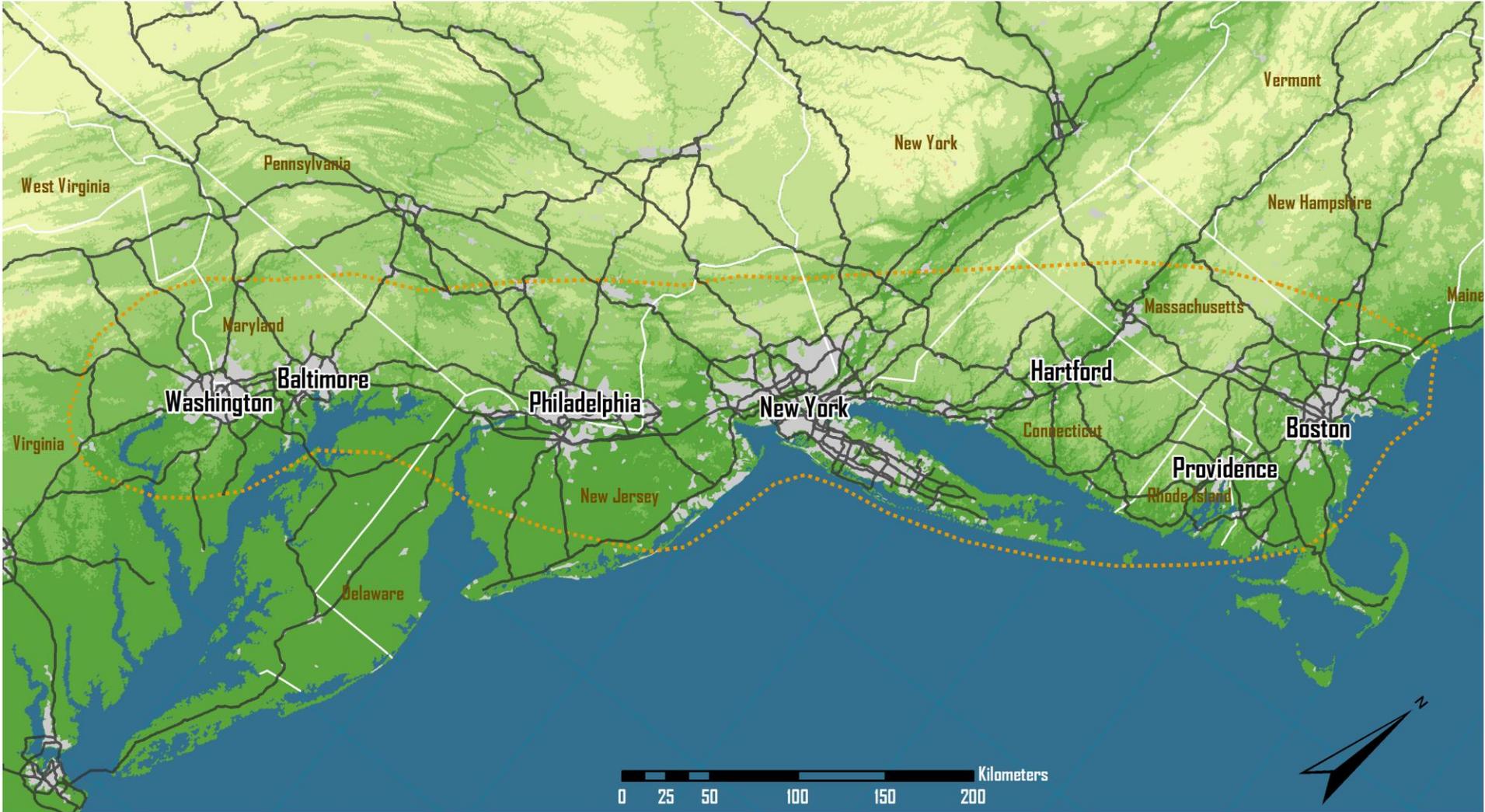


● Transport terminal ○ Added value to mobility ○ Cluster

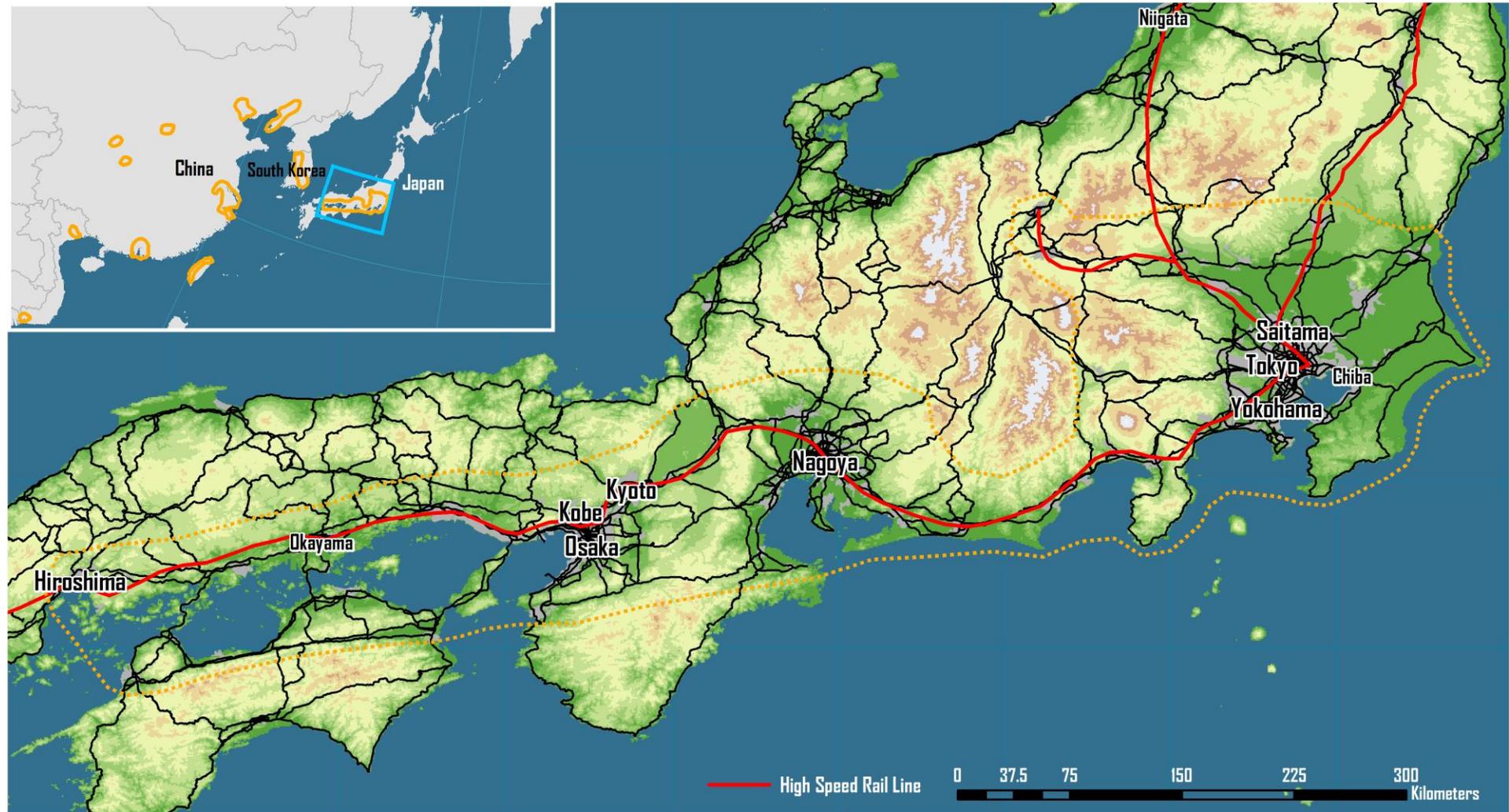
Modal Corridors in an Urban Region

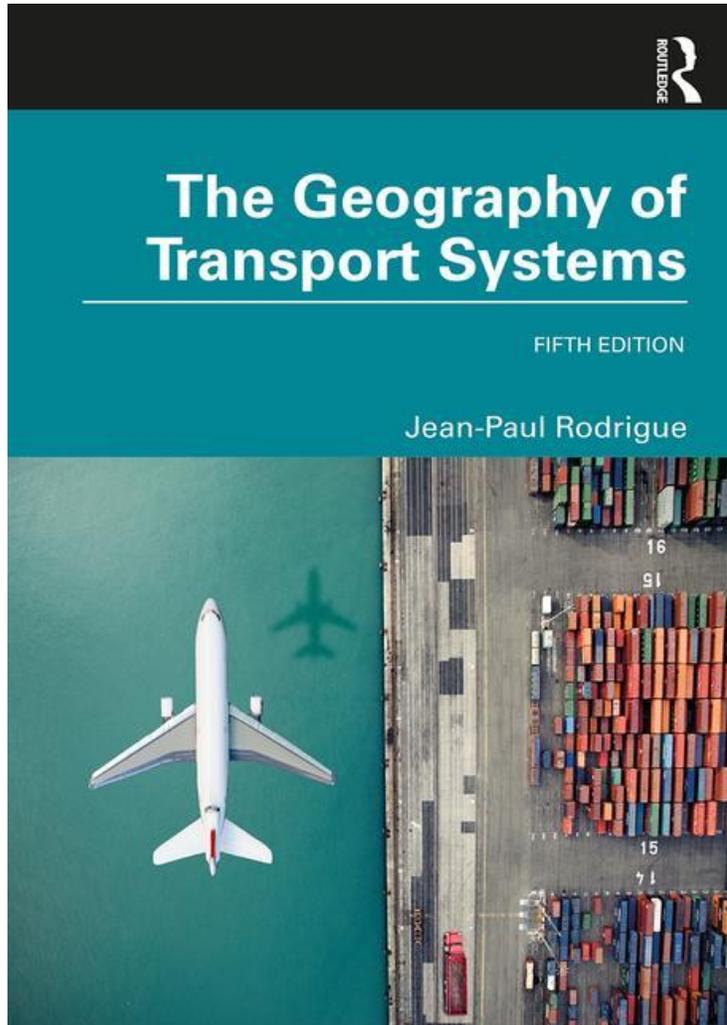


The BostWash Mega Urban Region



Tokaido Megalopolis





Transcontinental Bridges

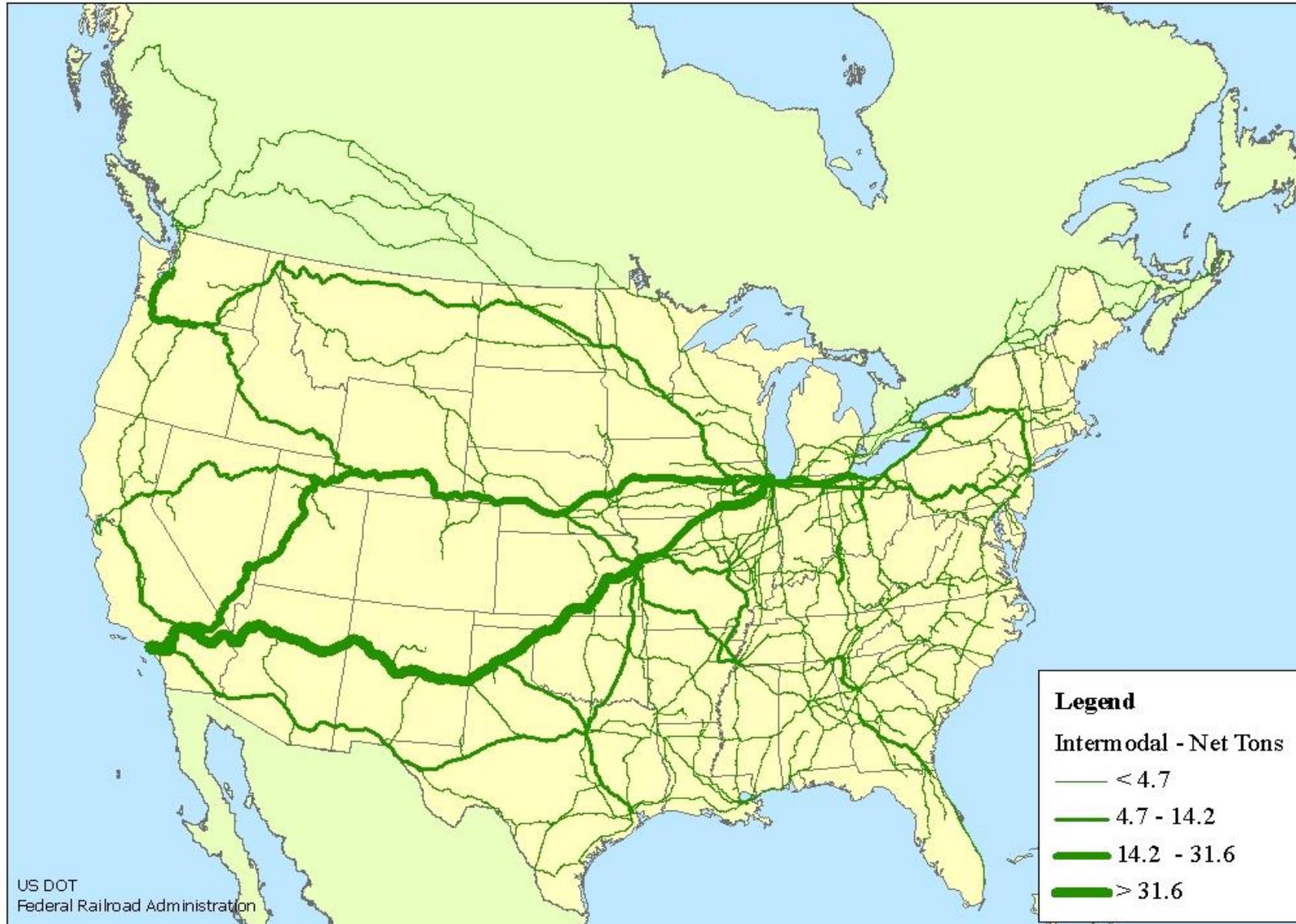
Types of Landbridges



The North American Landbridge



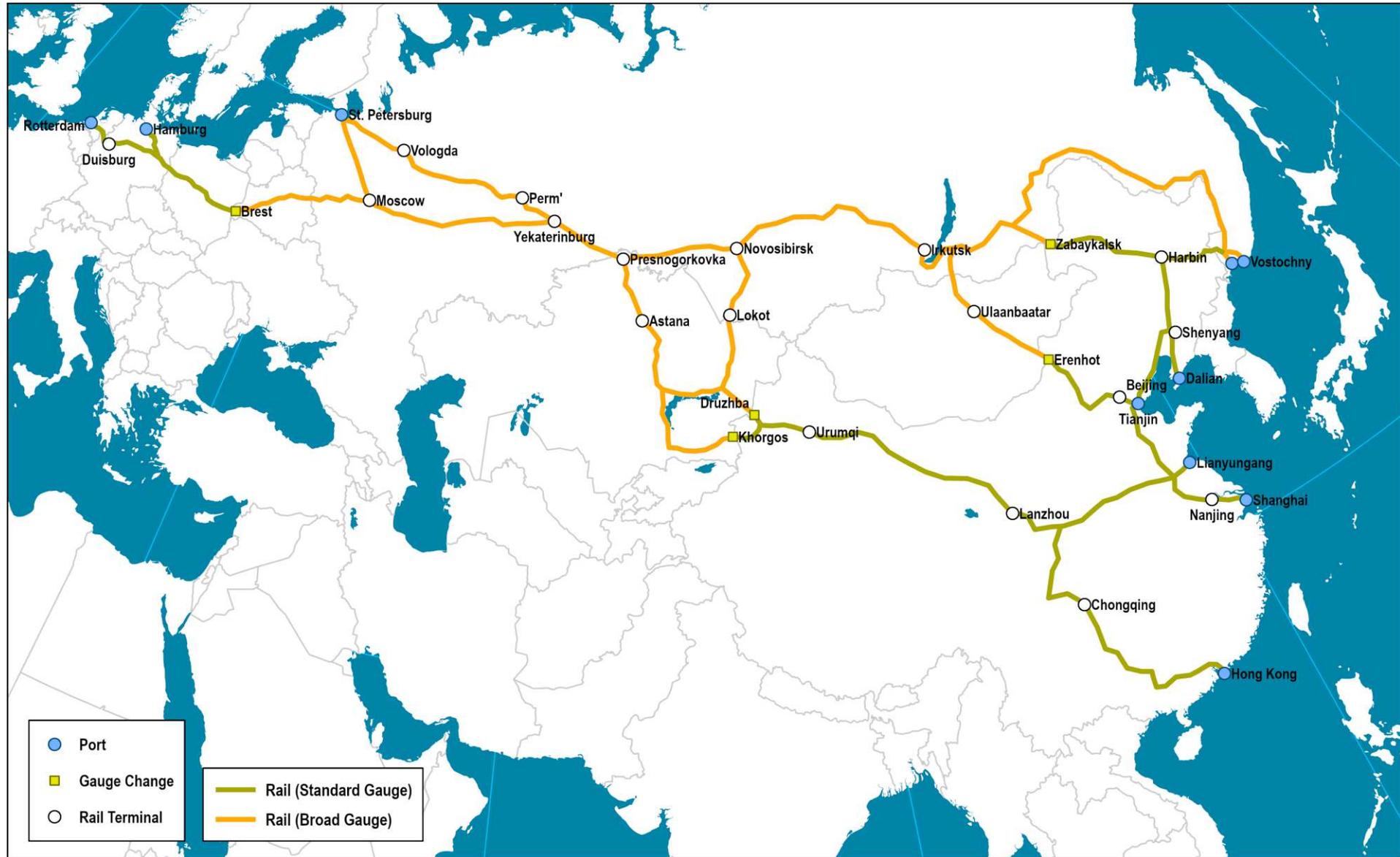
Intermodal Rail Flows, 2006



Circum-Hemispheric Rings of Circulation



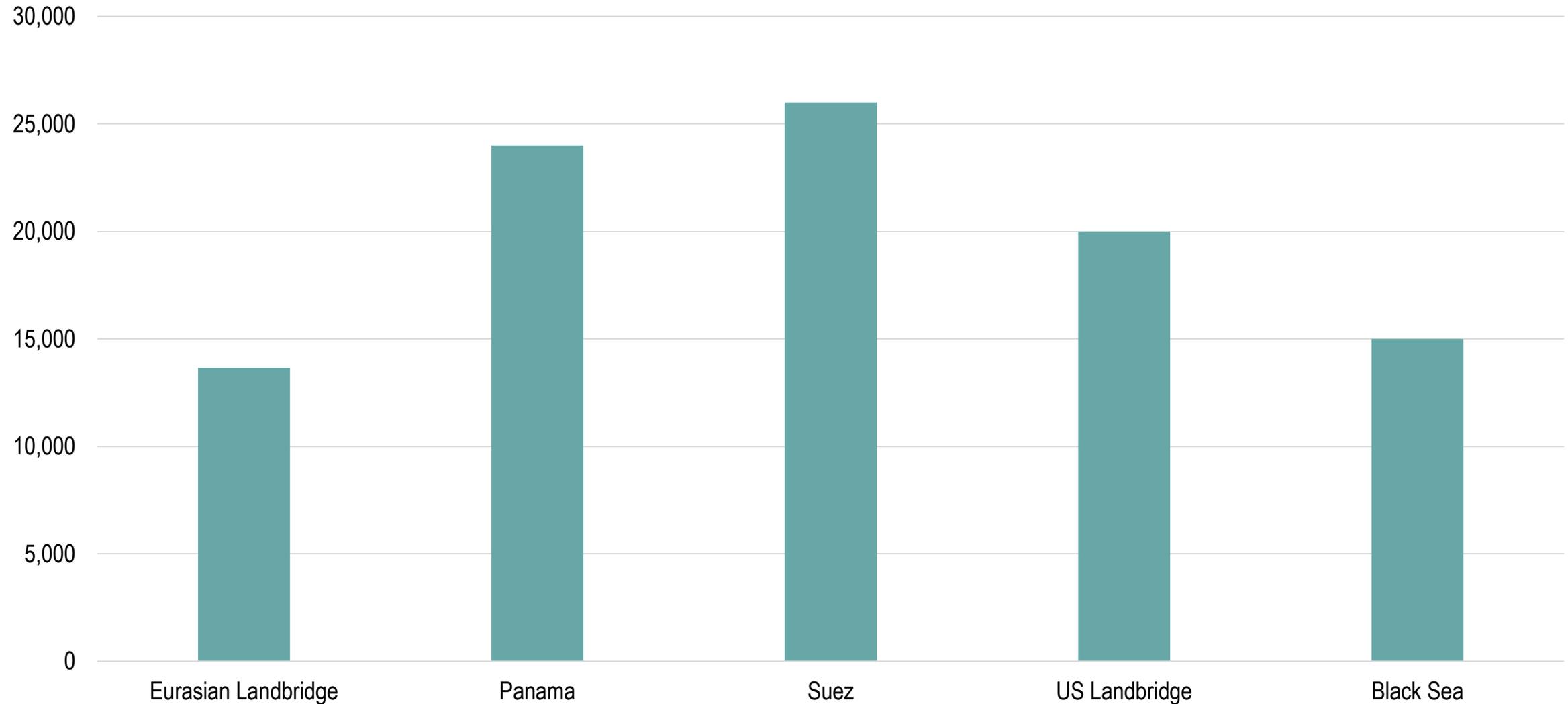
The Eurasian Landbridge

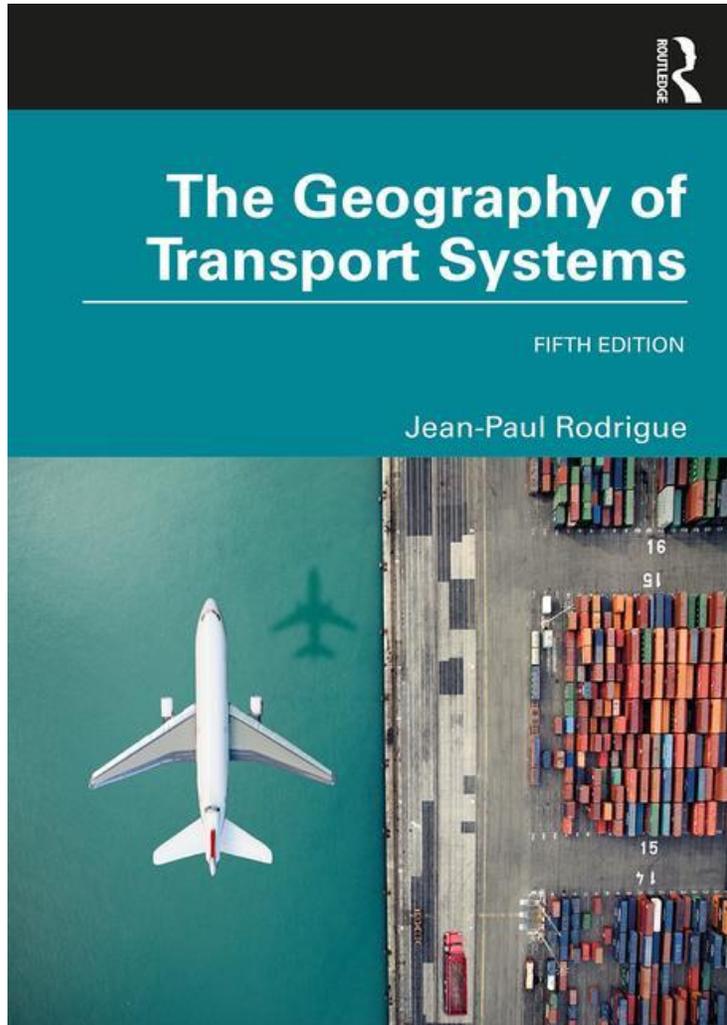


The Northern East-West Freight Corridor



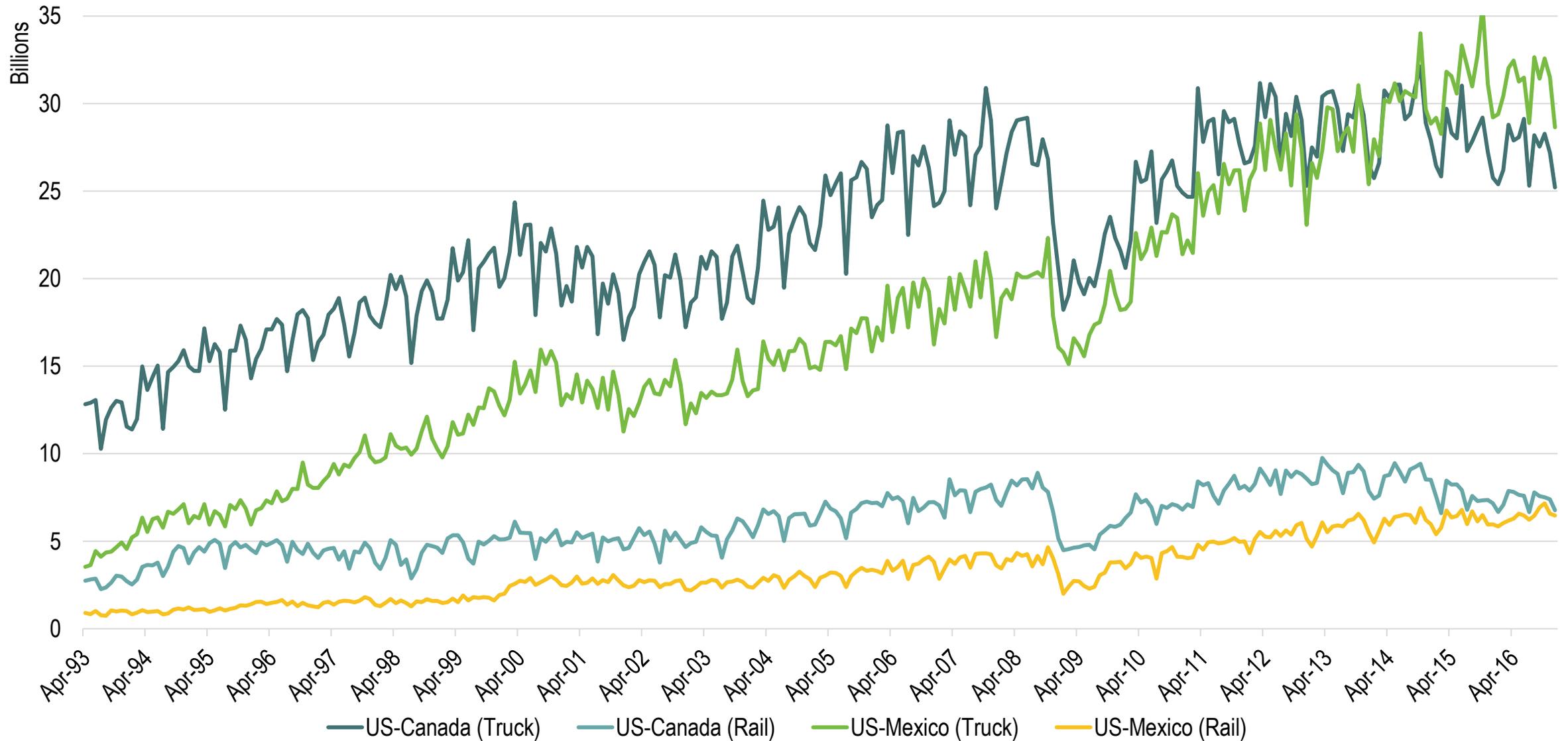
Distance to New York from Eastern China (in km)



