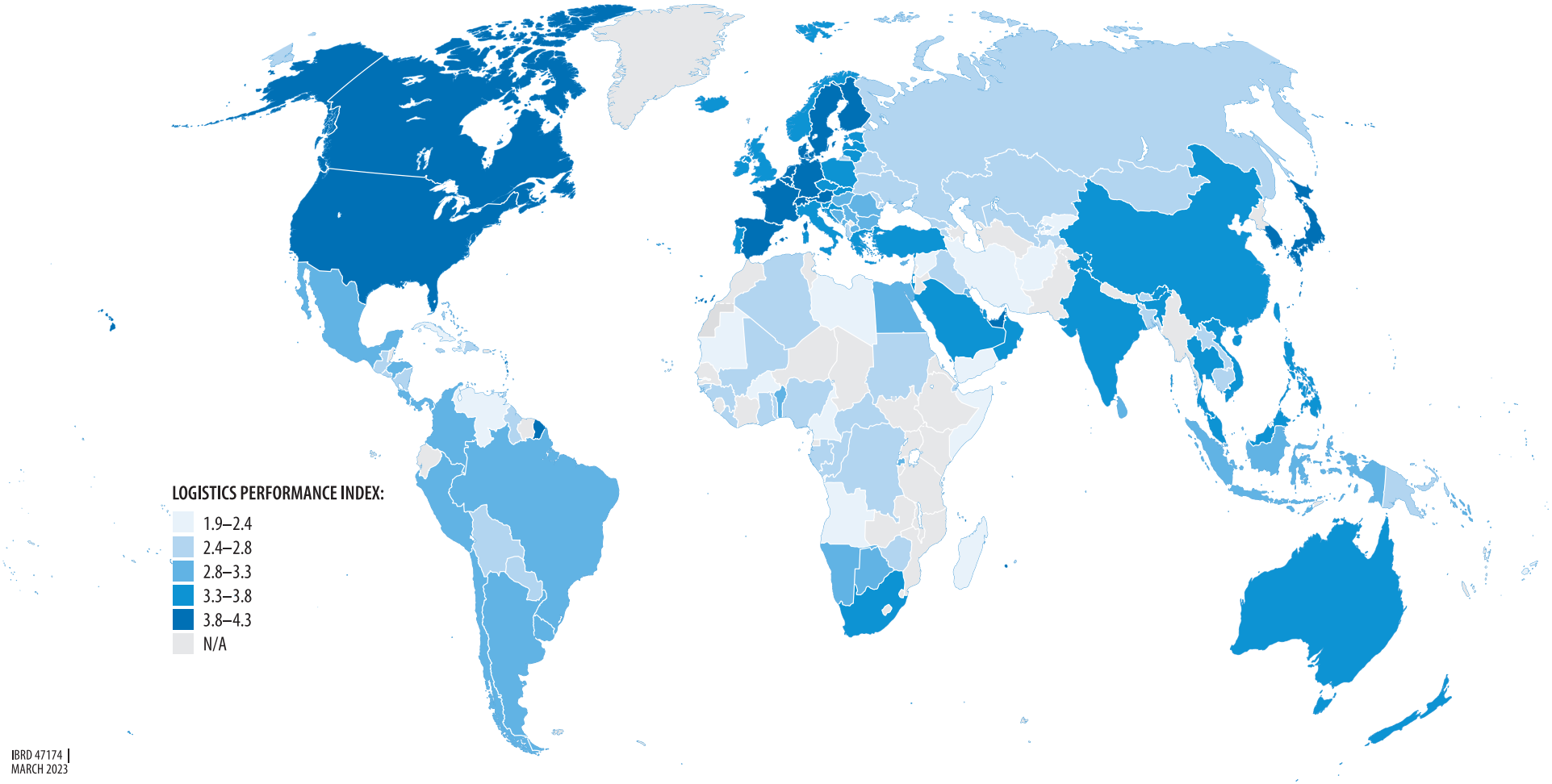
Connecting to Compete

2023

Trade Logistics in the Global Economy

The Logistics Performance Index and Its Indicators



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Connecting to Compete 2023

Trade Logistics in an Uncertain Global Economy

The Logistics Performance Index and Its Indicators

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Abbreviations

COVID-19	Coronavirus Disease 2019
EDI	Electronic Data Interchange
GDP	Gross Domestic Product
LPI	Logistics Performance Index
TIR	Transports Internationaux Routiers (Routiers, a road transit system)
UN	United Nations
UNLOCODE	United Nations Code for Trade and Transport Locations
UPU	Universal Postal Union