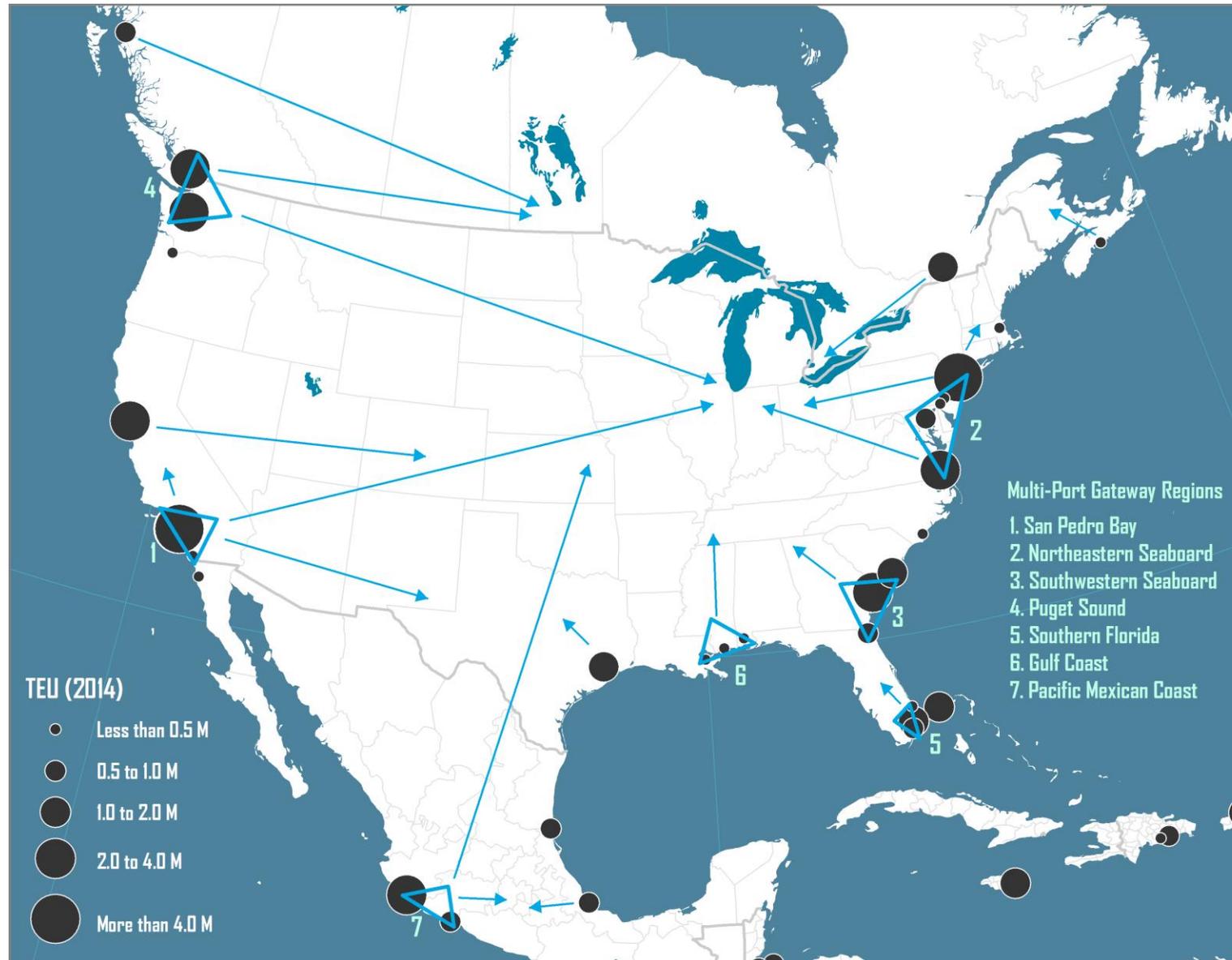


Transport Corridors in North America

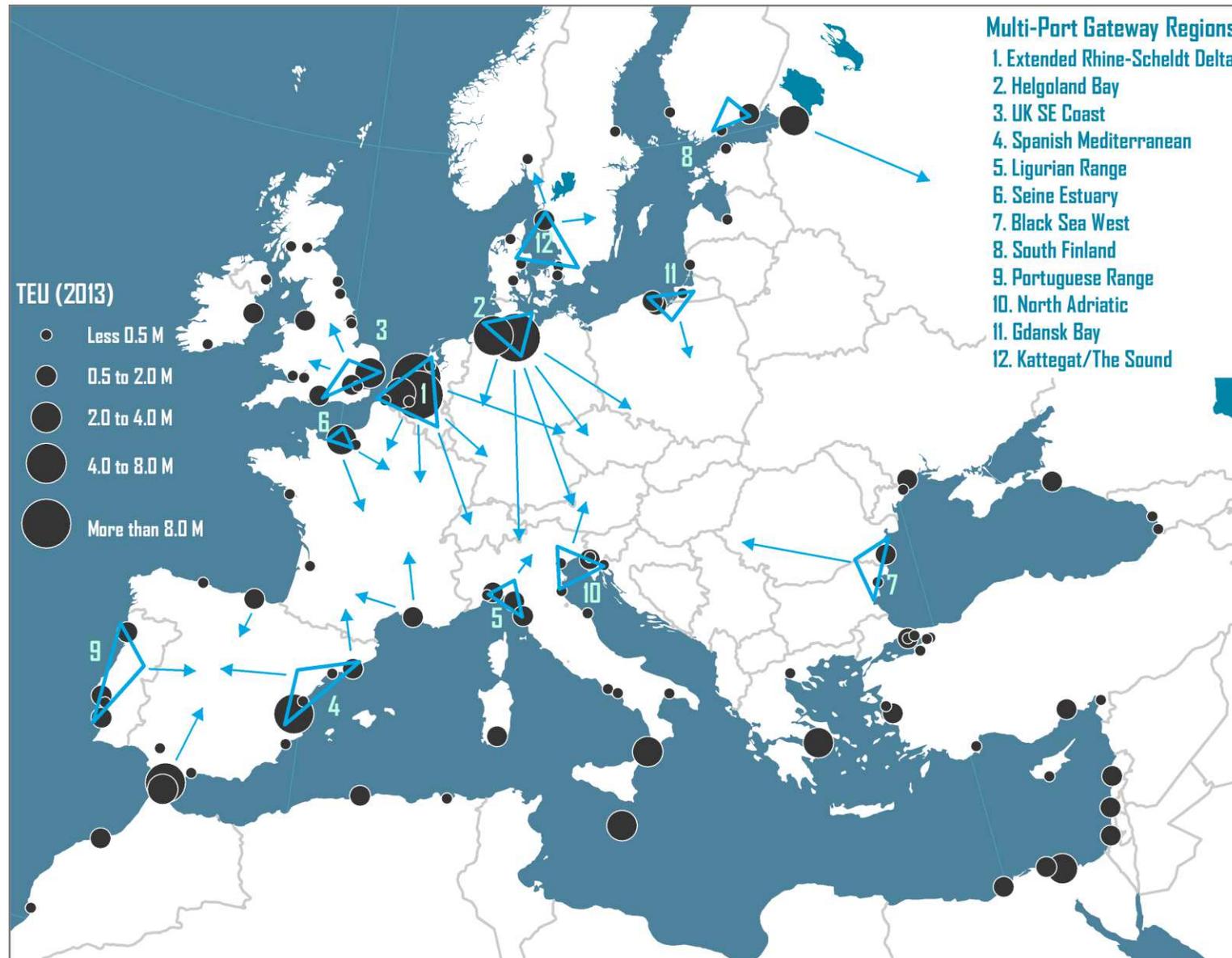
Monthly Value of Surface Trade between the United States, Canada and Mexico, 1993-2016 (USD)



The North-American Container Port System and its Multi-Port Gateway Regions



The European Container Port System and its Multi-port Gateway Regions



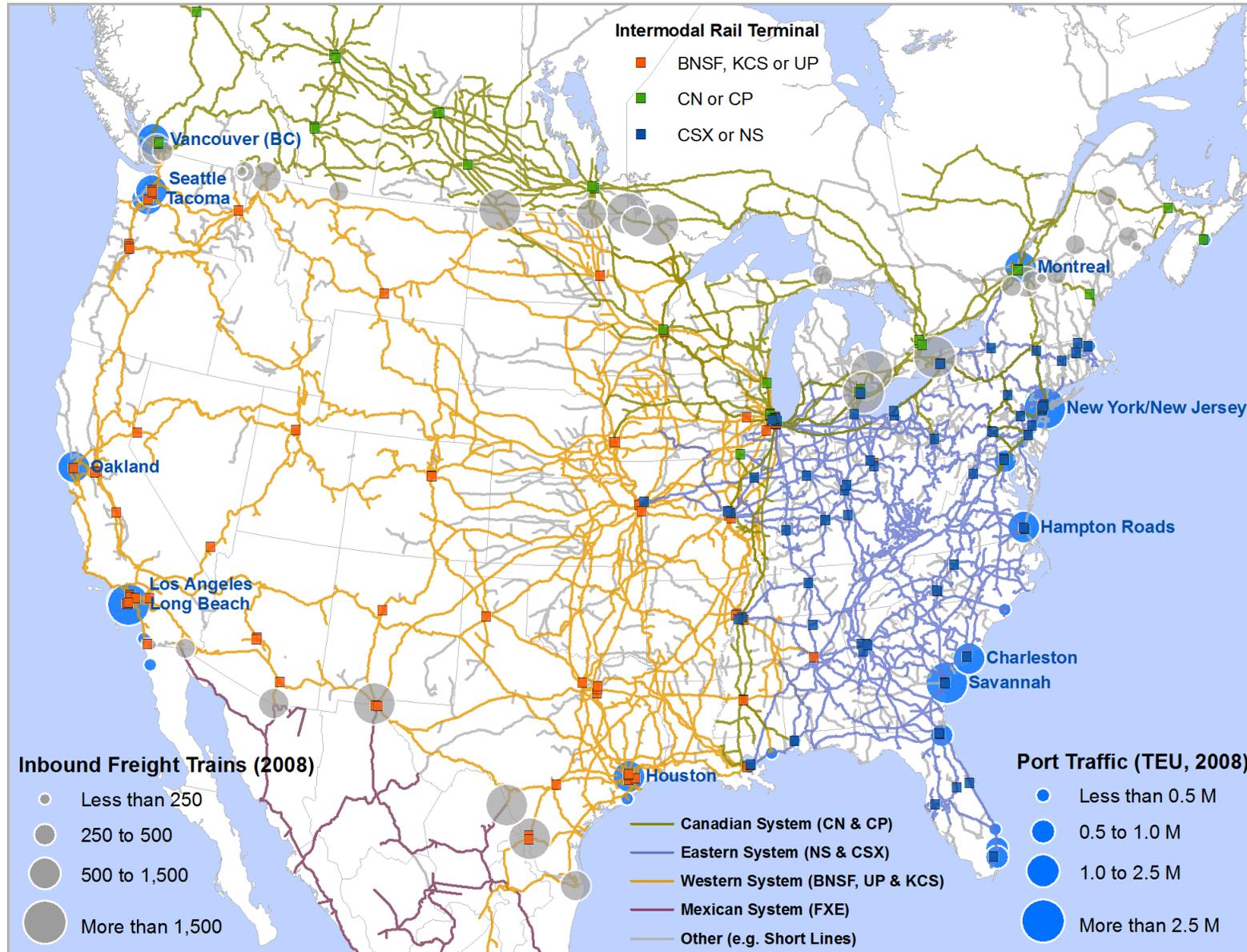
Main Container Ports, Trade Corridors and Distribution Hubs in North America



Some North American Trade Corridor Initiatives



North American Rail Freight Transport System

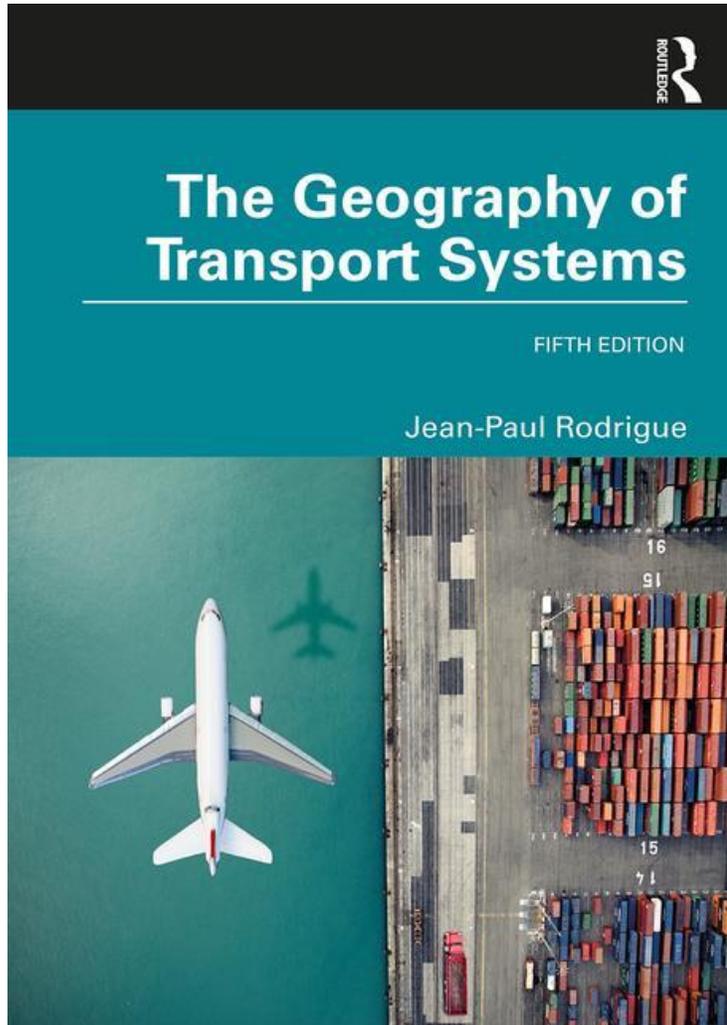


Transit Times from Shanghai and North American Routing Options (in Days)



Factors Impacting North American Freight Distribution in View of the Panama Canal Expansion

Factor	Impacts
<i>Macroeconomic factors</i>	
Aggregate demand changes	Level and composition of cargo.
Structure of production changes	Regionalization of production (NAFTA). Production shifts within Asia (e.g. Vietnam and Indonesia).
<i>Operational factors</i>	
Economies of scale in shipping	Changes in the frequency of services, port calls and network configuration.
Shipping costs structure (e.g. tolls and fuel)	Comparative advantages of respective routing options (landbridge, Suez, all-water).
<i>Competitive factors</i>	
Response from East and West coast ports	Comparative advantages of port selection. New transshipment hubs.
Response from railways	Comparative advantages of inland routes.
Response from Suez Canal and transshipment hubs	Comparative advantages of routing options.
New gateways	Additional inland routing options (e.g. Prince Rupert and Lazaro Cardenas).

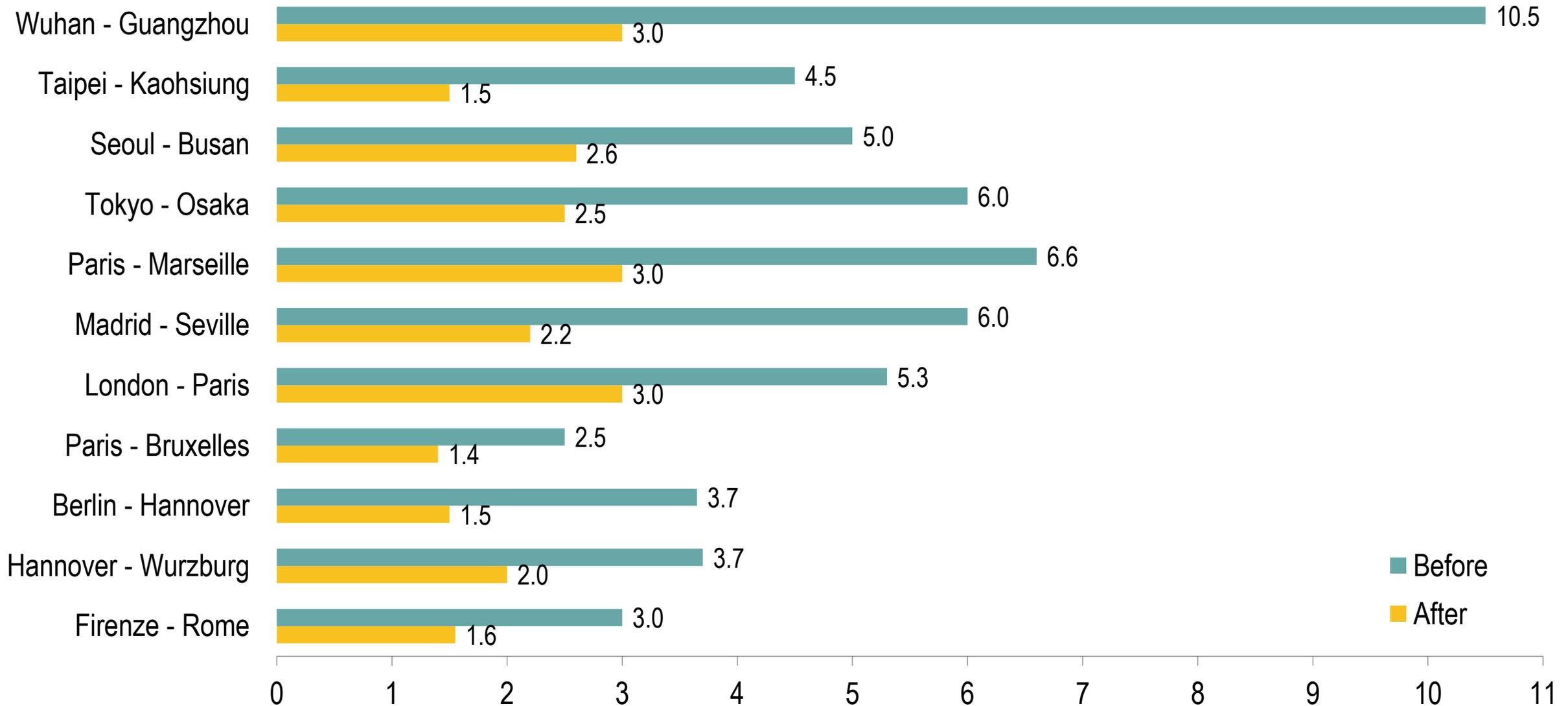


High Speed Trains

The Shinkansen High Speed Rail Network



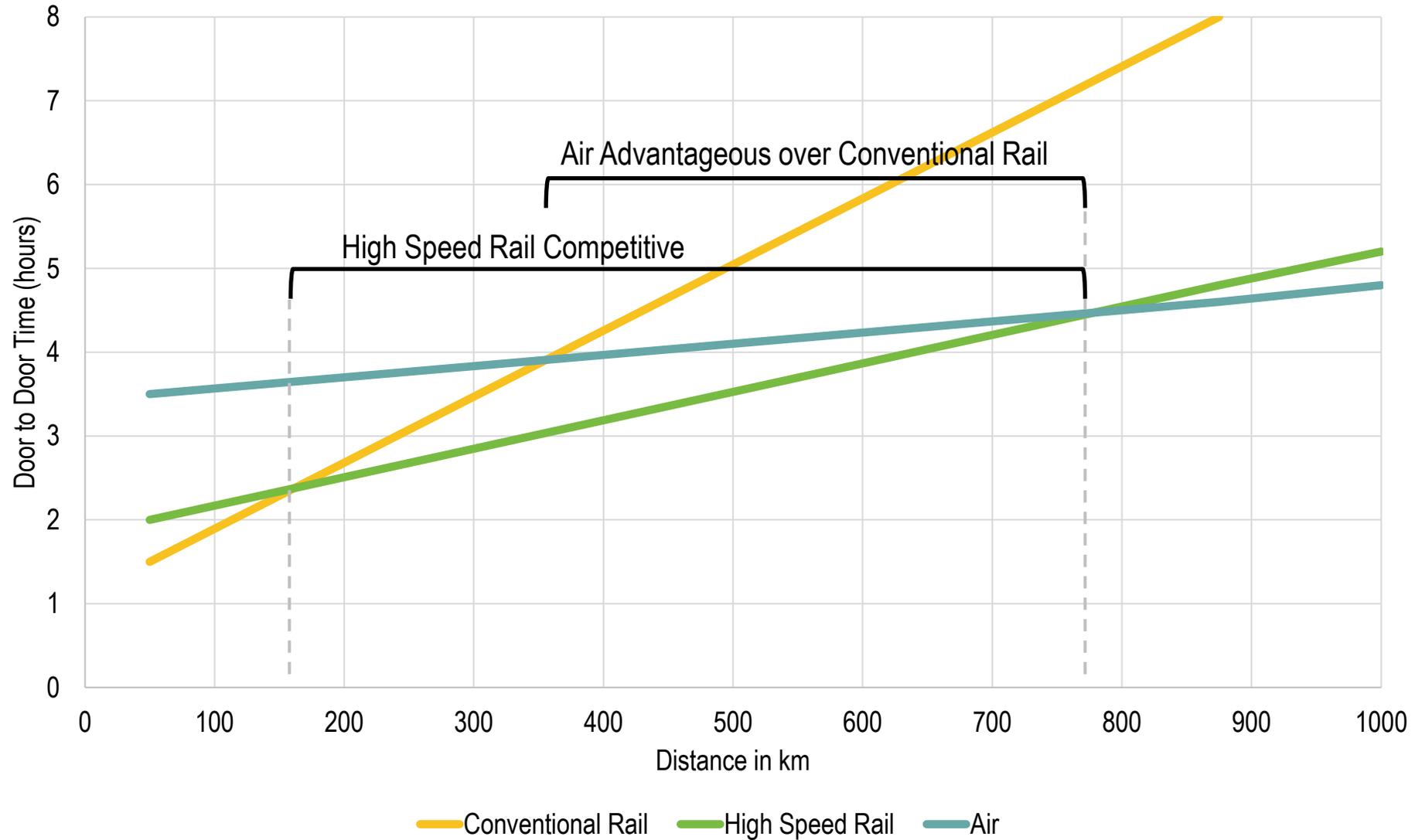
Travel Times before and after the Introduction of a High-Speed Rail Service (hours)



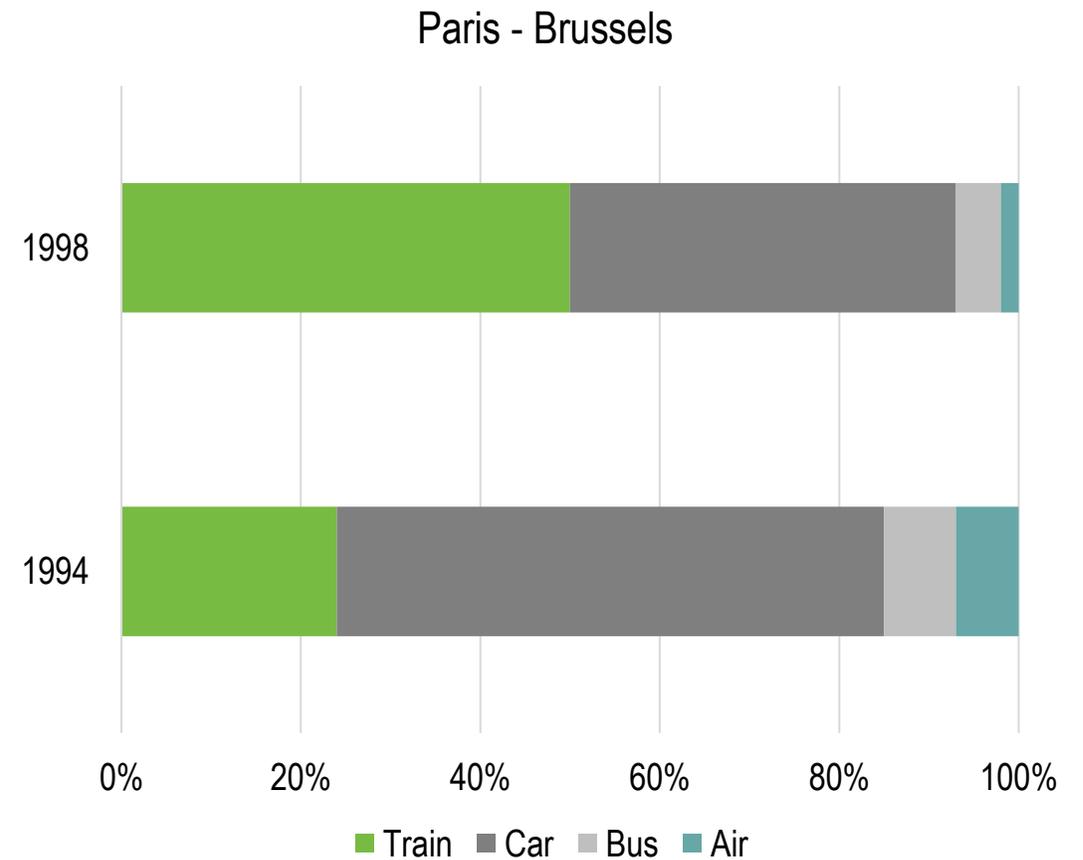
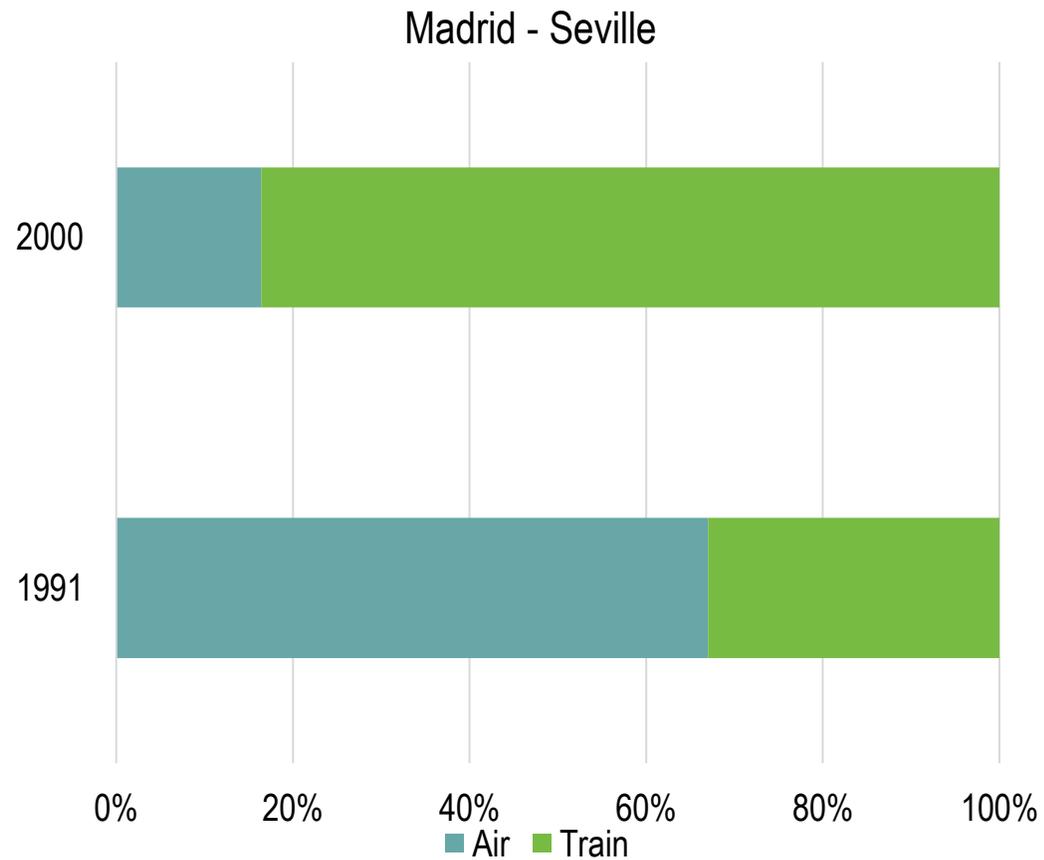
Evolution of the French TGV, 1981-2005

Name	TGV Paris Sud-Est	TGV Atlantique	AVE	TGV Reseau	Eurostar	TGV Duplex	TGV Thalys	TGV NG
Introduction	1981	1989	1991	1993	1994	1996	1996	2005
Operating Speed	168 mph (270 km/h)	186 mph (300 km/h)	186 mph (300 km/h)	186 mph 300km/h	186 mph (300 km/h)	186 mph (300 km/h)	186 mph (300 km/h)	225 mph (360 km/h)
Design Speed	168 mph (270 km/h)	186 mph (300 km/h)	186 mph (300 km/h)	200 mph (320 km/h)	225 mph (360 km/hr)			
Speed Record	236 mph (380 km/h)	320 mph (515 km/h)	N/A	N/A	N/A	N/A	N/A	N/A
Maximum speed on normal railways	138 mph (220 km/h)	138 mph (220 km/h)	No running	138 mph (220 km/h)	100 mph (160 km/h)	No running	unknown	156 mph (250 km/h)
Comments	Famous Orange TGV	Rail Speed Record	TGV for Spain	Pressure Sealed	Strictly not a TGV	Double decker	International TGV	Next Generation

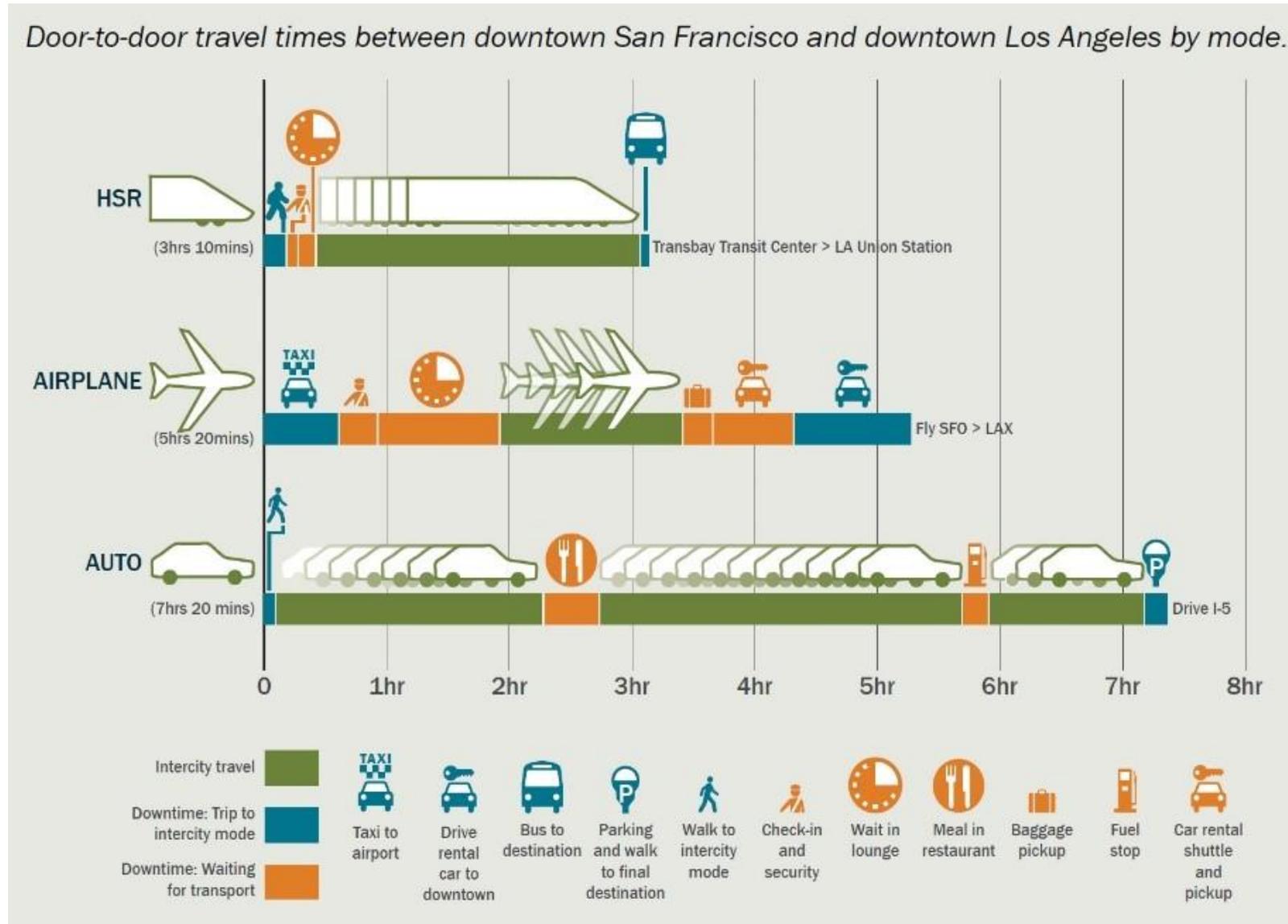
Breakeven Distances between Conventional Rail, High Speed Rail and Air Transportation



Modal Share before and after the Introduction of High-Speed Rail

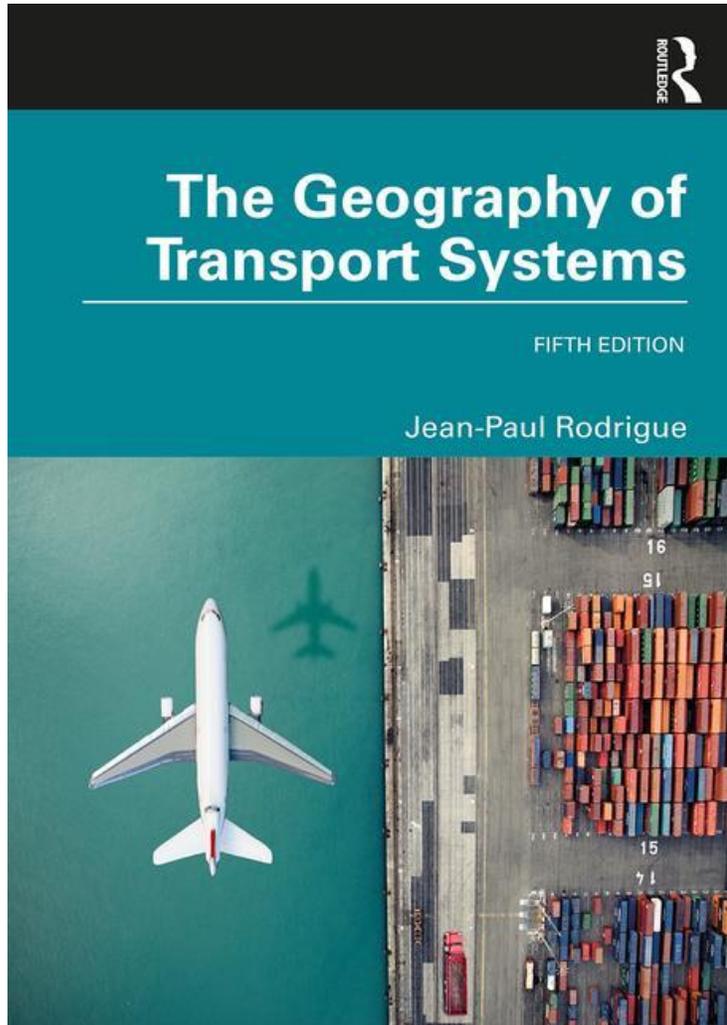


Under construction



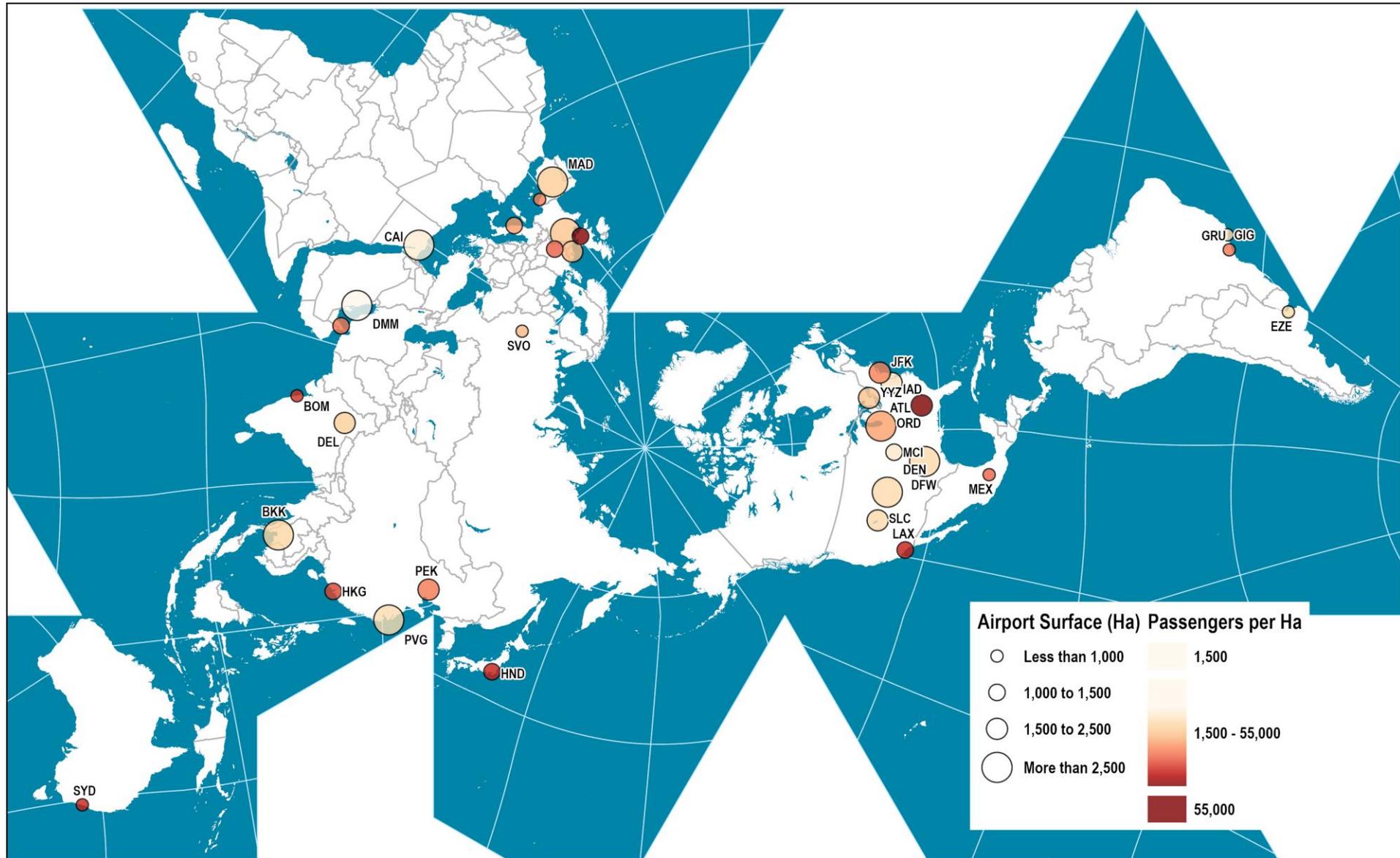
The Socioeconomic Context of High Speed Rail

Criteria	Issues
Goals	Mitigate congestion and demand along high density interurban corridors. Extending services into lower density regions for political purposes (e.g. social equity) lead to economic failure.
Spatial Structure	Limited impacts on the spatial structure. Routes supporting the existing spatial structure are the most effective. Limited number of stations that are well connected to their metropolitan areas most effective. HSR stations should be hubs of regional transport systems.
Investments	Very high construction and operation costs. Land (expropriation costs) are particularly high to secure a corridor. Cost overruns common. Limited or no profitability. Most costs are usually subsidized.
Demand	Significant time savings compared to existing services. Initial increase in the demand, but a stabilization after 2 years. Lower demand than forecasted common. Significant impacts on air services on distances less than 700km. Low cost airlines able to compete.
Economic Impacts	Little or no generation of new economic activities. Service and touristic sectors favored. Tendency to consolidate activities in the most connected locations (large cities). Medium-sized cities usually negatively impacted.
Environmental Impacts	Comparatively better than air transportation. Long term mitigation of environmental impacts during construction.

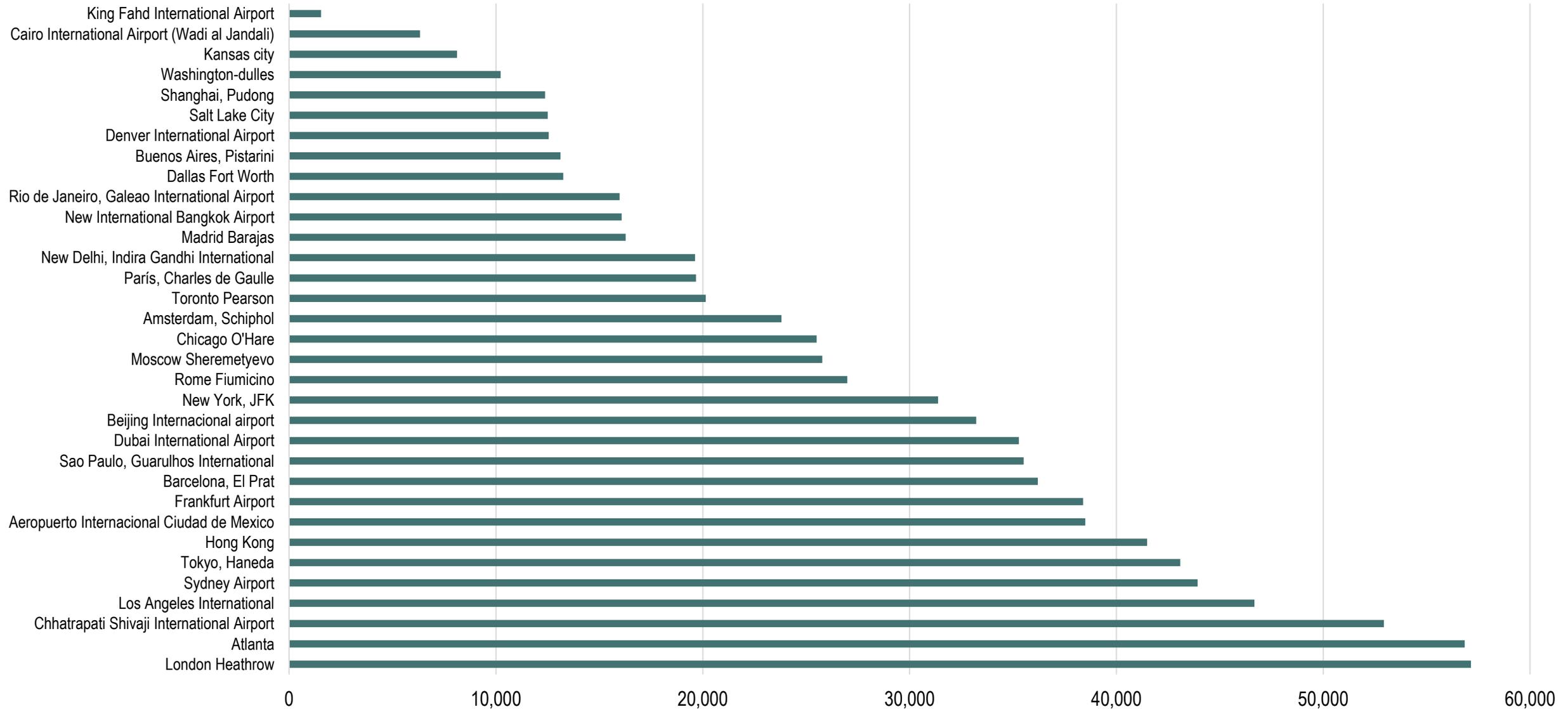


Mega Airport Projects

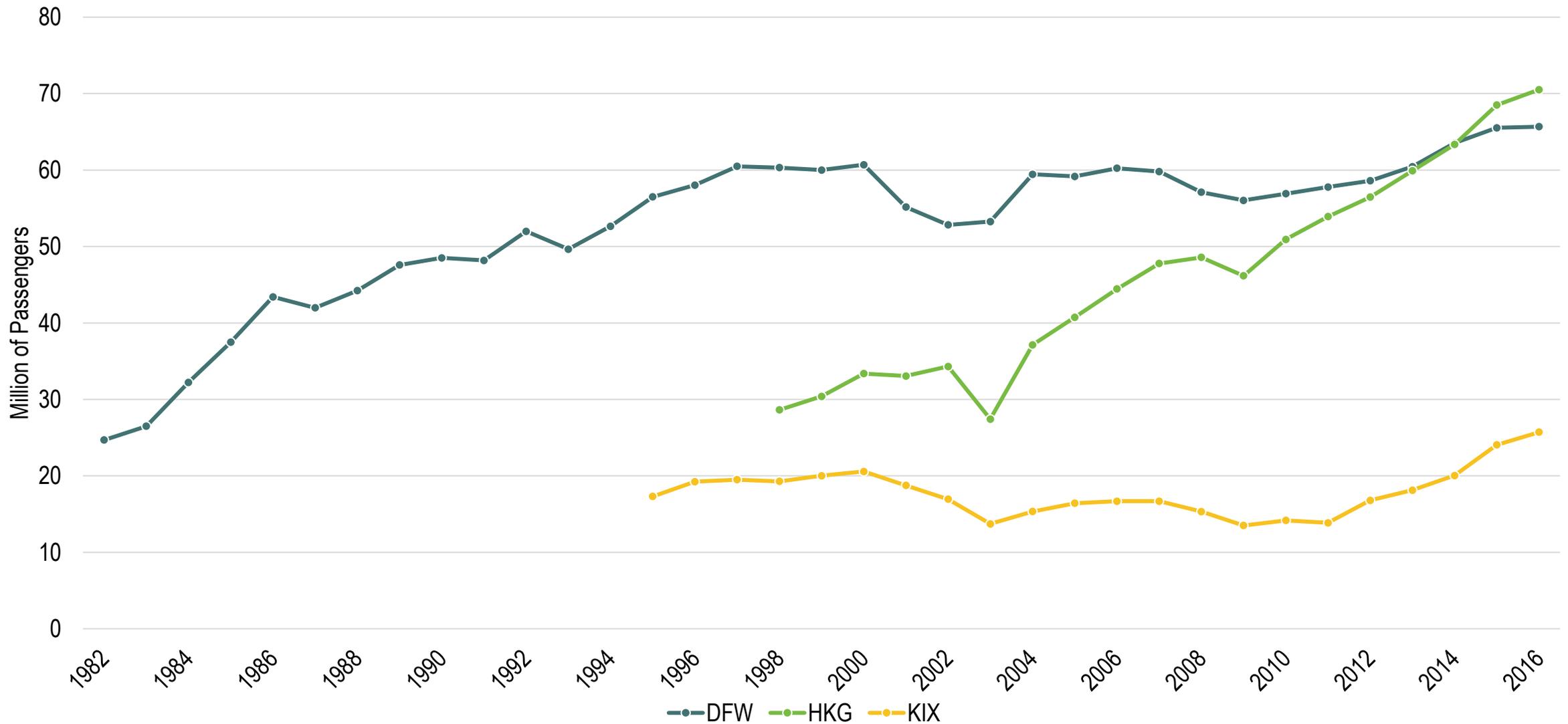
Surface of the World's Largest Airport Terminals



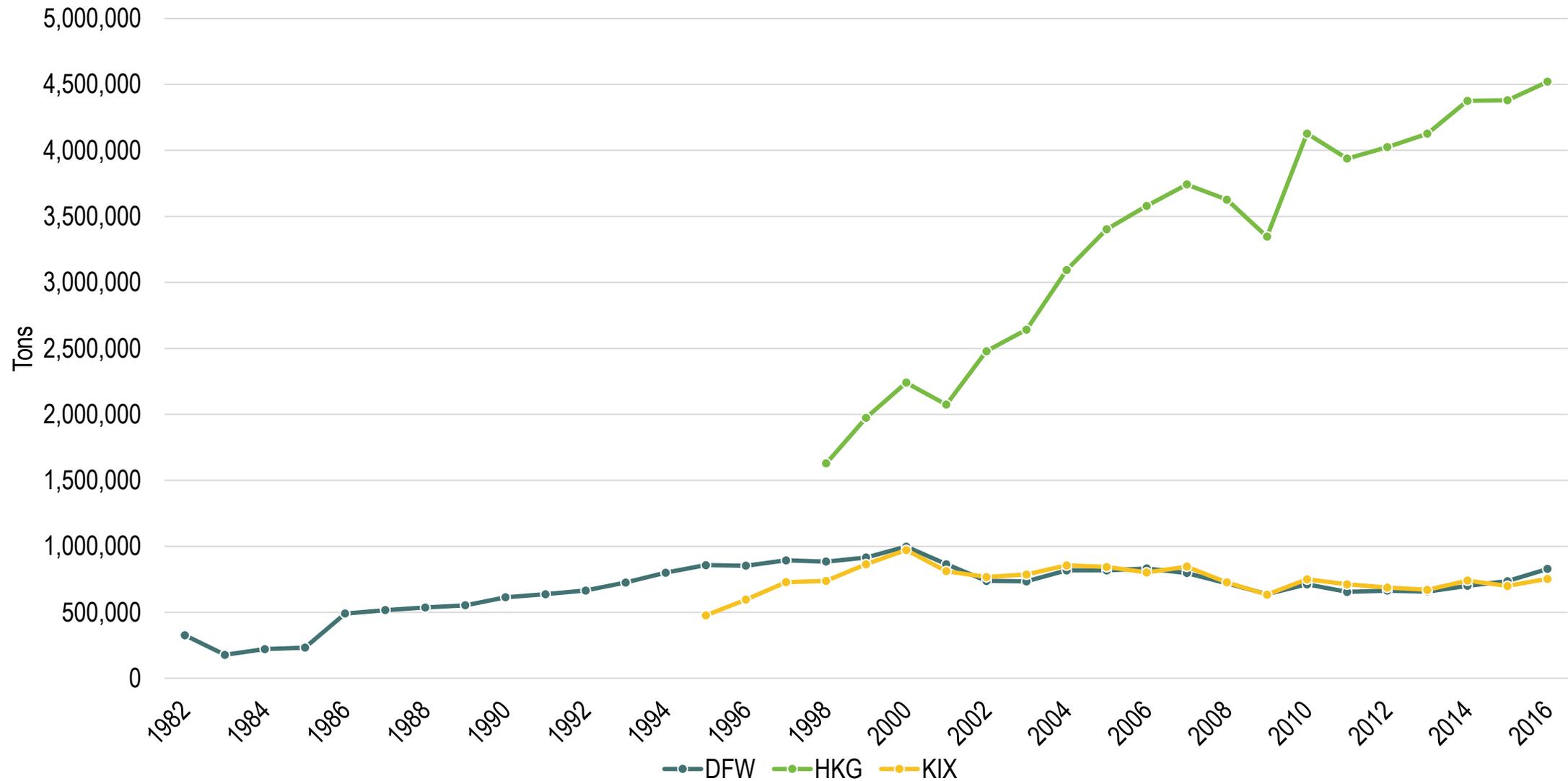
Passenger Density of the World's Largest Airports (In Passengers per Hectare)