2023 LPI scores

Economy	LPI score	Customs score	Infra-structure score	Interna-tional shipments score	Logistics competence and quality score	Time-liness score	Tracking and tracing score
Singapore	4.3	4.2	4.6	4.0	4.4	4.3	4.4
Finland	4.2	4.0	4.2	4.1	4.2	4.3	4.2
Denmark	4.1	4.1	4.1	3.6	4.1	4.1	4.3
Germany	4.1	3.9	4.3	3.7	4.2	4.1	4.2
Netherlands	4.1	3.9	4.2	3.7	4.2	4.0	4.2
Switzerland	4.1	4.1	4.4	3.6	4.3	4.2	4.2
Austria	4.0	3.7	3.9	3.8	4.0	4.3	4.2
Belgium	4.0	3.9	4.1	3.8	4.2	4.2	4.0
Canada	4.0	4.0	4.3	3.6	4.2	4.1	4.1
Hong Kong SAR, China	4.0	3.8	4.0	4.0	4.0	4.1	4.2
Sweden	4.0	4.0	4.2	3.4	4.2	4.2	4.1
United Arab Emirates	4.0	3.7	4.1	3.8	4.0	4.2	4.1
France	3.9	3.7	3.8	3.7	3.8	4.1	4.0
Japan	3.9	3.9	4.2	3.3	4.1	4.0	4.0
Spain	3.9	3.6	3.8	3.7	3.9	4.2	4.1
Taiwan, China	3.9	3.5	3.8	3.7	3.9	4.2	4.2
Korea, Rep.	3.8	3.9	4.1	3.4	3.8	3.8	3.8
United States	3.8	3.7	3.9	3.4	3.9	3.8	4.2
Australia	3.7	3.7	4.1	3.1	3.9	3.6	4.1
China	3.7	3.3	4.0	3.6	3.8	3.7	3.8
Greece	3.7	3.2	3.7	3.8	3.8	3.9	3.9
Italy	3.7	3.4	3.8	3.4	3.8	3.9	3.9
Norway	3.7	3.8	3.9	3.0	3.8	4.0	3.7
South Africa	3.7	3.3	3.6	3.6	3.8	3.8	3.8
United Kingdom	3.7	3.5	3.7	3.5	3.7	3.7	4.0
Estonia	3.6	3.2	3.5	3.4	3.7	4.1	3.8
Iceland	3.6	3.7	3.6	3.3	3.5	3.6	3.7
Ireland	3.6	3.4	3.5	3.6	3.6	3.7	3.7
Israel	3.6	3.4	3.7	3.5	3.8	3.8	3.7
Luxembourg	3.6	3.6	3.6	3.6	3.9	3.5	3.5
Malaysia	3.6	3.3	3.6	3.7	3.7	3.7	3.7
New Zealand	3.6	3.4	3.8	3.2	3.7	3.8	3.8
Poland	3.6	3.4	3.5	3.3	3.6	3.9	3.8
Bahrain	3.5	3.3	3.6	3.1	3.3	4.1	3.4
Latvia	3.5	3.3	3.3	3.2	3.7	4.0	3.6
Qatar	3.5	3.1	3.8	3.1	3.9	3.5	3.6
Thailand	3.5	3.3	3.7	3.5	3.5	3.5	3.6
India	3.4	3.0	3.2	3.5	3.5	3.6	3.4
Lithuania	3.4	3.2	3.5	3.4	3.6	3.6	3.1
Portugal	3.4	3.2	3.6	3.1	3.6	3.6	3.2
Saudi Arabia	3.4	3.0	3.6	3.3	3.3	3.6	3.5
Türkiye	3.4	3.0	3.4	3.4	3.5	3.6	3.5
Croatia	3.3	3.0	3.0	3.6	3.4	3.2	3.4
Czechia	3.3	3.0	3.0	3.4	3.6	3.7	3.2