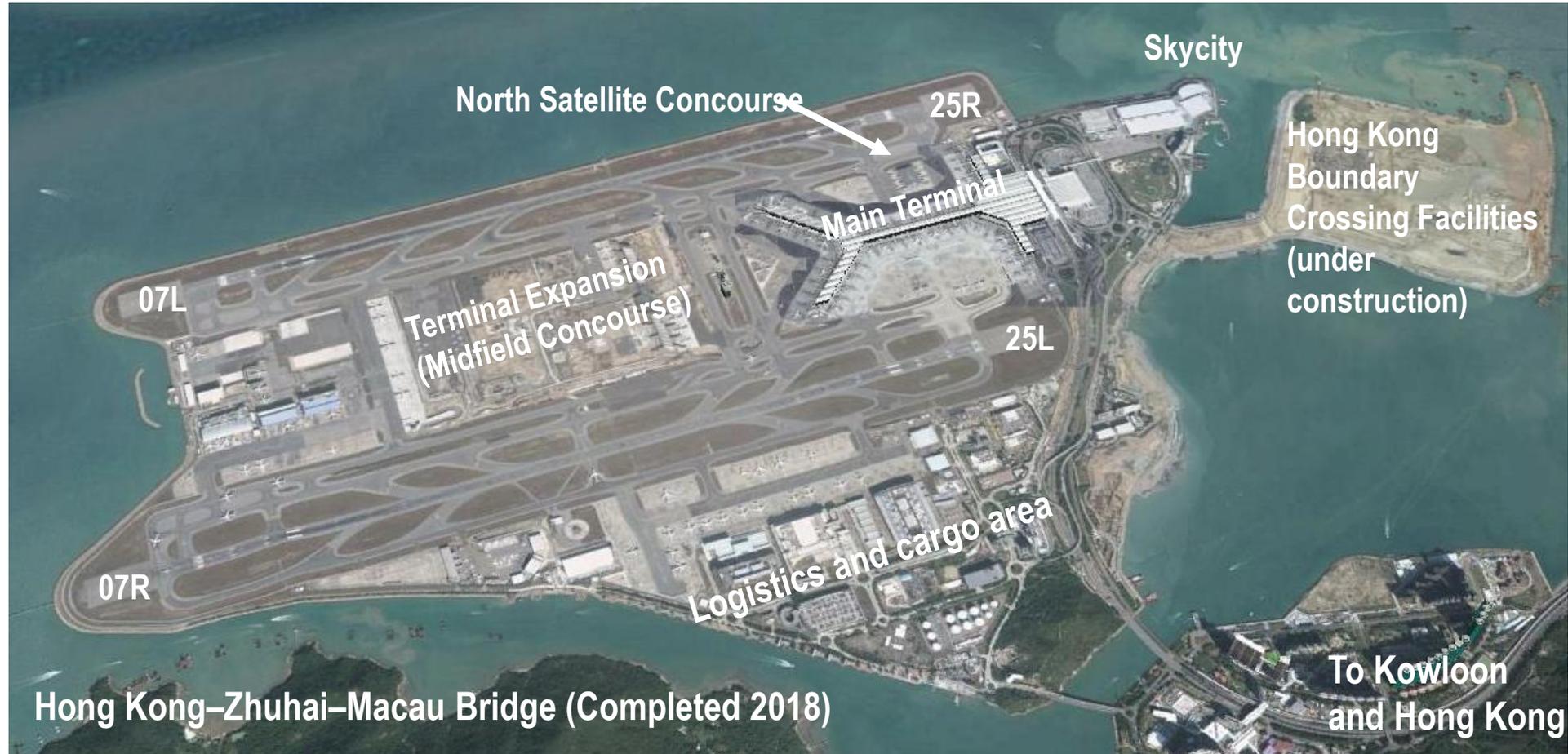
Passengers Traffic, DFW, HKG and KIX, 1982-2016



Freight Traffic, DFW, HKG and KIX, 1982-2016



Hong Kong Chek Lap Kok Terminal

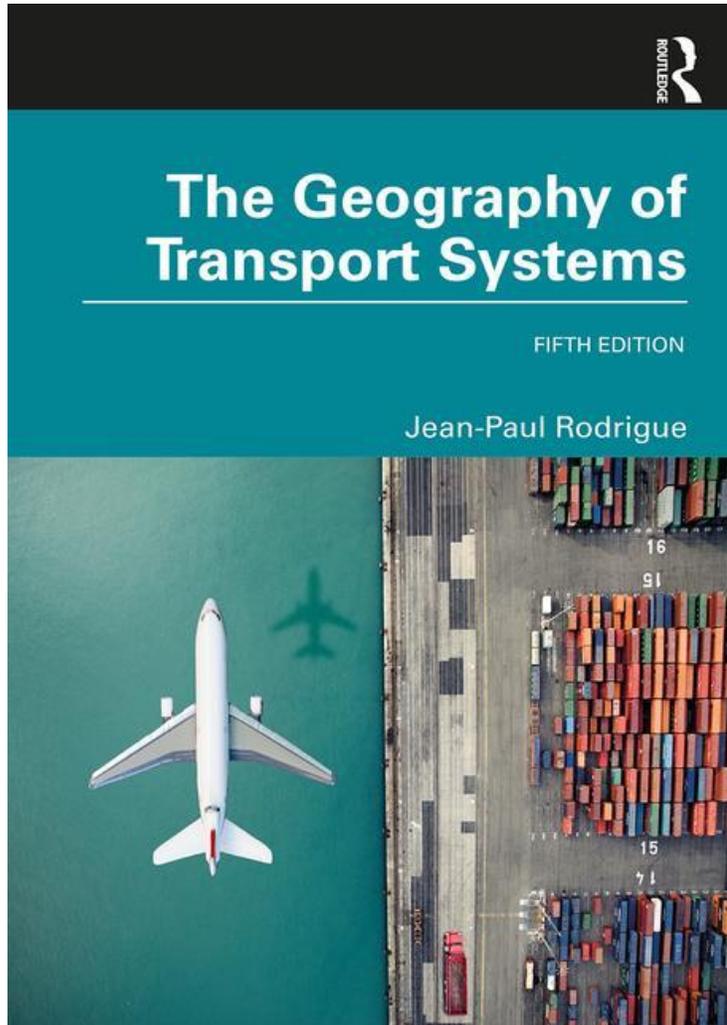


Dallas/Fort Worth International Airport



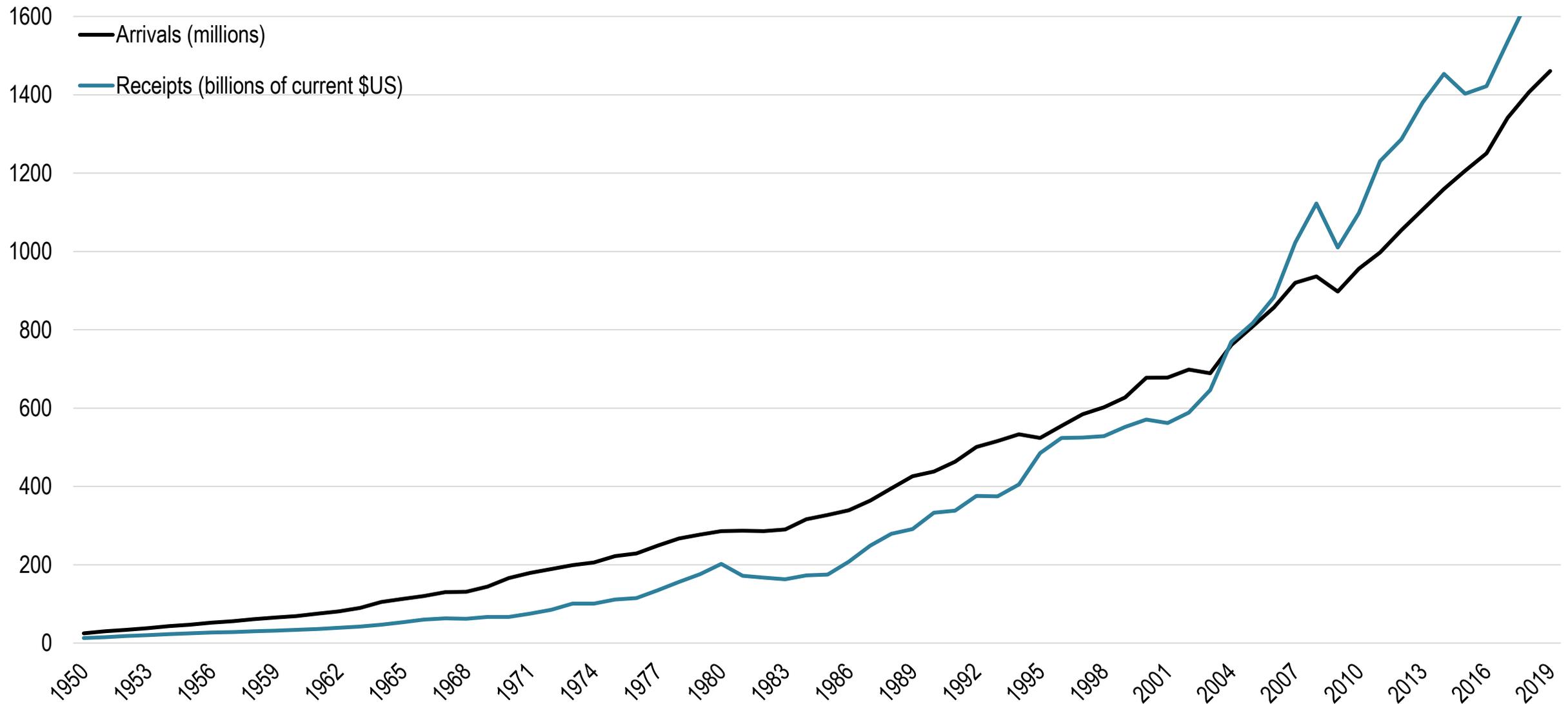
Kansai International Airport



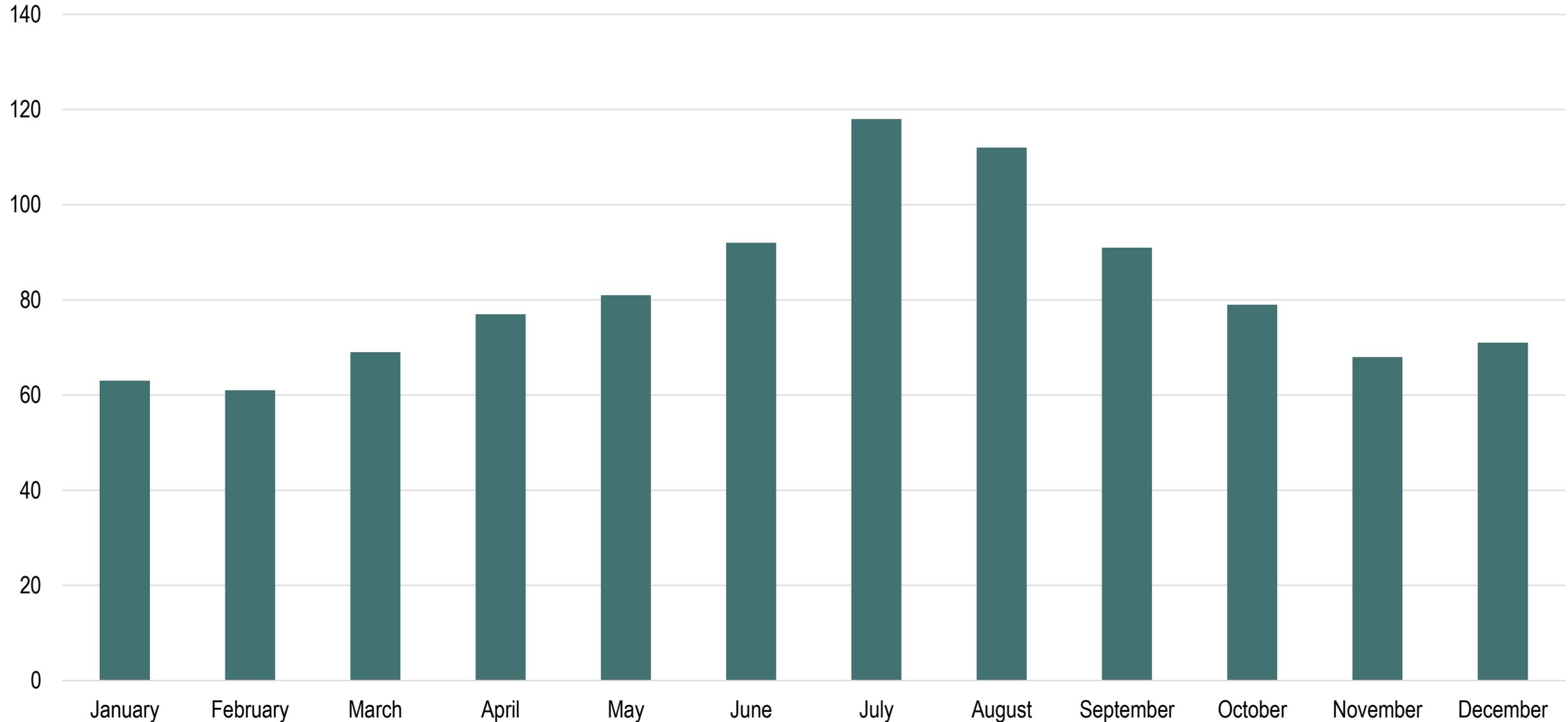


International Tourism and Transport

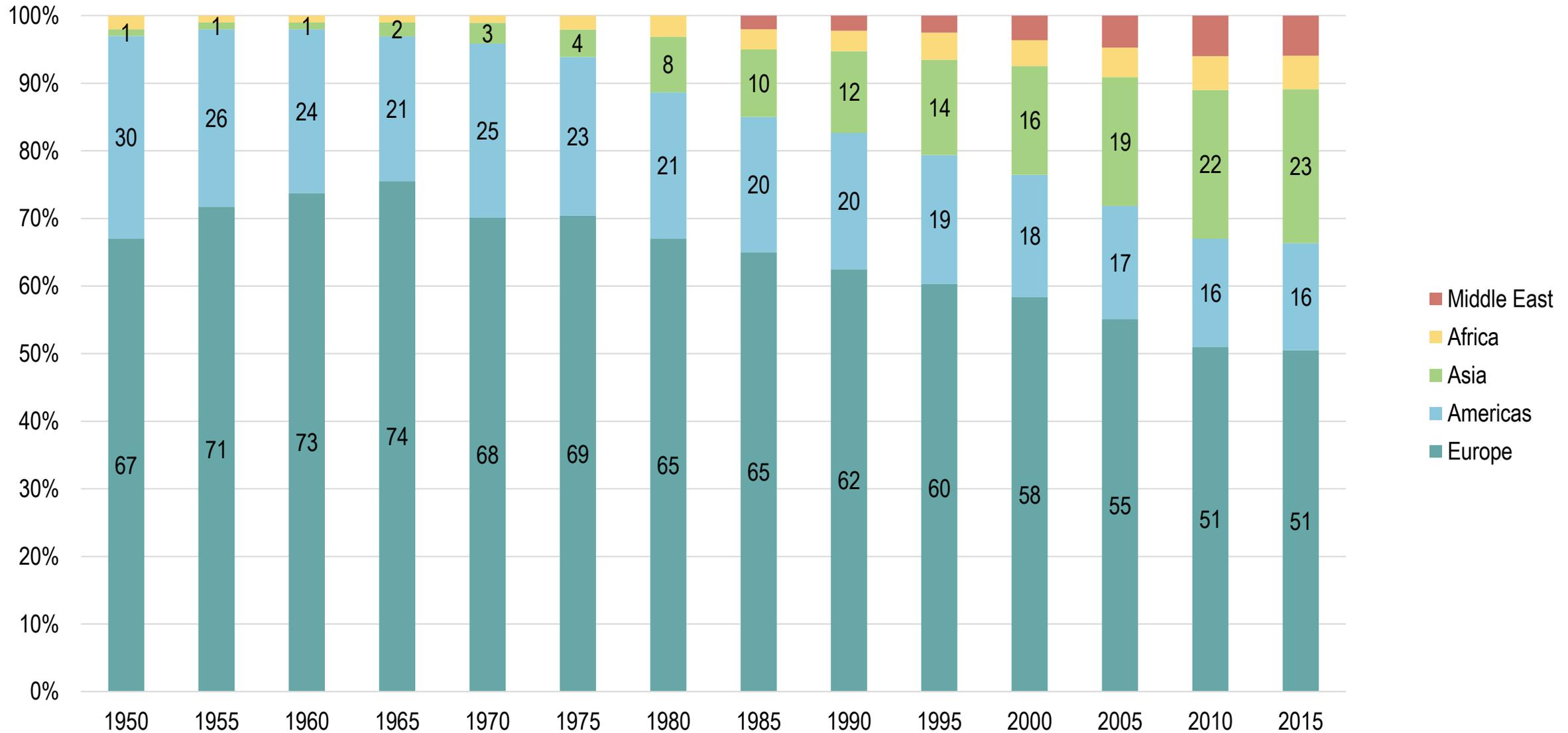
International Tourists Arrivals and Receipts, 1950-2019



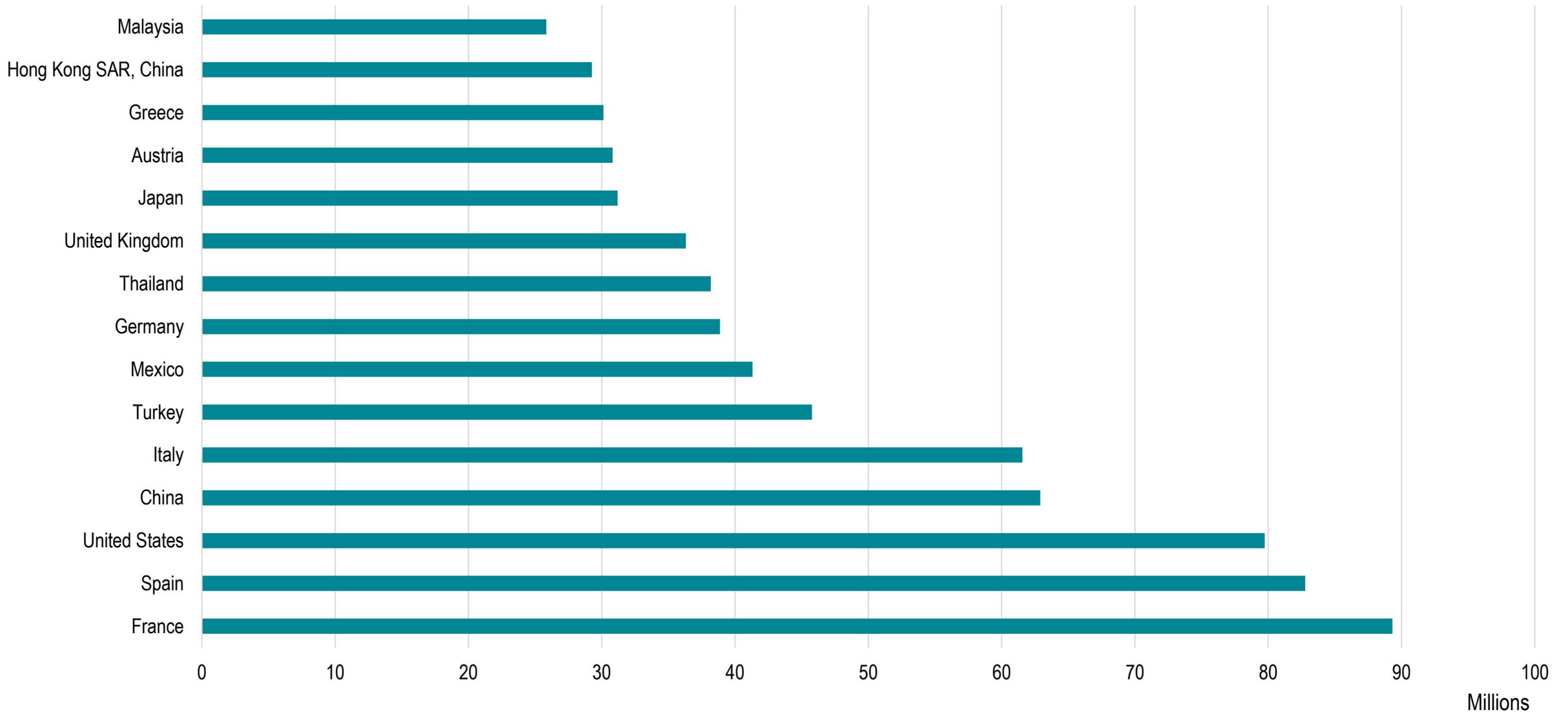
Monthly International Tourist Arrivals, 2011