Malta	3.3	3.4	3.7	3.0	3.4	3.2	3.4
Oman	3.3	3.0	3.2	3.4	3.2	3.1	3.9
Philippines	3.3	2.8	3.2	3.1	3.3	3.9	3.3
Slovak Republic	3.3	3.2	3.3	3.0	3.4	3.5	3.3
Slovenia	3.3	3.4	3.6	3.4	3.3	3.3	3.0
Vietnam	3.3	3.1	3.2	3.3	3.2	3.3	3.4
Brazil	3.2	2.9	3.2	2.9	3.3	3.5	3.2
Bulgaria	3.2	3.1	3.1	3.0	3.3	3.5	3.3
Cyprus	3.2	2.9	2.8	3.1	3.2	3.5	3.4
Hungary	3.2	2.7	3.1	3.4	3.1	3.6	3.4
Kuwait	3.2	3.2	3.6	3.2	2.9	2.8	3.3
Romania	3.2	2.7	2.9	3.4	3.3	3.6	3.5
Botswana	3.1	3.0	3.1	3.0	3.4	3.3	3.0
Egypt, Arab Rep.	3.1	2.8	3.0	3.2	2.9	3.6	2.9
North Macedonia	3.1	3.1	3.0	2.8	3.2	3.5	3.2
Panama	3.1	3.0	3.3	3.1	3.0	3.4	2.9
Bosnia and Herzegovina	3.0	2.7	2.6	3.1	2.9	3.2	3.2
Chile	3.0	3.0	2.8	2.7	3.1	3.2	3.0
Indonesia	3.0	2.8	2.9	3.0	2.9	3.3	3.0
Peru	3.0	2.6	2.5	3.1	2.7	3.4	3.4
Uruguay	3.0	2.9	2.7	2.7	3.1	3.2	3.3
Antigua and Barbuda	2.9	2.2	2.7	2.9	2.9	3.4	3.2
Benin	2.9	2.7	2.5	2.9	3.0	2.7	3.2
Colombia	2.9	2.5	2.9	3.0	3.1	3.2	3.1
Costa Rica	2.9	2.8	2.7	2.8	2.9	3.2	2.9
Honduras	2.9	2.8	2.7	3.0	2.7	3.2	2.6
Mexico	2.9	2.5	2.8	2.8	3.0	3.5	3.1
Namibia	2.9	2.8	2.8	3.0	2.9	2.9	2.8
Argentina	2.8	2.7	2.8	2.7	2.7	3.1	2.9
Montenegro	2.8	2.6	2.5	2.8	2.8	3.2	3.2
Rwanda	2.8	2.5	2.9	2.4	3.0	3.1	3.0
Serbia	2.8	2.2	2.4	2.9	2.7	3.4	2.9
Solomon Islands	2.8	2.4	2.6	2.9	2.9	3.2	2.9
Sri Lanka	2.8	2.5	2.4	2.8	2.7	3.3	3.0
Bahamas, The	2.7	2.7	2.5	3.1	2.5	3.0	2.6
Belarus	2.7	2.6	2.7	2.6	2.6	3.1	2.6
Djibouti	2.7	2.6	2.3	2.5	2.8	3.6	2.7
El Salvador	2.7	2.4	2.2	2.6	2.7	3.2	2.9
Georgia	2.7	2.6	2.3	2.7	2.6	3.1	2.8
Kazakhstan	2.7	2.6	2.5	2.6	2.7	2.9	2.8
Papua New Guinea	2.7	2.4	2.4	2.6	2.7	3.3	3.0
Paraguay	2.7	2.4	2.5	2.7	2.6	3.0	2.8
Ukraine	2.7	2.4	2.4	2.8	2.6	3.1	2.6
Bangladesh	2.6	2.3	2.3	2.6	2.7	3.0	2.4
Congo, Rep.	2.6	2.3	2.1	2.6	2.9	2.9	2.7
Dominican Republic	2.6	2.6	2.7	2.4	2.6	3.1	2.4
Guatemala	2.6	2.3	2.4	2.8	2.7	2.6	2.7