Share of International Tourist Arrivals by Region, 1950-2015

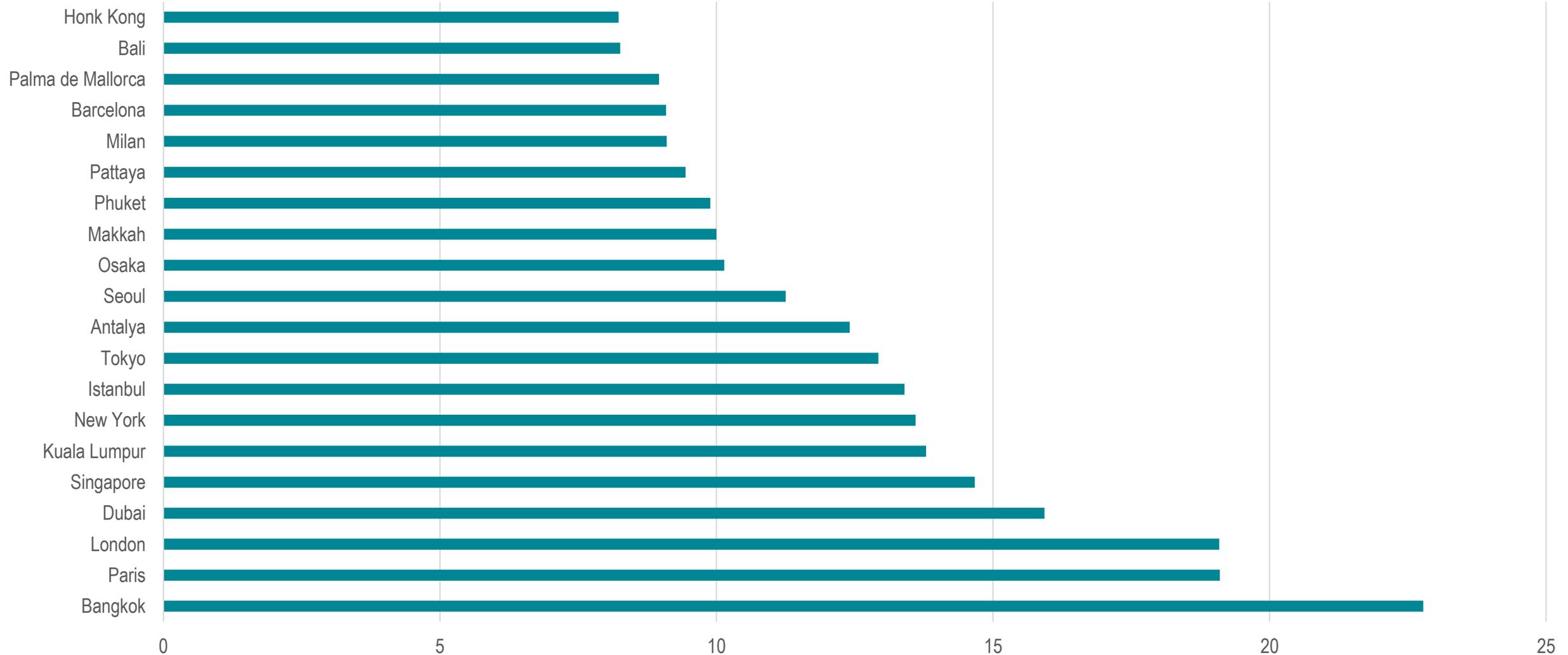


International Tourists Arrivals, 2018

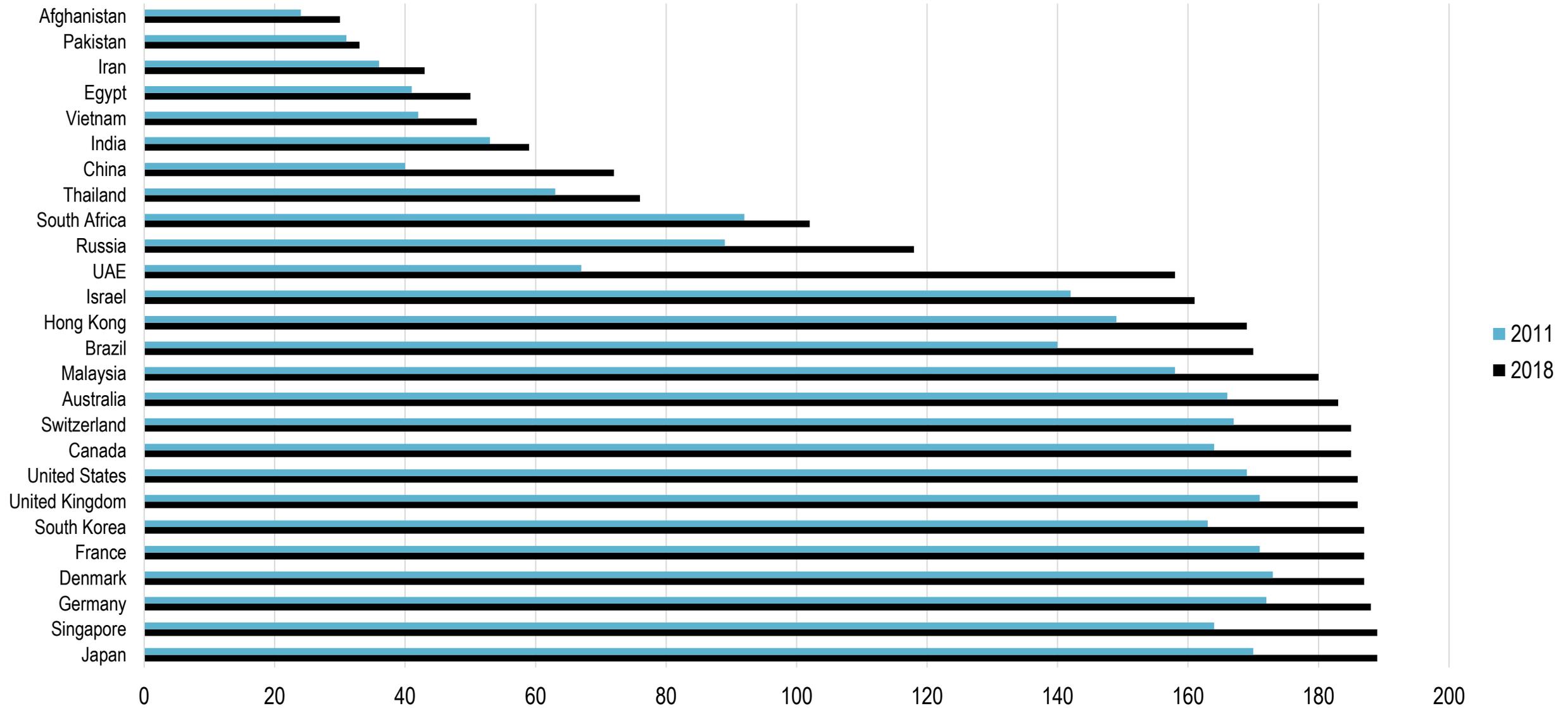


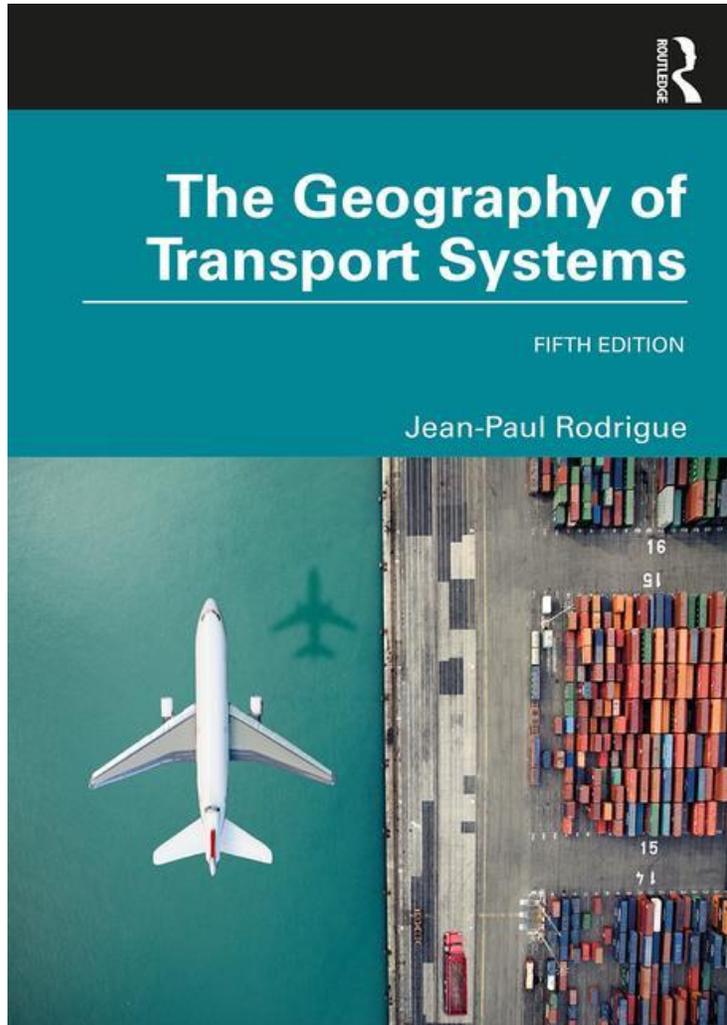
Destination Cities by International Overnight Visitors, 2018

2018



The Passport Index, 2011, 2018



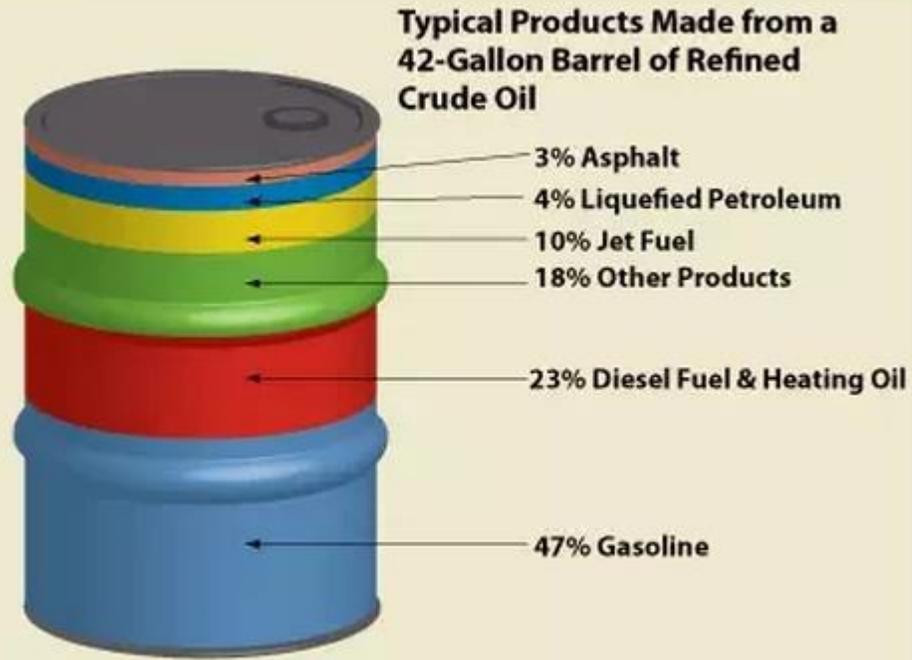


Petroleum: A Transportation Resource

OPEC Members and Countries with more than 10 Billion Barrels of Oil Reserves

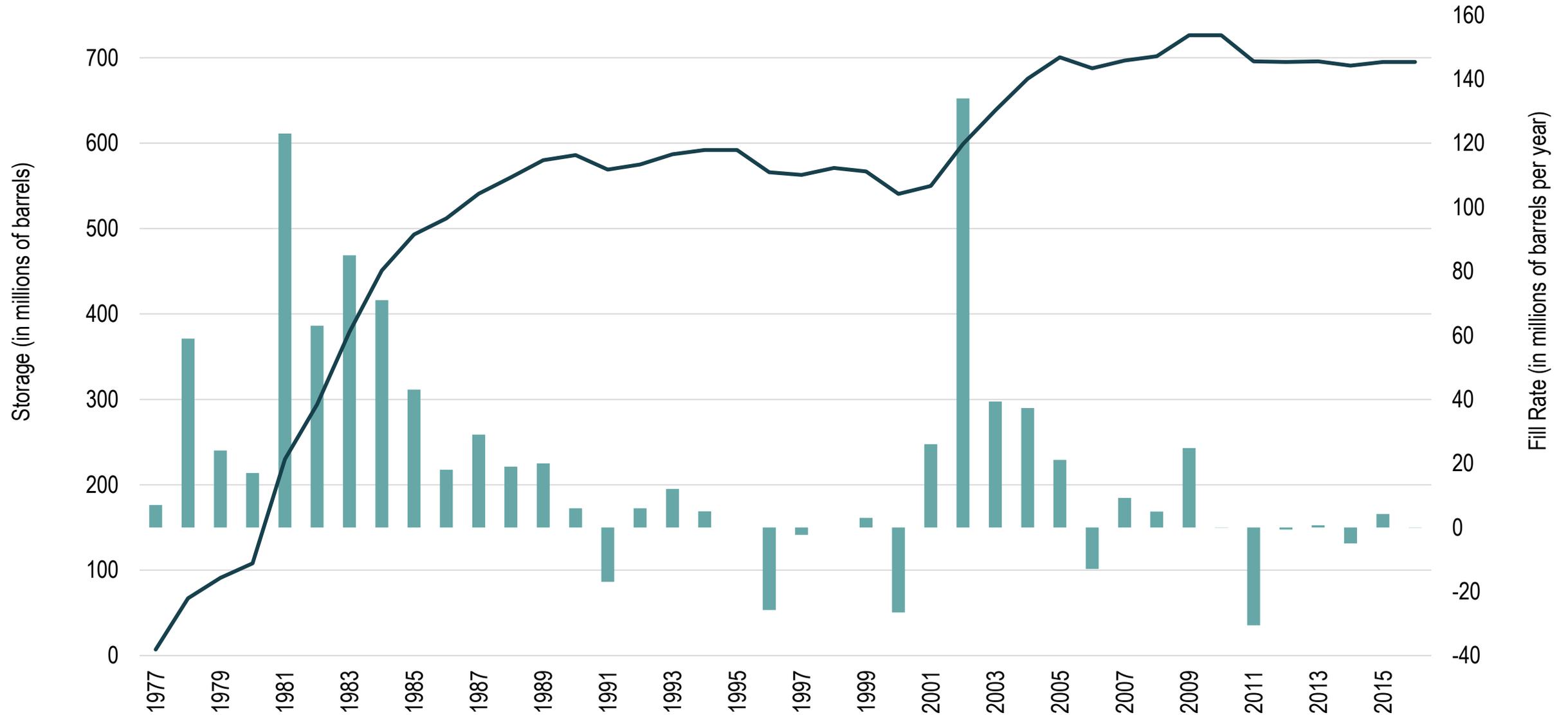


Products Made from a Barrel of Crude Oil

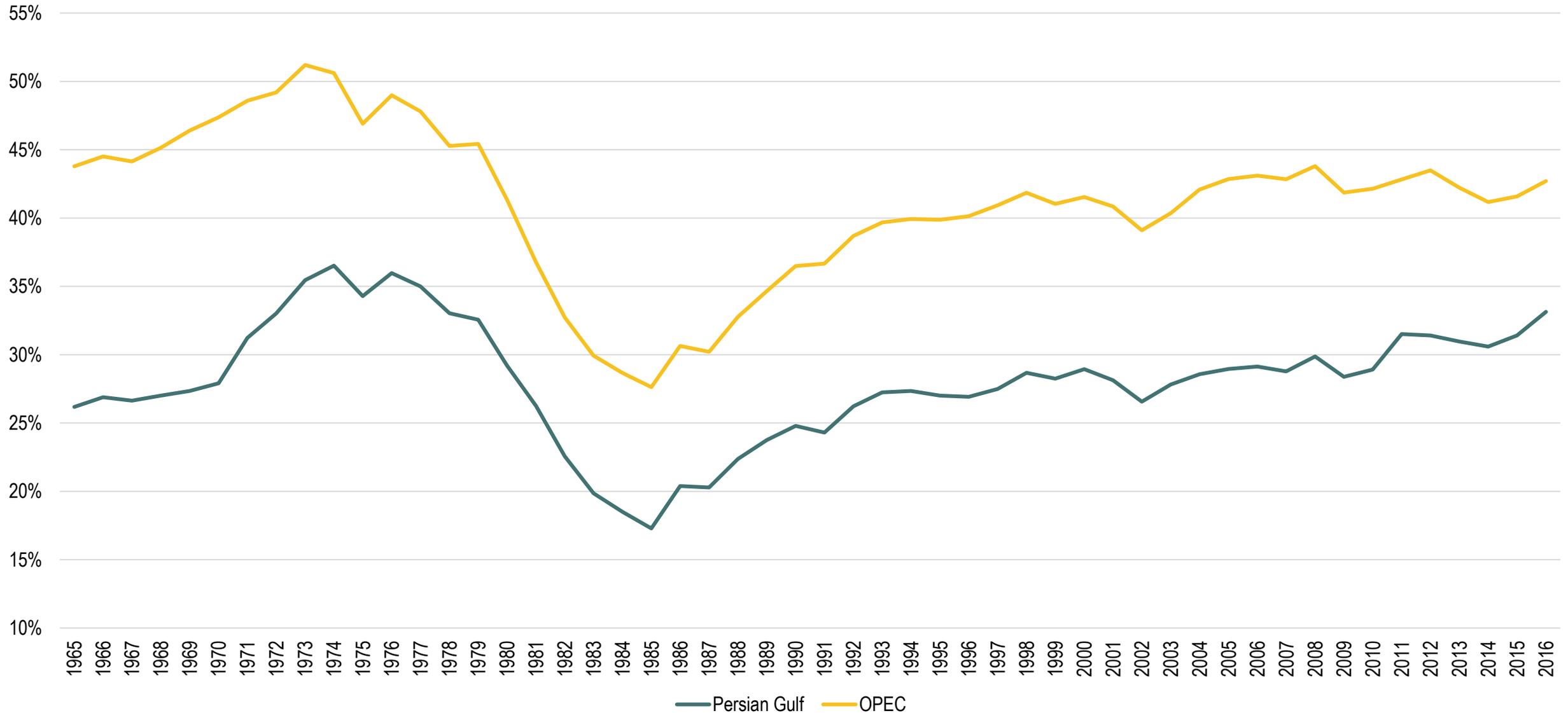


Source: U.S. Department of Energy.

United States Strategic Petroleum Reserves, 1977-2016



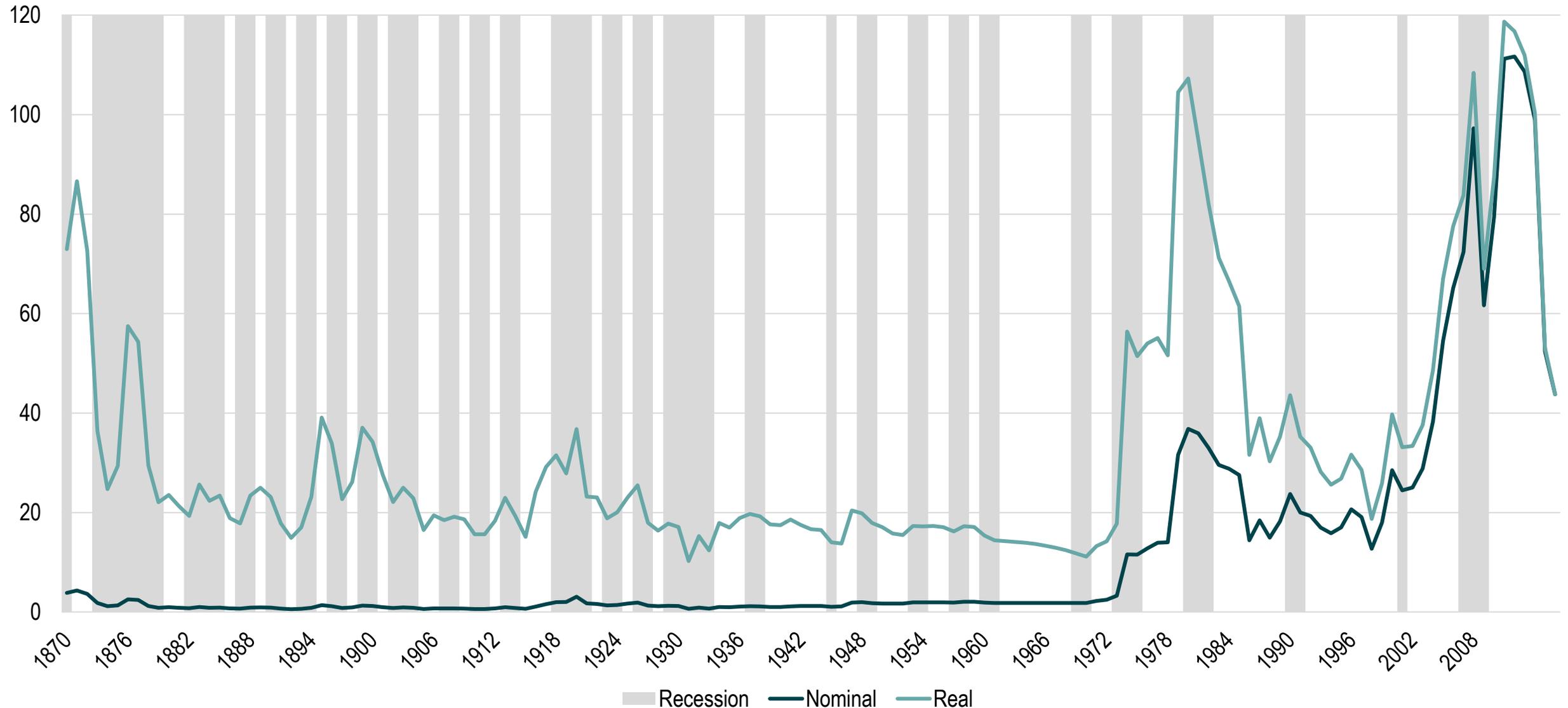
Share of OPEC and the Persian Gulf of the World Crude Oil Production, 1960-2016



Major Oil Price Fluctuations

Price Change Event	Price Change Time Frame	Cause	Nominal Price Change
First Oil Shock	October 1973 to March 1974	Yom Kippur War / OPEC oil embargo	From \$4.31 to \$10.11 (+134.5%)
Second Oil Shock	April 1979 to July 1980	Iranian revolution (1978) / Iran-Iraq war (1980)	From \$15.85 to \$39.50 (+149.2%)
Oil counter shock (A)	November 1985 to July 1986	OPEC oversupply / Lower demand	From \$30.81 to \$11.57 (-62.4%)
First Gulf War (1)	July 1990 to November 1990	Iraqi invasion of Kuwait	From \$18.63 to \$32.30 (+73.4%)
Asian Financial Crisis (B)	January 1997 to December 1998	Debt defaults / Non-USD currency devaluations / Reduced demand	From \$25.17 to \$11.28 (-55.1%)
"Asian Demand Contagion" (2)	January 1999 to September 2000	Rising demand / OPEC output cutbacks	From \$11.28 to \$33.88 (+200.3%)
"September 11 Effect" (C)	August 2001 to December 2001	Oversupply / American recession	From \$27.47 to \$19.33 (-29.6%)
Third Oil Shock	December 2003 to June 2008	Peak oil / Rising demand / Monetary debasement / Speculation	From \$32.15 to \$133.95 (+316.6%)
Financial Crisis of 2008 (D)	July 2008 to February 2009	Collapse of asset bubbles / Demand destruction / Global recession	From \$133.95 to \$39.16 (-70.7%; Dec 2008)

Nominal and Real Oil Price, 1870-2016 (Dollars per Barrel)