Guinea-Bissau	2.6	2.7	2.4	2.9	2.9	2.4	2.3
Mali	2.6	2.6	2.0	2.6	2.5	3.1	2.7
Nigeria	2.6	2.4	2.4	2.5	2.3	3.1	2.7
Russian Federation	2.6	2.4	2.7	2.3	2.6	2.9	2.5
Uzbekistan	2.6	2.6	2.4	2.6	2.6	2.8	2.4
Albania	2.5	2.4	2.7	2.8	2.3	2.5	2.3
Algeria	2.5	2.3	2.1	3.0	2.2	2.6	2.5
Armenia	2.5	2.5	2.6	2.2	2.6	2.7	2.3
Bhutan	2.5	2.7	2.2	2.3	2.6	2.6	2.3
Central African Republic	2.5	2.4	2.6	2.1	2.9	2.6	2.4
Congo, Dem. Rep.	2.5	2.3	2.3	2.5	2.4	2.8	2.5
Ghana	2.5	2.7	2.4	2.4	2.5	2.7	2.2
Grenada	2.5	2.6	2.5	2.6	2.2	3.1	2.3
Guinea	2.5	2.4	2.4	2.2	2.7	2.5	2.7
Jamaica	2.5	2.2	2.4	2.4	2.5	2.9	2.8
Mauritius	2.5	2.4	2.5	1.9	2.5	3.1	2.9
Moldova	2.5	1.9	1.9	2.7	2.8	3.0	2.8
Mongolia	2.5	2.5	2.3	2.5	2.3	2.7	2.4
Nicaragua	2.5	2.0	1.9	2.8	2.8	2.9	2.4
Tajikistan	2.5	2.2	2.5	2.5	2.8	2.9	2.0
Togo	2.5	2.3	2.3	3.0	2.4	2.8	2.3
Trinidad and Tobago	2.5	2.2	2.4	2.5	2.4	2.9	2.5
Zimbabwe	2.5	2.2	2.4	2.5	2.3	2.8	2.7
Bolivia	2.4	2.1	2.4	2.5	2.4	2.4	2.5
Cambodia	2.4	2.2	2.1	2.3	2.4	2.7	2.8
Gabon	2.4	2.0	2.2	2.6	2.0	3.0	2.5
Guyana	2.4	2.3	2.4	2.1	2.6	2.6	2.2
Iraq	2.4	2.1	2.2	2.5	2.2	3.0	2.4
Lao PDR	2.4	2.3	2.3	2.3	2.4	2.8	2.4
Liberia	2.4	2.1	2.4	2.8	2.4	2.3	2.4
Sudan	2.4	2.1	2.3	2.4	2.4	2.7	2.3
Burkina Faso	2.3	2.0	2.3	2.4	2.4	2.4	2.2
Fiji	2.3	2.3	2.2	2.3	2.3	2.3	2.2
Gambia, The	2.3	1.8	2.3	2.6	2.3	2.6	2.4
Iran, Islamic Rep.	2.3	2.2	2.4	2.4	2.1	2.7	2.4
Kyrgyz Republic	2.3	2.2	2.4	2.4	2.2	2.4	2.3
Madagascar	2.3	1.8	1.8	2.9	2.2	2.6	2.0
Mauritania	2.3	2.1	2.0	2.2	2.5	2.8	2.5
Syrian Arab Republic	2.3	2.2	2.2	2.3	2.2	2.5	2.3
Venezuela, RB	2.3	2.1	2.4	2.0	2.5	2.5	2.3
Cuba	2.2	2.0	2.2	2.1	2.2	2.6	2.4
Yemen, Rep.	2.2	1.7	1.9	1.7	2.6	2.8	2.3
Angola	2.1	1.7	2.1	2.4	2.3	2.1	2.3
Cameroon	2.1	2.1	2.1	2.2	2.1	2.1	1.8
Haiti	2.1	2.1	1.8	2.3	2.0	2.5	2.1
Somalia	2.0	1.5	1.9	2.4	1.8	2.3	1.8
Afghanistan	1.9	2.1	1.7	1.8	2.0	2.3	1.6
Libya	1.9	1.9	1.7	2.0	1.9	2.2	1.8