Nominal Price of Oil and Major Disruptions in World Oil Supply, 1950-2016

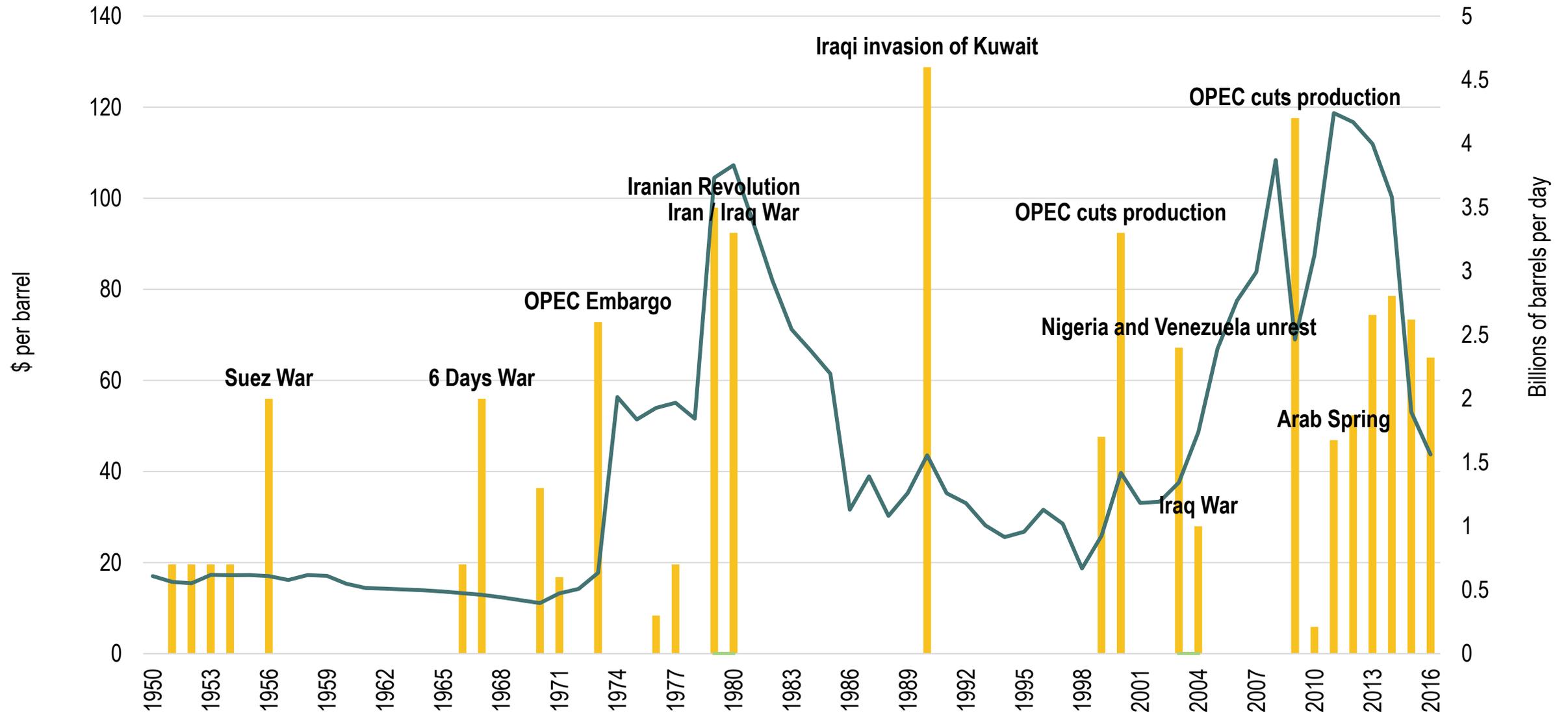
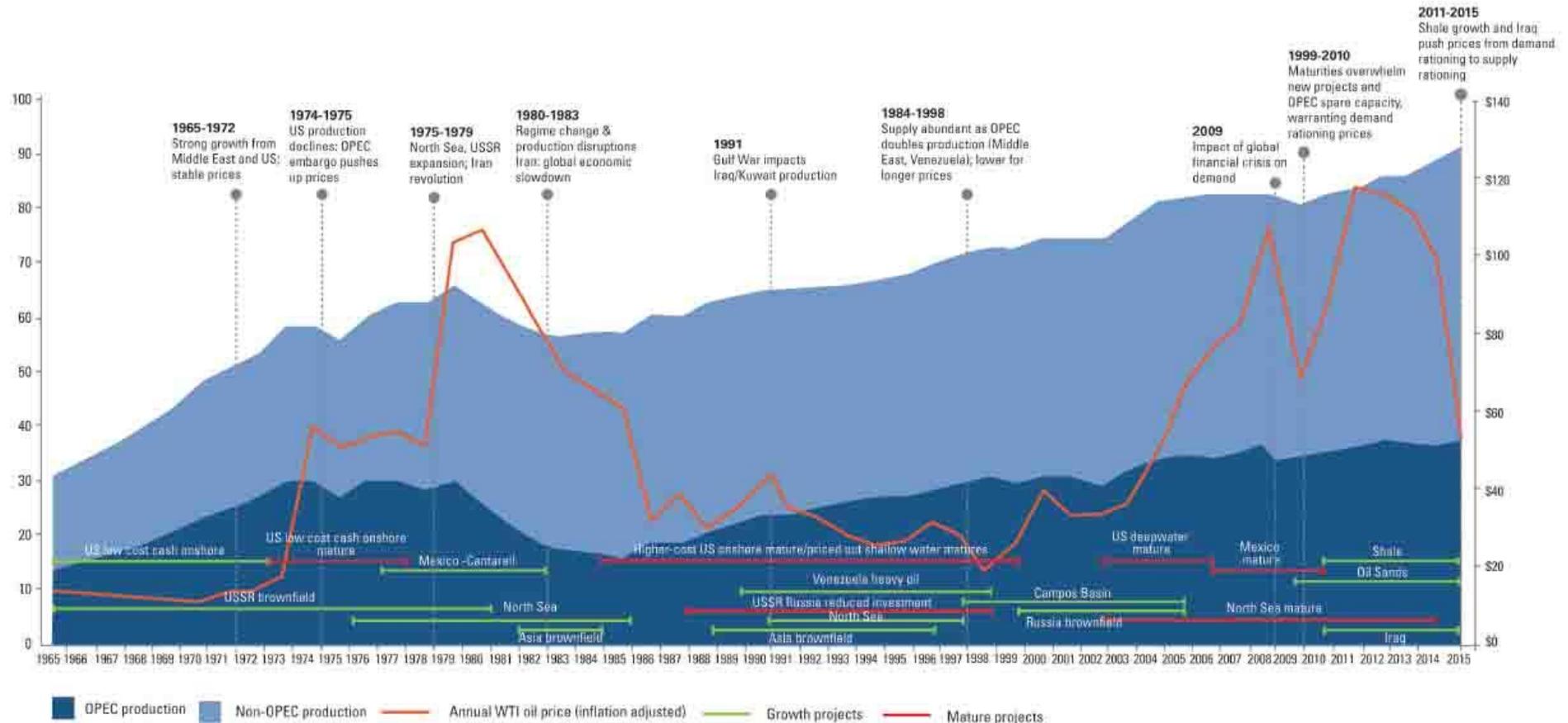
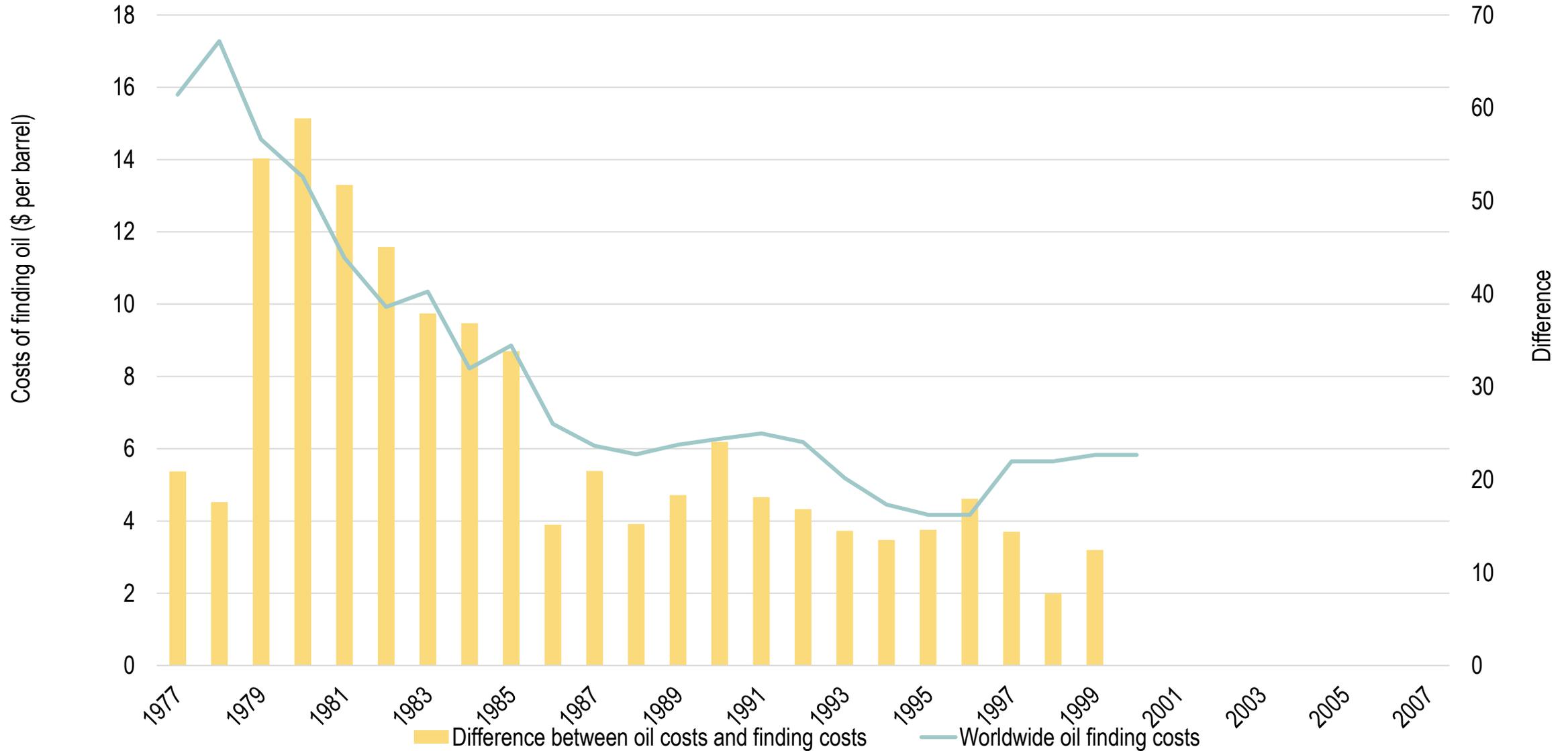


Exhibit 7: History indicates that assuming shale/OPEC can meet demand, oil prices likely need to stay lower for longer

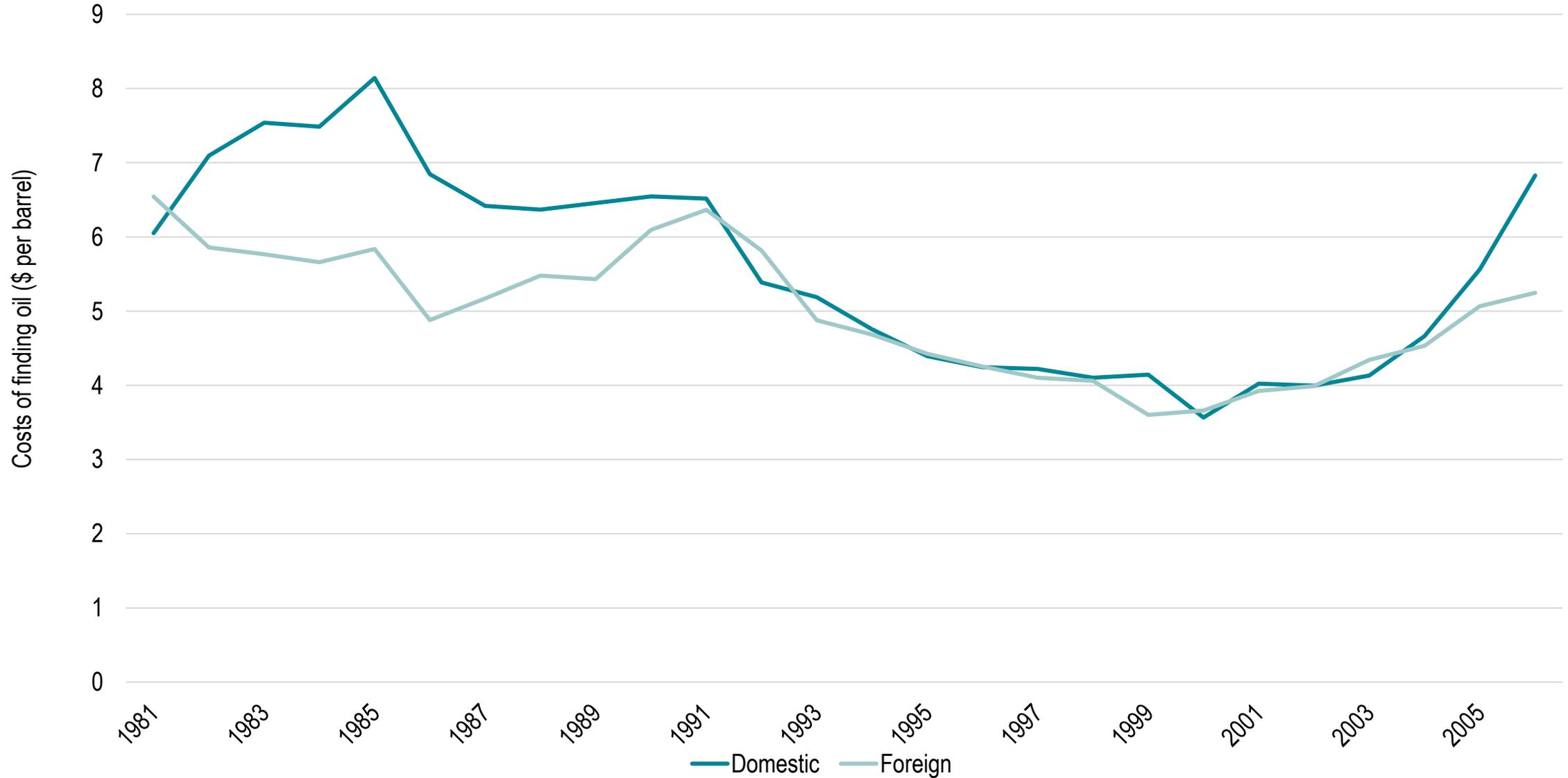


Source: BP Statistical Review of World Energy, Goldman Sachs Global Investment Research

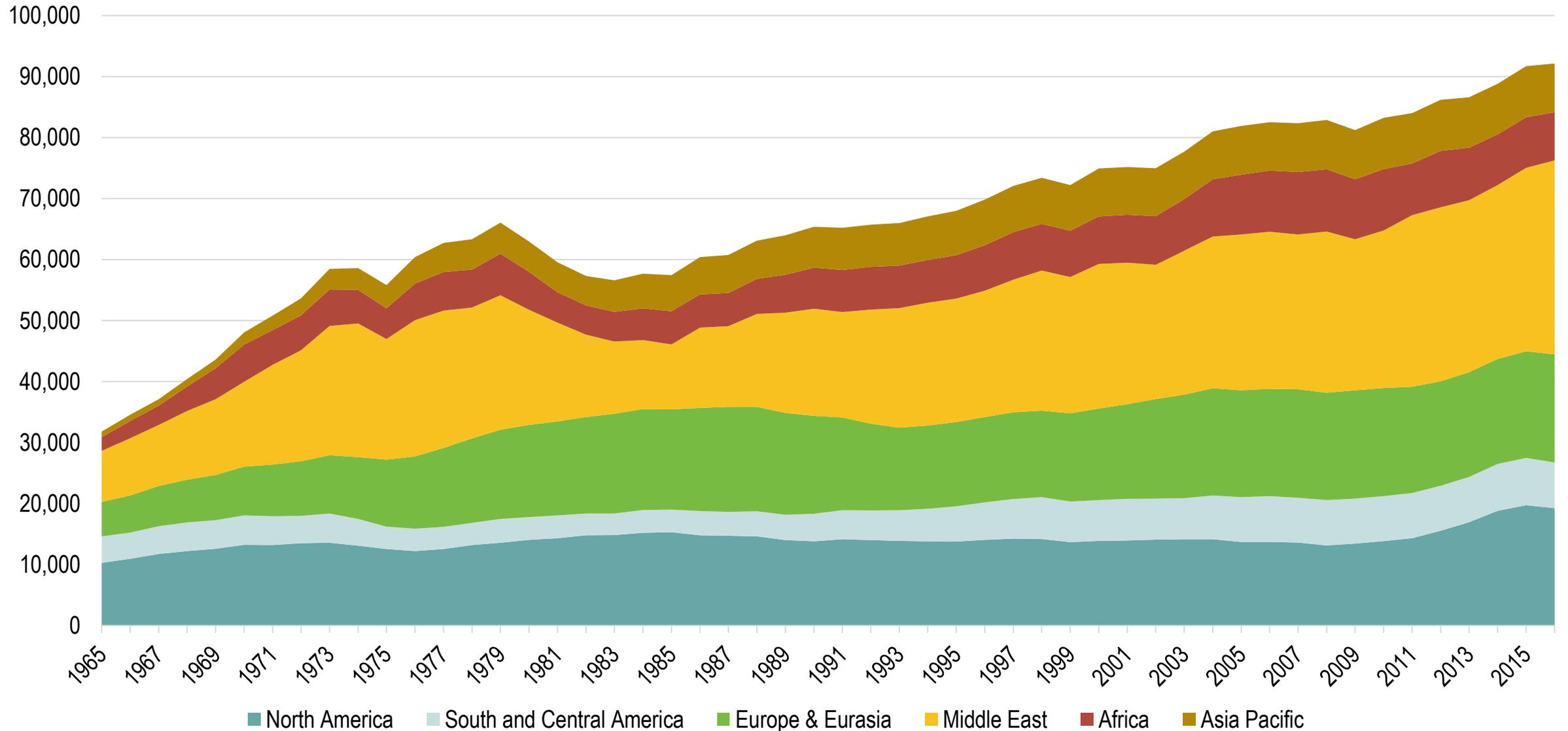
Costs of Finding Oil, 1977-2007



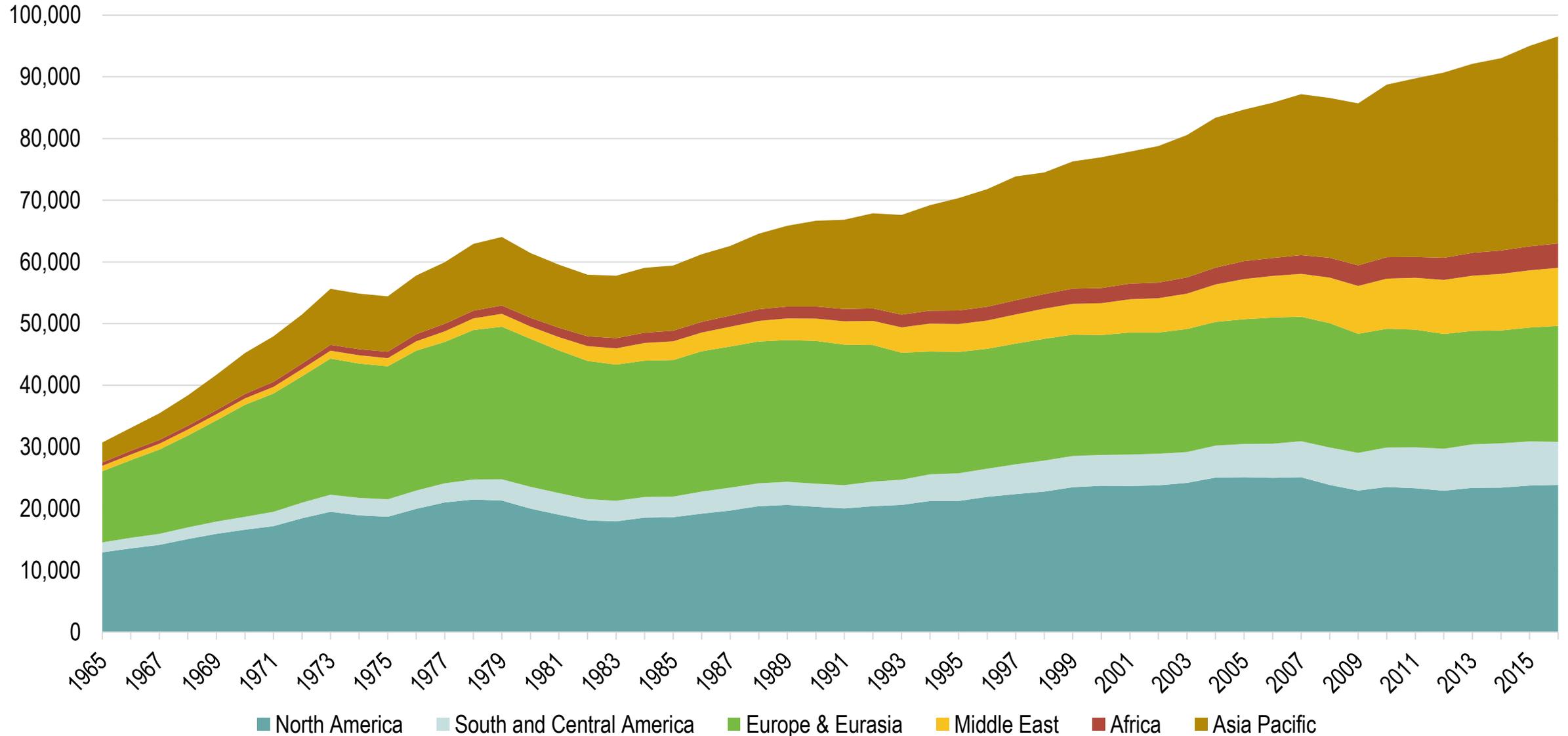
Cost of Finding Oil, 1981-2006



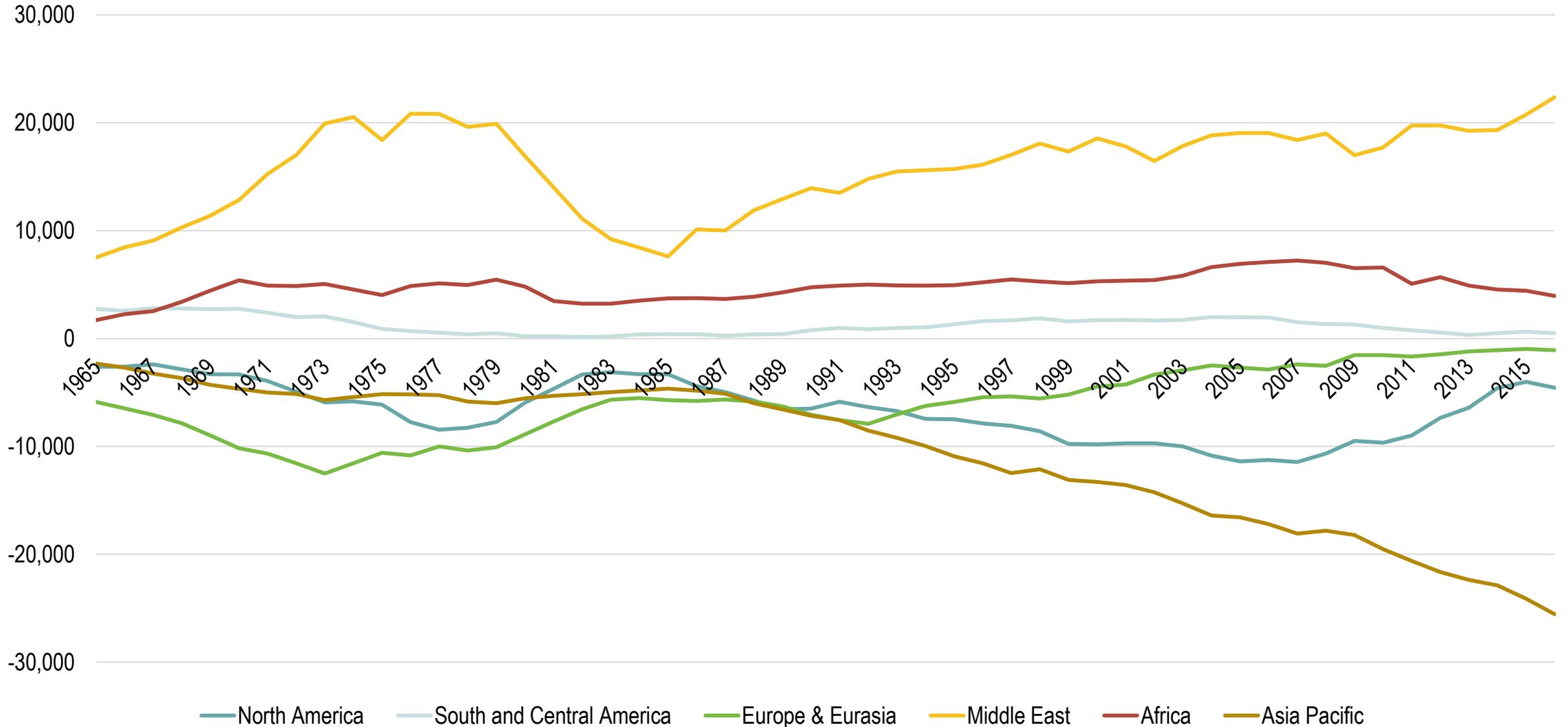
World Oil Production, 1965-2016 (1000s of barrels per day)



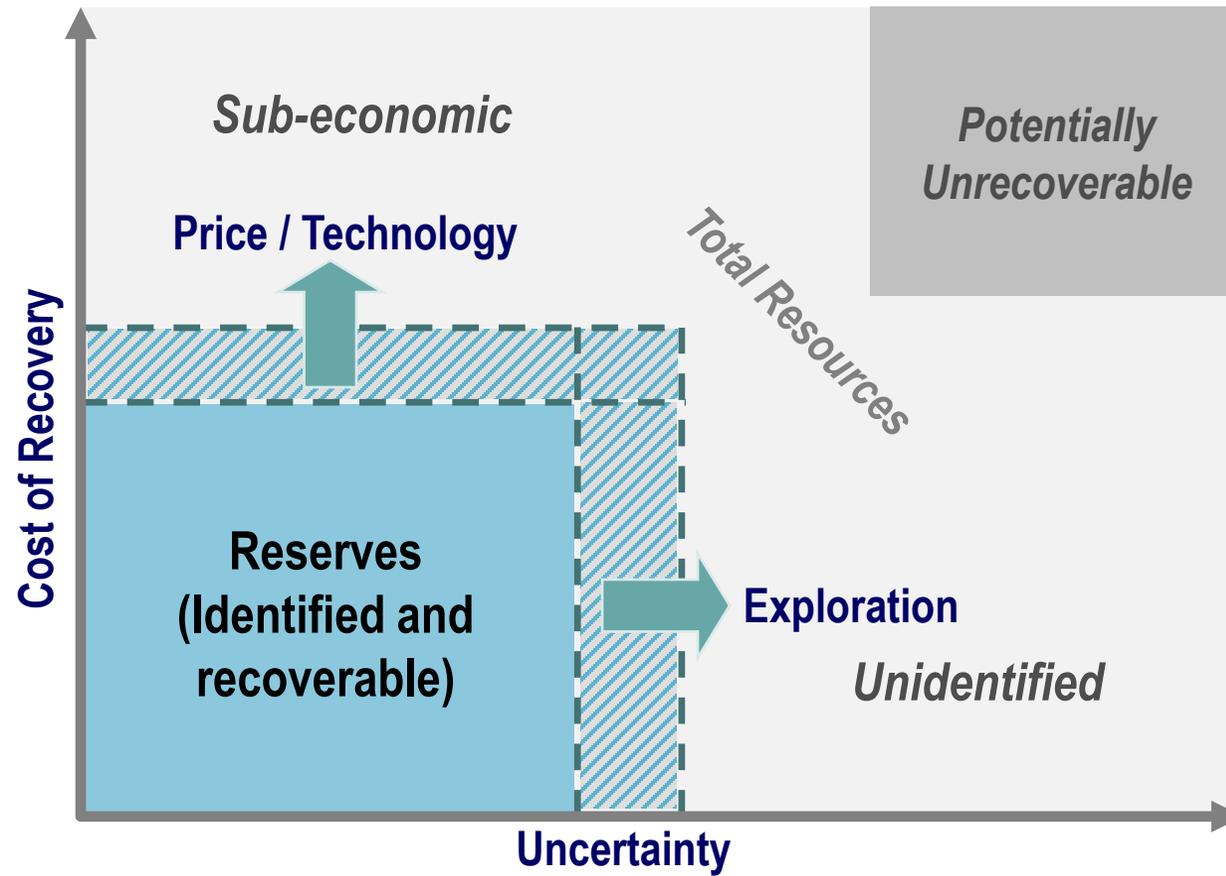
World Oil Consumption, 1965-2016 (1000s of barrels per day)