Key messages

- **The 2023 edition includes an extended dataset consisting of (i) the survey-based Logistics Performance Index (LPI), which results from the traditional LPI survey of logistics professional and (ii) new key performance indicators (KPI) measuring the actual speed of trade around the world.** The new KPI are derived from large global tracking datasets (Big Data) covering shipping containers, air cargo, and parcels. The new KPIs are not yet included in the construction of the main LPI indicators (country scores and ranks), which remain solely based on the LPI survey. The two categories of indicators provide a complementary yet consistent understanding of logistics performance. The KPI measure time or count the performance of specific links (e.g. delays at port or airports), while the survey-based LPI provides country-wide assessments of six aspects of logistics performance: trade- and transport-related infrastructure, customs and border management, logistics services quality, timeliness of shipments, ability to track and trace, and the availability of competitively priced international shipments.

- **Logistics services were broadly resilient for both top performers and bottom performers in the Logistics Performance Index (LPI), despite a more challenging operating environment.** Even with the COVID-19 pandemic–induced disruptions to shipping and the global supply chain crisis, the average overall score in the 2023 LPI was broadly the same as in the last survey in 2018. This resilience partly reflects the robustness of the LPI survey, which captures structural factors that were not directly affected by the recent crisis, such as the quality of infrastructure or customs. The 10 countries with the best logistics performance continued to offer high-caliber logistics—rated 4.1 out of 5 on average compared with 4.0 in 2018. The average rating of the 10 poorest performers did not fall, despite challenging circumstances, and remained at 2.1 out of 5, as in 2018. But the 2023 edition included 21 fewer countries, many of them low-income, than the 2018 edition.

- **Mid-level logistics performers are showing progress.** More countries scored higher in the LPI compared with previous years. The average overall country score has steadily risen over the past decade, with more countries clustered at an overall score of 3 to 4.

- **Supply chain reliability is critical.** For containers, the average time across all potential trade routes from entering the port of export to exiting the destination port is 44 days, with a standard deviation of 10.5 days. About 60 percent of the time it takes to trade goods internationally is spent at sea. But the biggest delays occur when containers are held up at the origin or destination—at ports, airports, or multimodal facilities. Policies targeting these facilities, such as investing in port productivity, modernizing customs, and new technologies, can improve reliability.

- **Performance transcends income.** This is especially apparent with new key performance indicators, such as the time containers spent in ports (dwell time). Emerging

economies tend to have shorter delays than industrialized economies, possibly because of the lingering effects of the 2021–22 supply chain crisis, the effects of Russia's invasion of Ukraine on logistics in Europe, and the leapfrogging of richer economies in port productivity and digitalization of end-to-end supply chains. Middle-income countries with consistent performance across the six LPI components could outperform both their peers and more advanced countries.

Policy highlights

- **Improving customs and infrastructure matters most for raising the overall score of bottom performers.** The performance of customs and border agencies, as well as the quality of trade- and transport-related infrastructure, is particularly weak in the lowest performing countries. These countries, many of them in the Middle East and North Africa and in Sub-Saharan Africa, experience much longer delays than advanced and emerging economies and many middle-income countries. On average, export delays are of the same magnitude as import delays but for different reasons: export delays are tied more to the quality of service or to economies of scale.