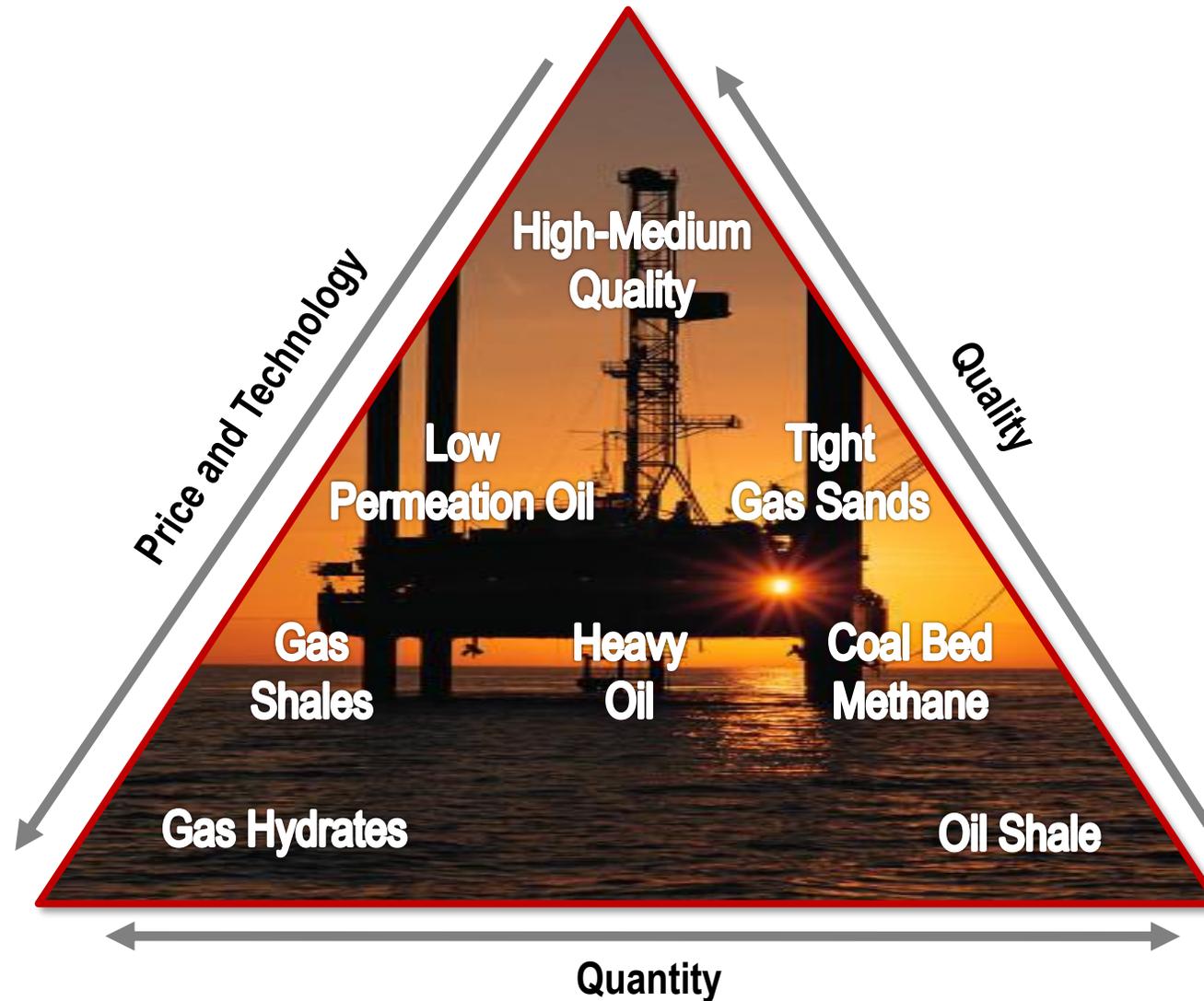
World Oil Balance, 1965-2016 (1000s of barrels per day)



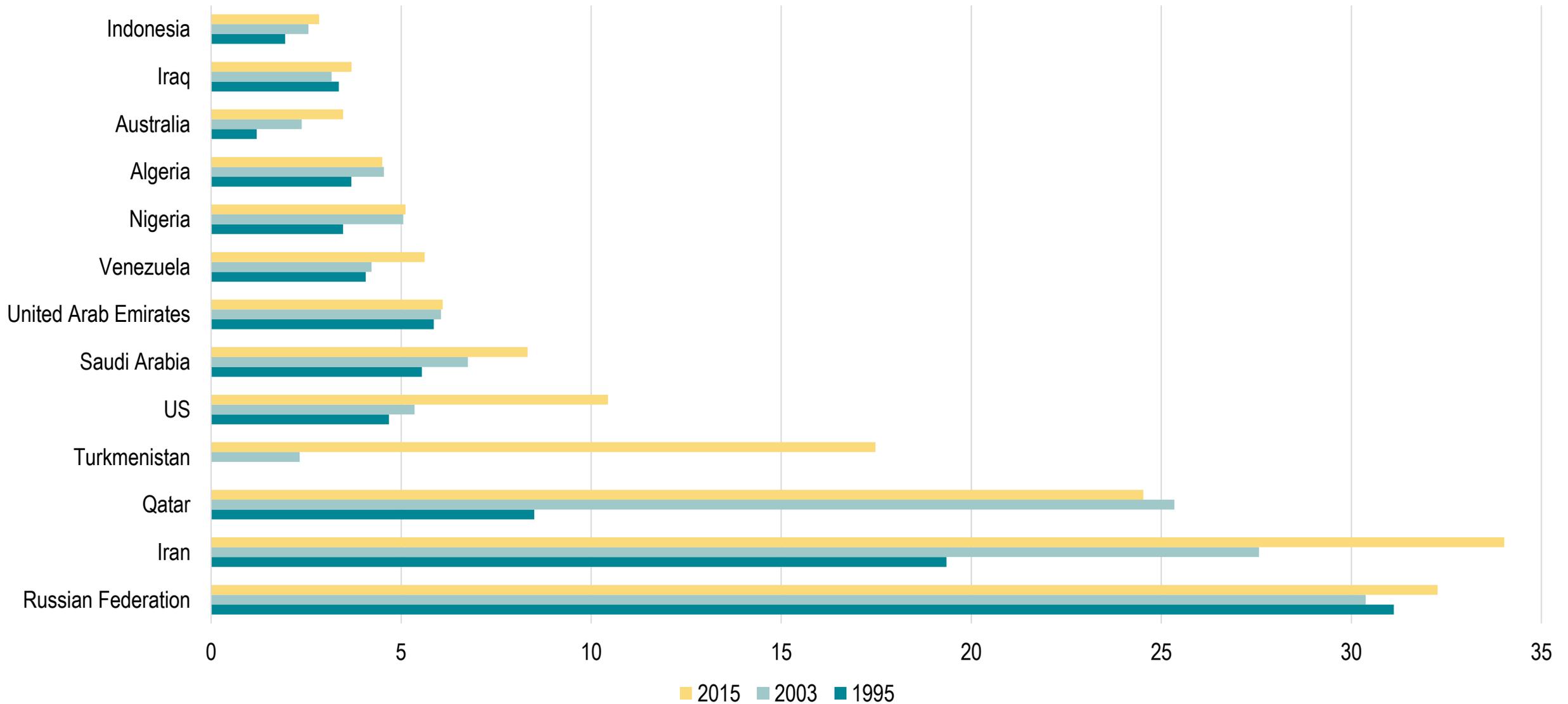
Reserves and Total Resources



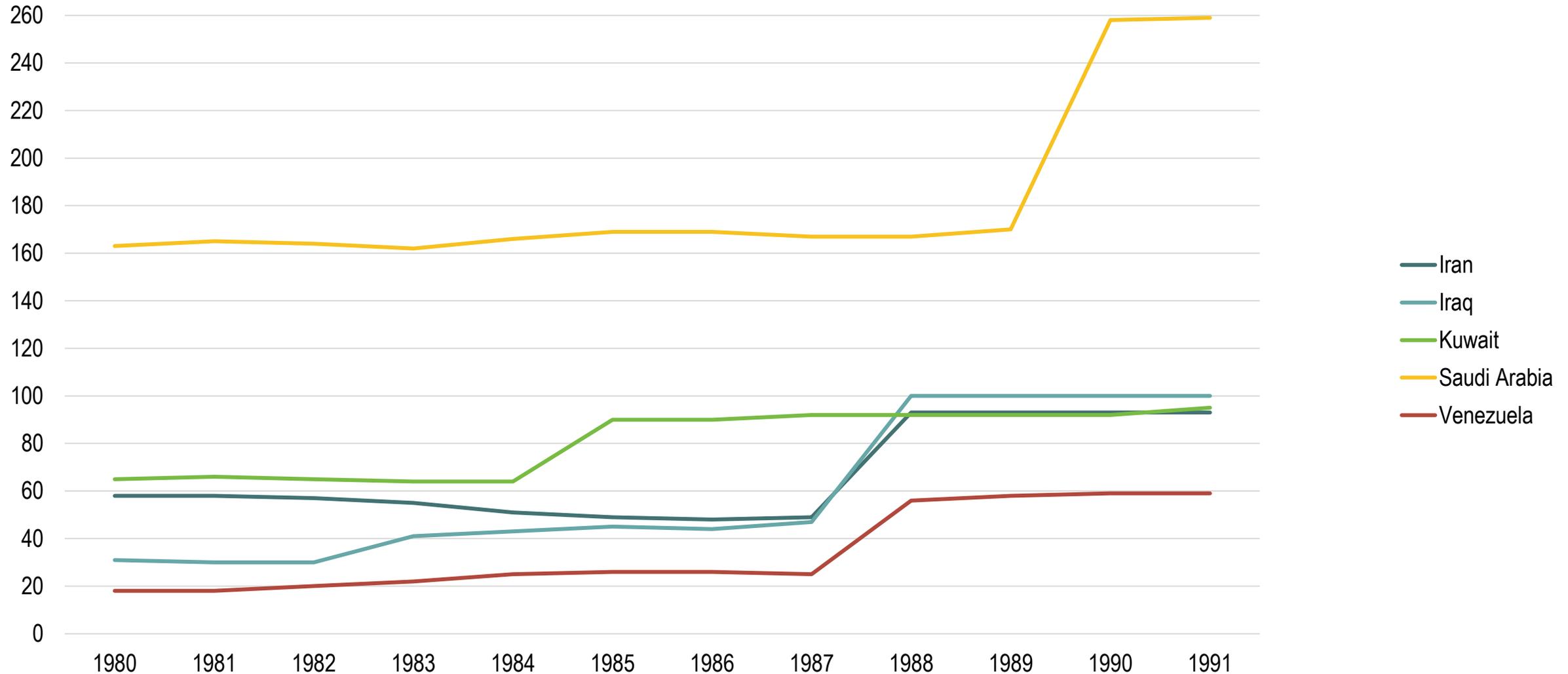
Types of Oil and Gas Reserves



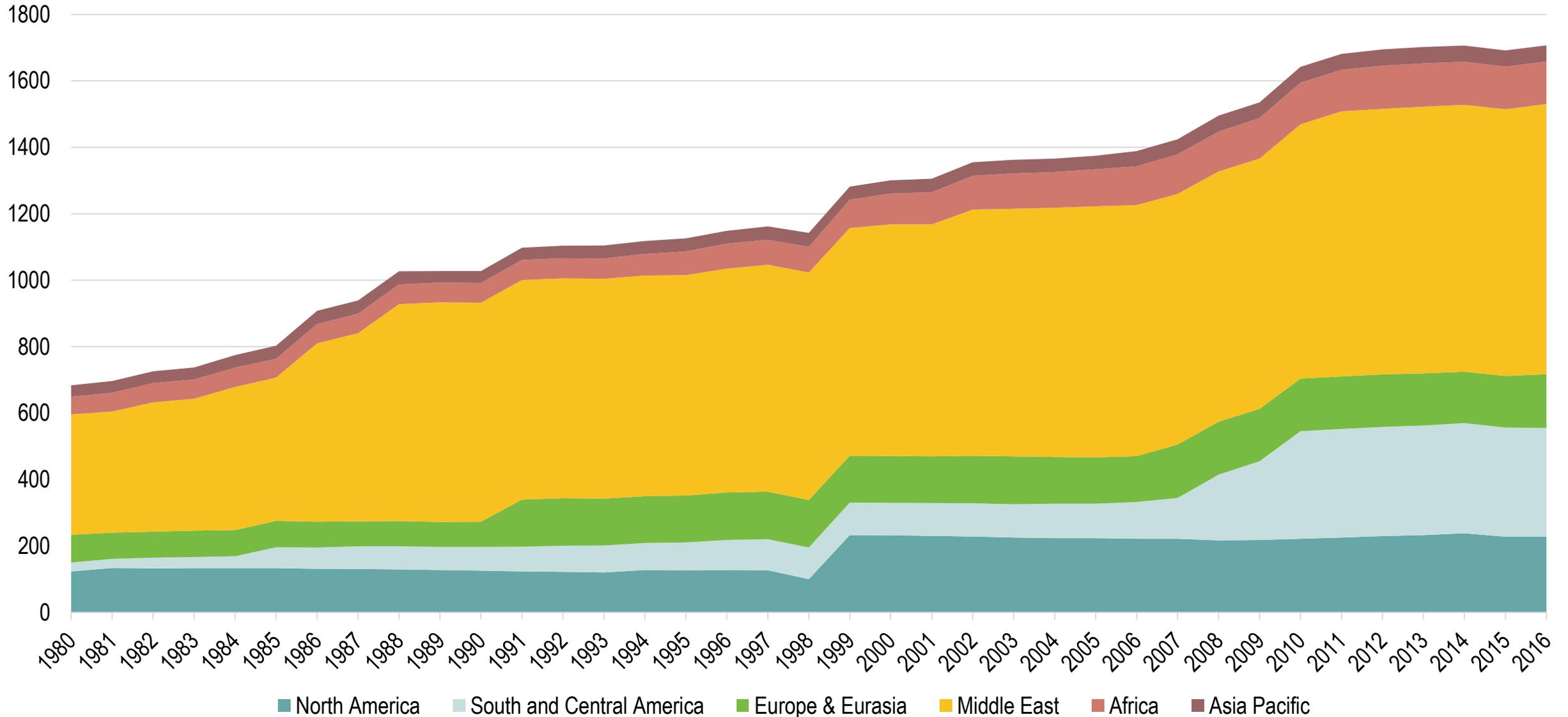
Proved Reserves of Natural Gas



Estimated Oil Reserves, Selected OPEC Countries, 1980-1991 (billions of barrels)



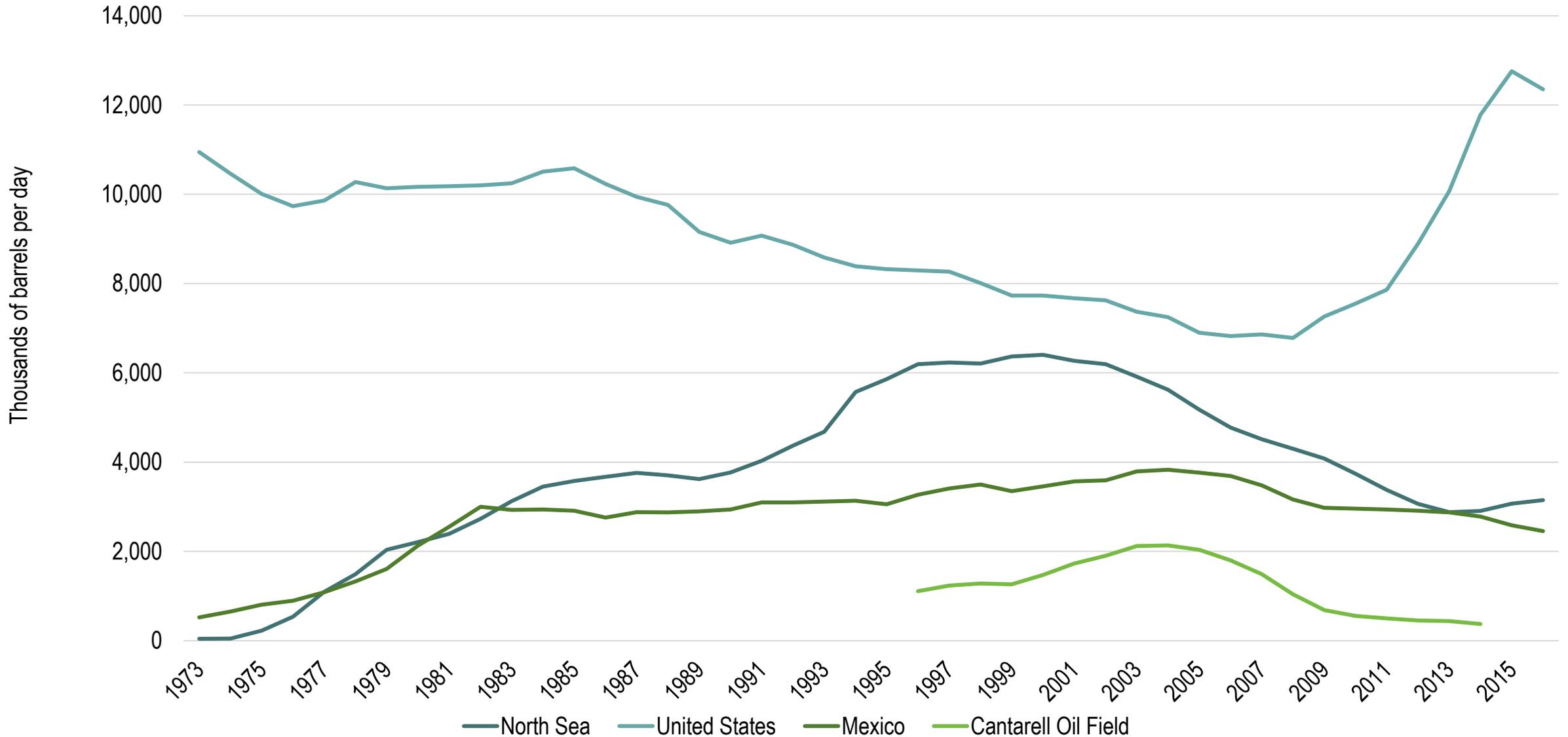
Proven Oil Reserves, 1980-2016 (thousand million barrels)



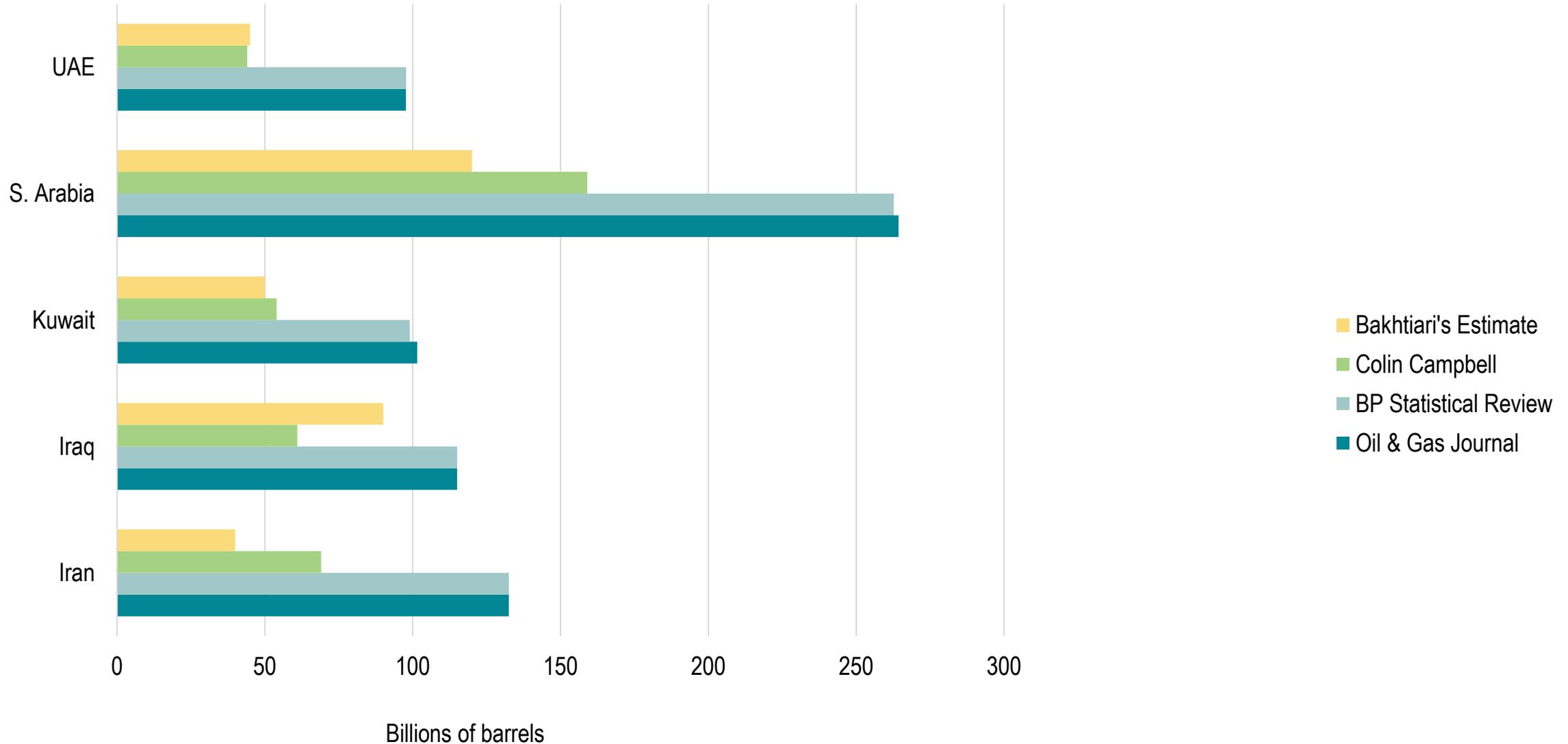
World's Largest Oil Fields, 2005

Oil Field	Output (MBD)	% of national output	Status
Ghawar (Saudi Arabia)	4.5	40%	Possibly declining
Cantarell (Mexico)	2.0 (1.7; 2007, 1.04; 2008)	60%	Declining
Burgan (Kuwait)	1.7	68%	Declining
DaQing (China)	1.0	40%	Possibly declining

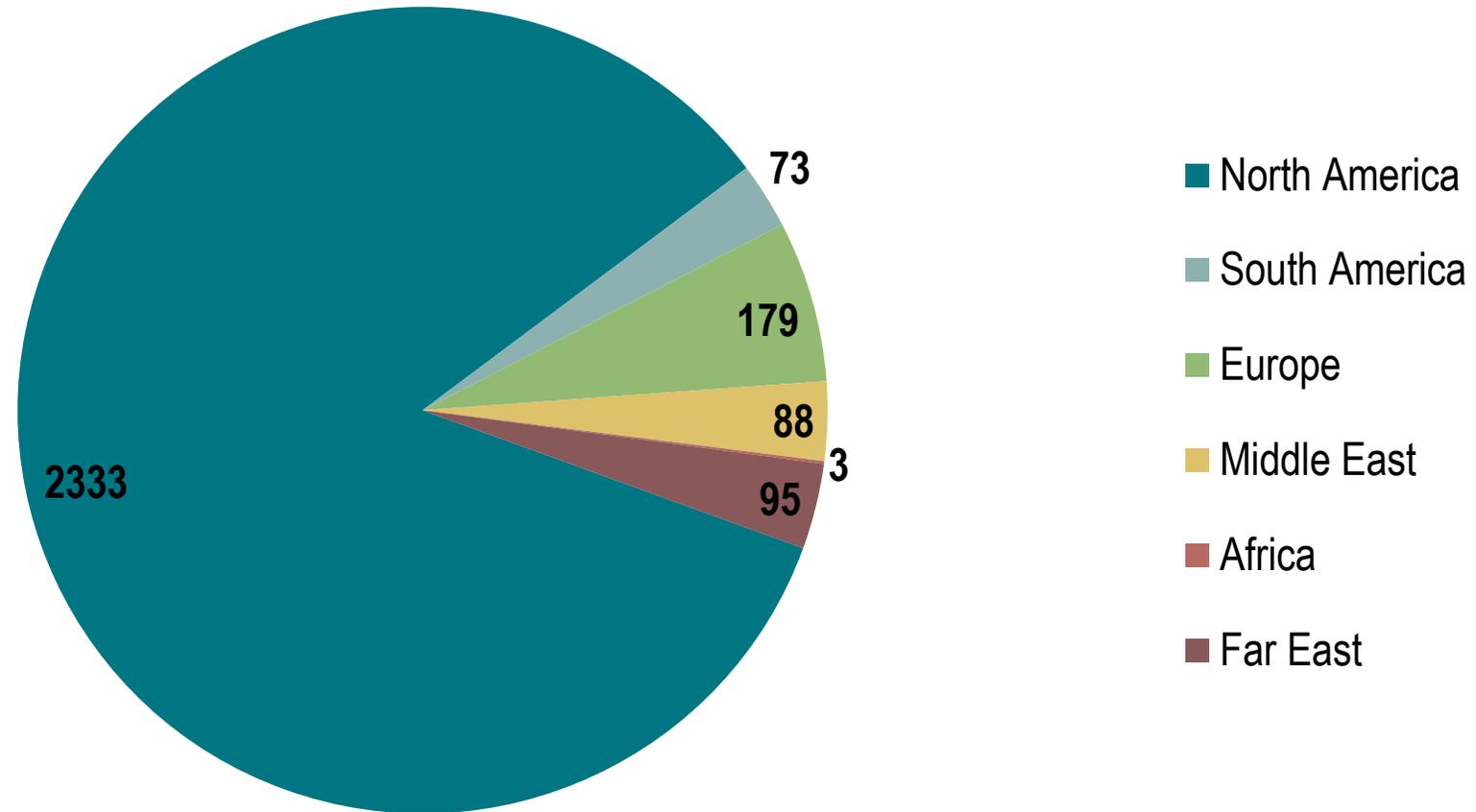
Oil Production of Some Declining Regions, 1973-2016



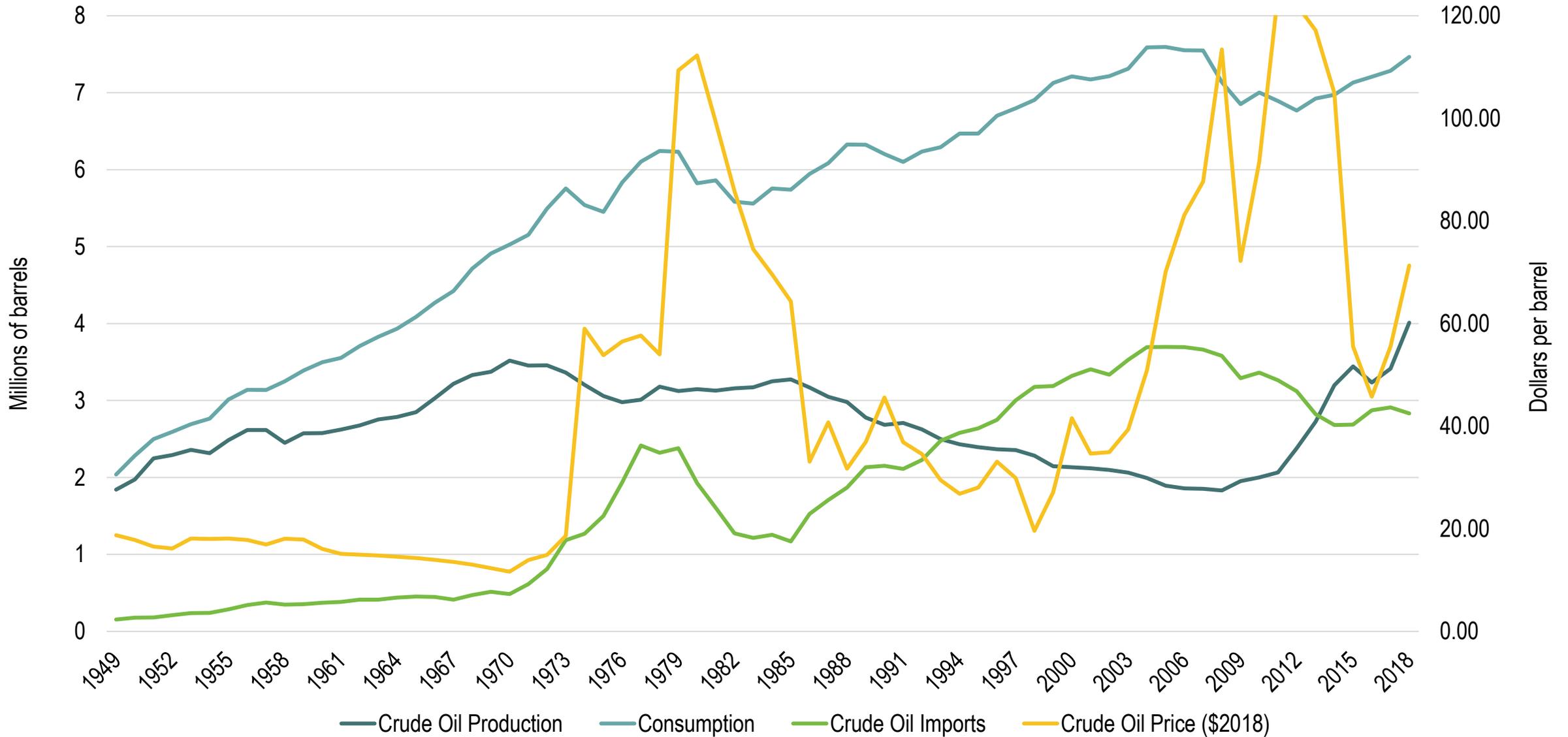
Remaining Proven Oil Reserves for “Middle Eastern Five” According to Major Assessors, 2005



Global Oil Production, 1924 (1,000s of barrels per day)



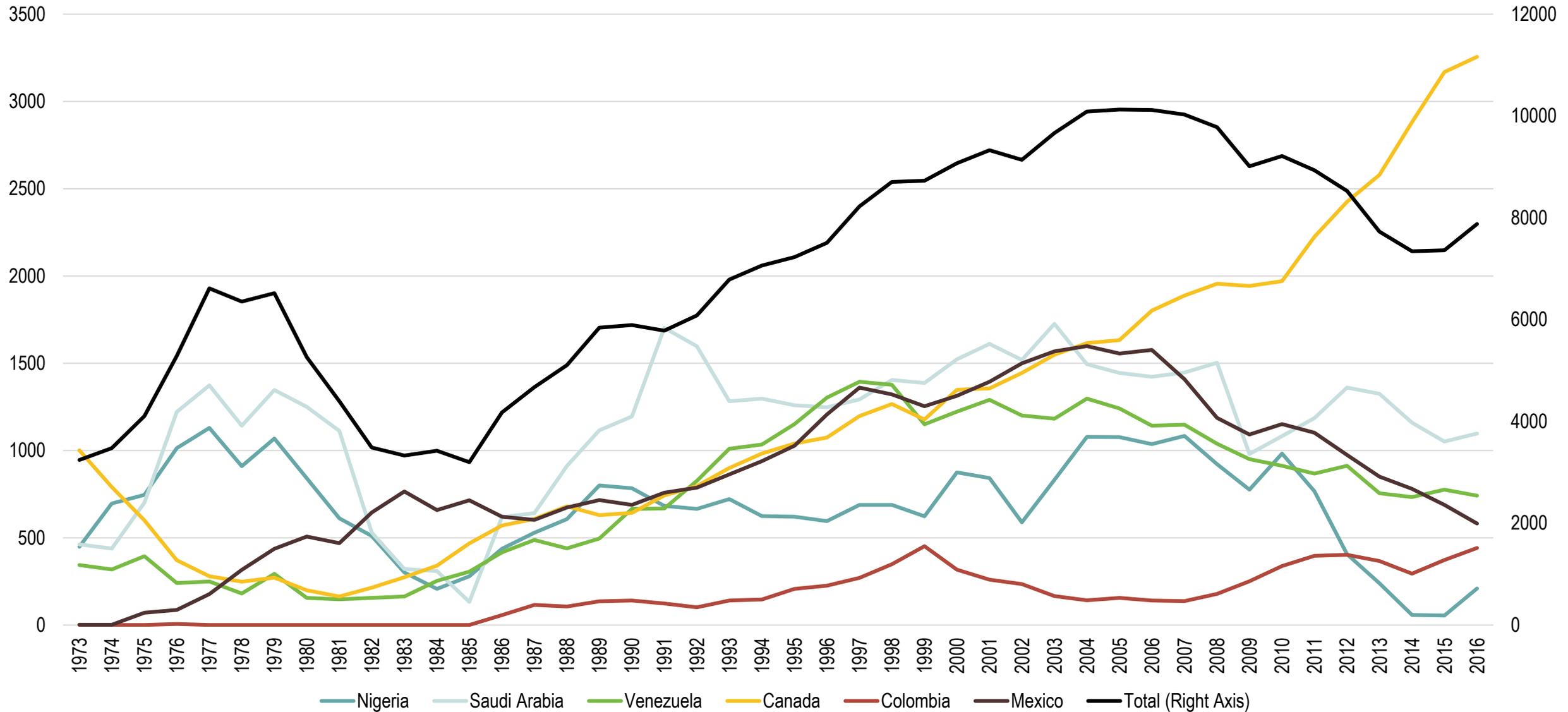
Petroleum Production, Consumption and Imports, United States, 1949-2018



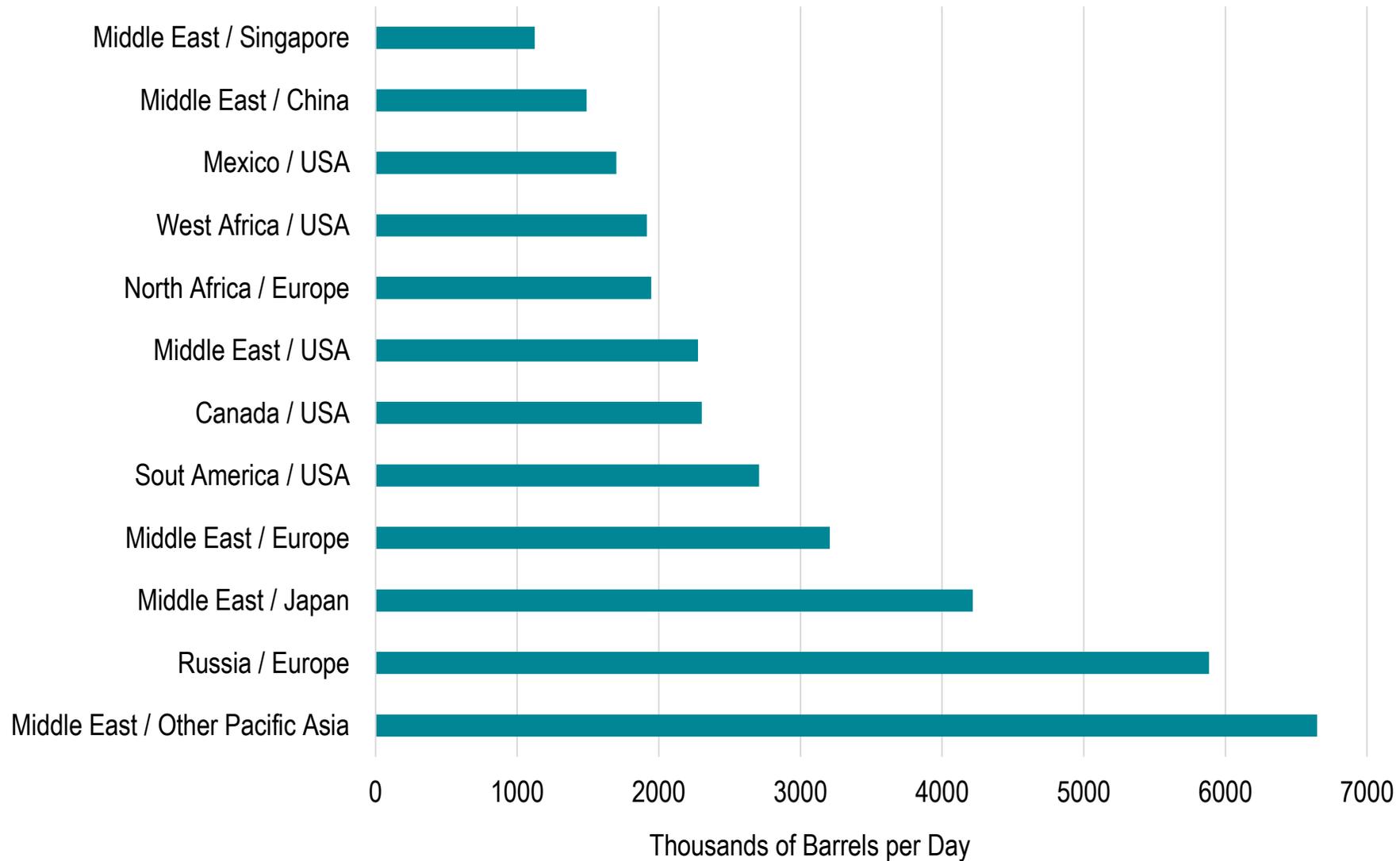
Modes Used for Petroleum Transportation

	Pipeline	Marine	Rail	Truck
Volumes	Large	Very large	Small	Large
Materials	Crude / Products	Crude / Products	Products	Products
Scale	2 ML+	10 ML+	100 kL	5-60 kL
Unit costs	Very low	Low	High	Very high
Capital costs	High	Medium	Low	Very low
Access	Very limited	Very limited	Limited	High
Responsiveness	1-4 weeks	7 days	2-4 days	4-12 hours
Flexibility	Limited	Limited	Good	High
Usage	Long haul	Long haul	Medium haul	Short haul

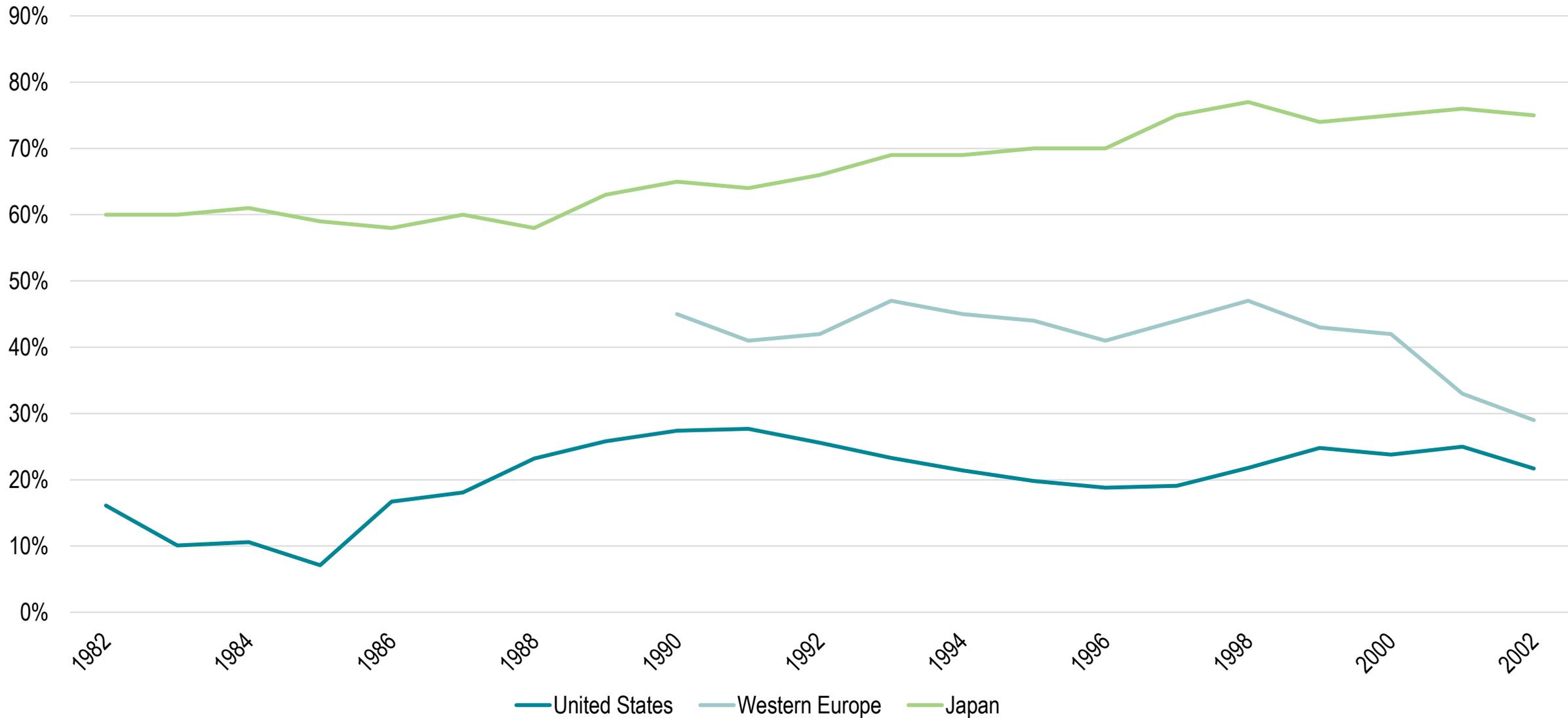
Main Origin of Crude Oil Imports, United States, 1973-2016 (in thousands of barrels per day)



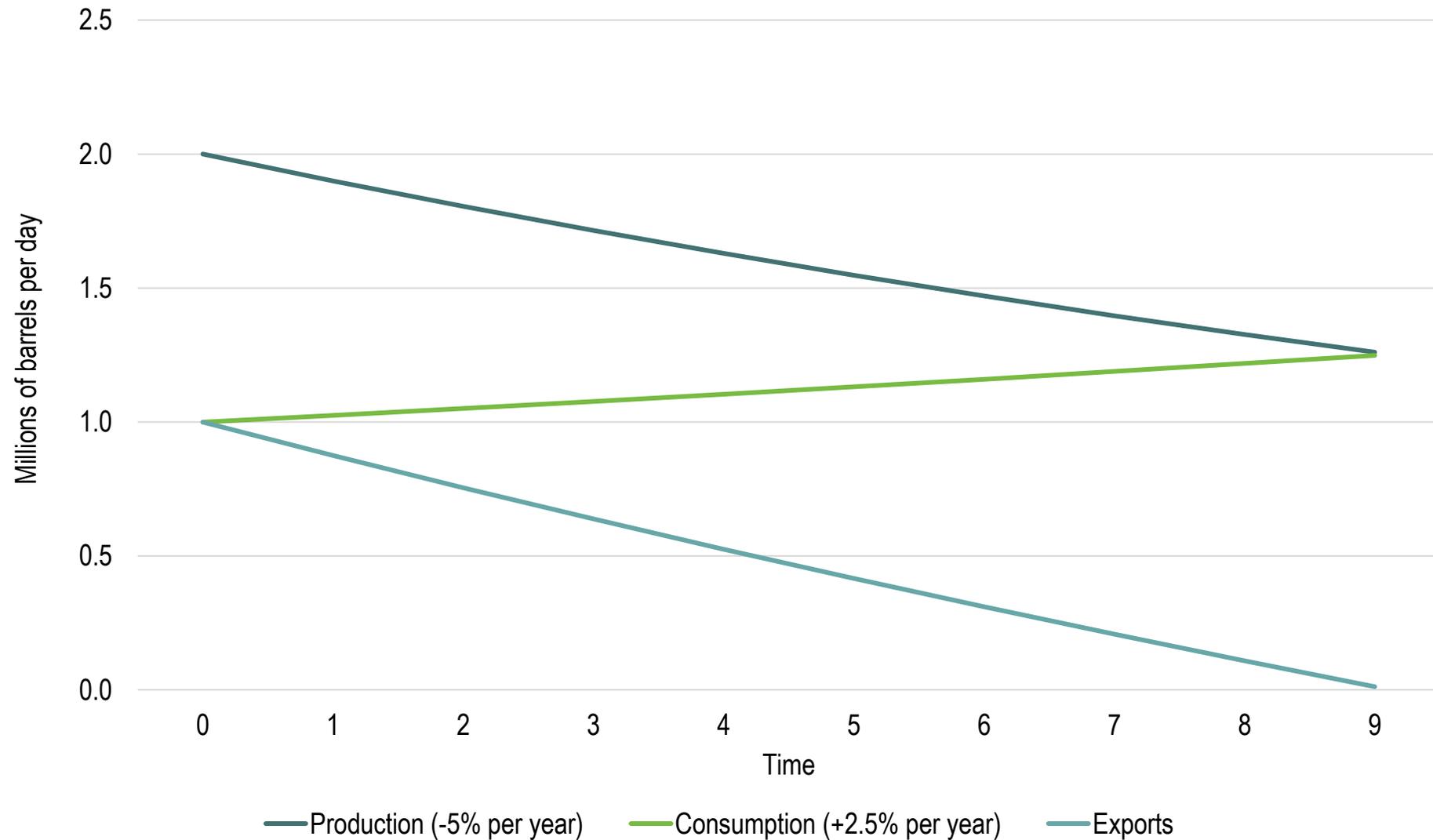
Inter-Regional Petroleum Movements, 2006



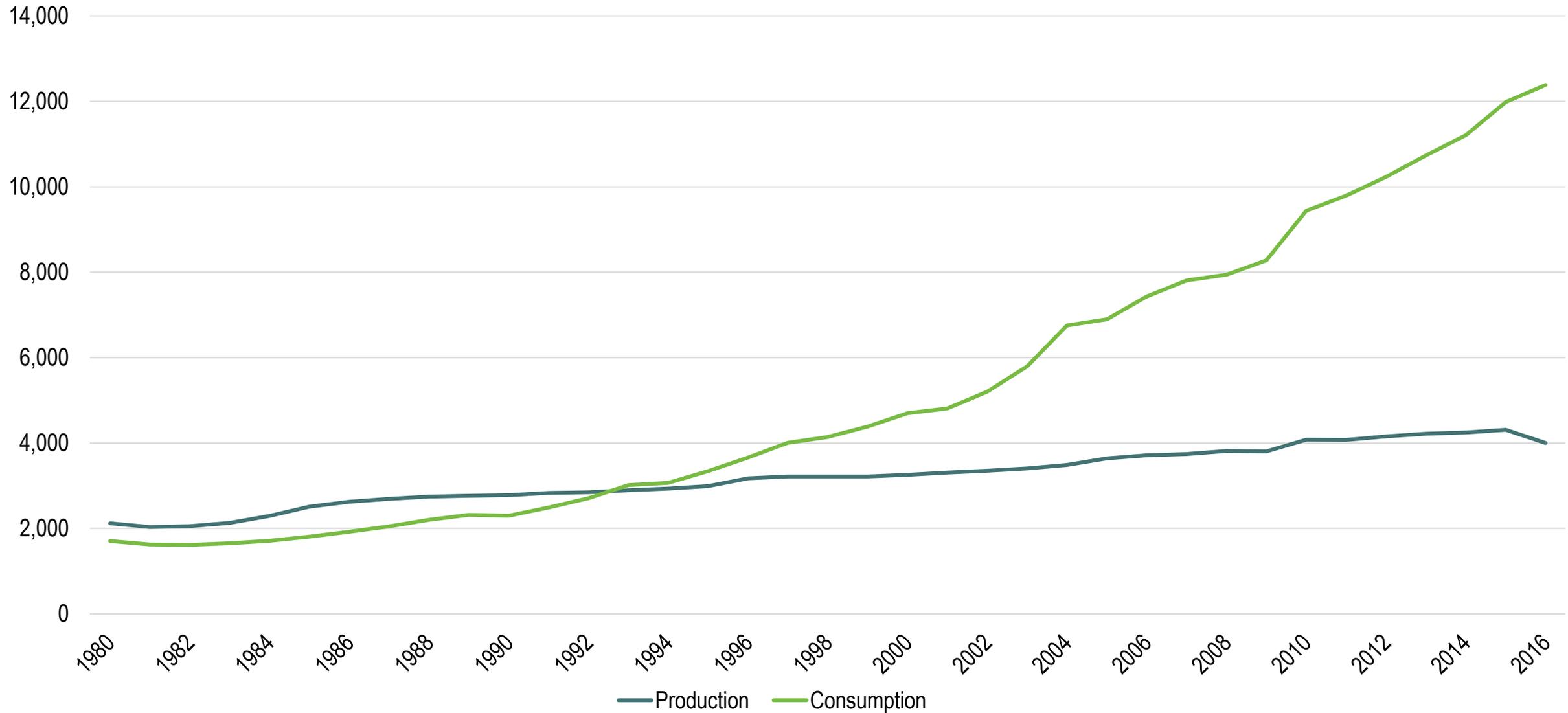
Net Oil Imports from the Persian Gulf Region as % of Total Net Oil Imports, 1982-2002



Export Land Theory



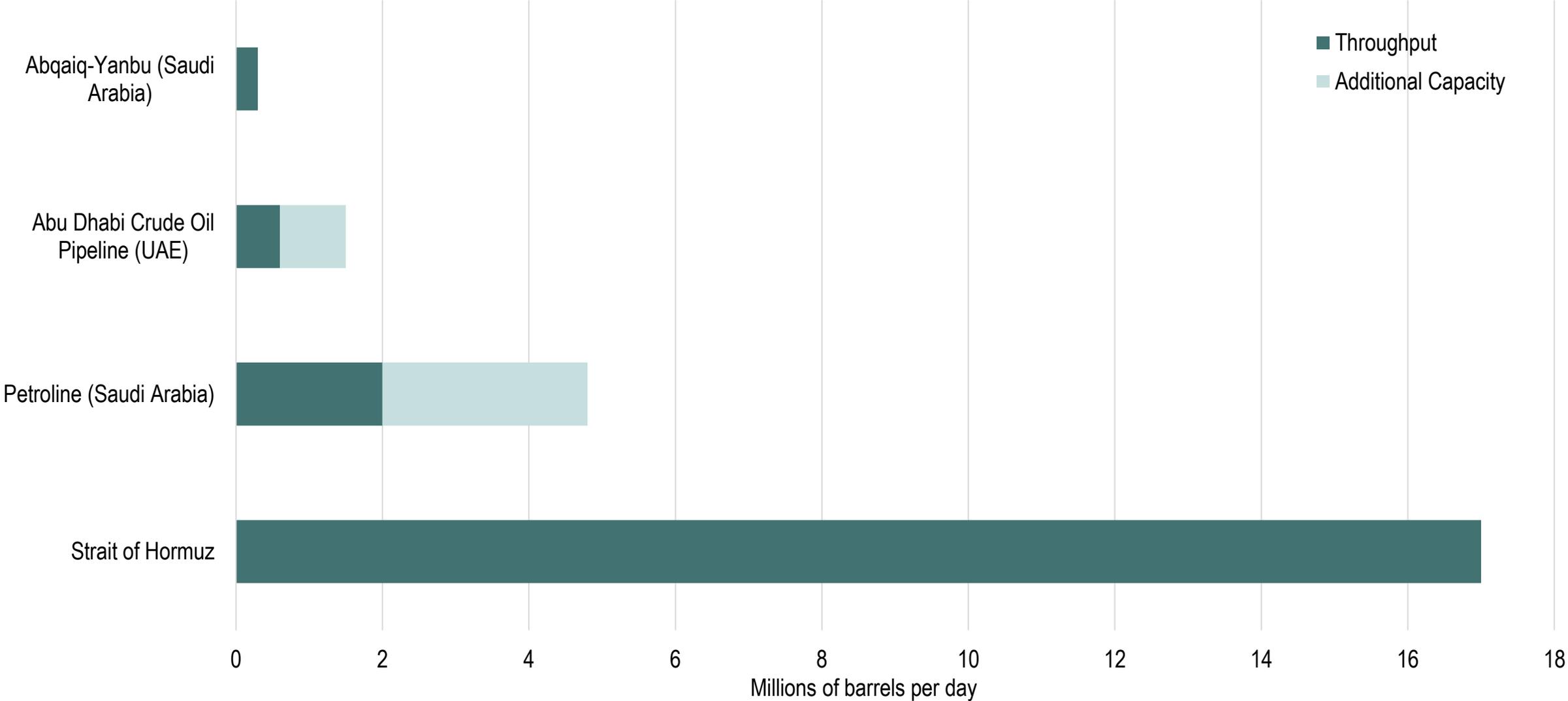
Crude Oil Production and Consumption, China, 1980-2016 (in 1,000 of barrels per day)



Factors of Oil Dependency

Occurrence	Localized large deposits (decades)
Transportability	Liquid that can be easily transported. Economies of scale
Energy content	High mass / energy released ratio
Reliability	Continuous supply; geopolitically unstable
Storability	Easily stored
Flexibility	Many uses (petrochemical industry; plastics)
Safety	Relatively safe; some risks (transport)
Environment	Little wastes, CO2 emissions
Price	Relatively low costs

Alternatives to the Strait of Hormuz, 2013



World Gas Trade



LNG Exporters, 2003