- **Addressing bottlenecks in landlocked developing countries is beyond the scope of unilateral interventions and requires coordinated interventions across borders, such as introducing robust transit regimes.** The LPI is closely associated with connectivity indicators such as the number of maritime or aerial connections. Landlocked developing countries face long delays in transit countries, and small island states depend on transshipment and suffer from less frequent connections, which increases lead time and reduces reliability.

- **Environmentally sustainable logistics options can lessen the carbon footprint of supply chains and keep trade moving.** Environmentally friendly options include shifting to less carbon-intensive freight modes, more energy-efficient warehousing, or better capacity utilization. Demand for green shipping options is highest (75 percent) for exports to countries in the top two performance quintiles and lower for exports to countries in the middle (over 20 percent) and bottom two (10 percent) quintiles.

Executive summary

This seventh edition of *Connecting to Compete* comes as disruptions of global value chains have revealed the crucial importance of logistics systems. Because of these disruptions, supply chain resilience and its national security implications have emerged as top concerns. These concerns are often linked with supply chain security, including cybersecurity—a key consideration in a highly digitalized and globally connected service industry.

This report presents the latest view on trade logistics performance across 139 countries. Logistics is understood as a network of services that support the physical movement of goods, trade across borders, and commerce within borders. It comprises transportation, warehousing, brokerage, express delivery, terminal operations, and related data and information management.

Previous editions of this report have relied exclusively on a survey of logistics professionals. This edition introduces a new set of key performance indicators, derived from a Big Data approach, on actual movements of maritime shipping containers, air freight, and postal parcels by trade lane and gateway. These indicators complement the traditional survey-based Logistics Performance Index (LPI), on which LPI scores and ranks are still based. The survey asks a given country's partners to assess how easy or difficult it is to trade in manufactured products transported in unit forms such as shipping containers. The six components of the LPI, unchanged since its launch in 2007, are assessed at the country level on a 5-point scale.[1]

The 2023 LPI survey was conducted from September 6 to November 5, 2022. It contains 4,090 country assessments by 652 logistics professionals in 115 countries in all World Bank regions.[1][2] Unlike previous editions, the 2023 survey did not contain questions on logistics quality in the country from which these professionals operate—that is, an assessment of domestic performance—in order to keep the survey concise and easier to answer. The team also faced difficulties in conducting the survey in 2020/21 due to the COVID-19 pandemic, eventually postponing the survey to 2022.

The LPI measures structural factors of performance, beyond disruptions

The recent supply chain crisis did not substantially change the relative pattern of LPI scores in 2023, except for a slight deterioration of the timeliness component. There are several possible reasons behind this outcome:

- The global scope of the disruptions means that when everyone is affected, it is difficult to assign the impact to individual countries.
- The LPI survey was conducted in late 2022, when disruptions had already greatly diminished, possibly creating recency bias among respondents.
- Most LPI components reflect structural factors that are not directly affected by the recent crisis, such as the quality of infrastructure.
- Shippers and logistics service providers have generally been able to absorb the disruptions well, as indicated by the rebound in GDP growth in most countries.[3]

Logistics performance remained stable or improved, but a gap persisted between the top and bottom performers

Overall, the score profile of countries covered in the LPI has remained stable, despite the more challenging operational environment

Table 1 Top 10 and bottom 10 average LPI scores, 2007–23 (1, low, to 5, high)

	2007	2010	2012	2014	2016	2018	2023[a]
Top 10 average	4.1	4.0	4.0	4.0	4.1	4.0	4.1[b]
Bottom 10 average	1.8	2.1	2.0	2.1	1.9	2.1	2.1

Source: 2007, 2010, 2012, 2014, 2016, 2018, and 2023 Logistics Performance Index.
a. Data are for 2022.
b. Average is for the top 12 scores due to rounding scores to one decimal point in 2023 rather than two as in previous editions.

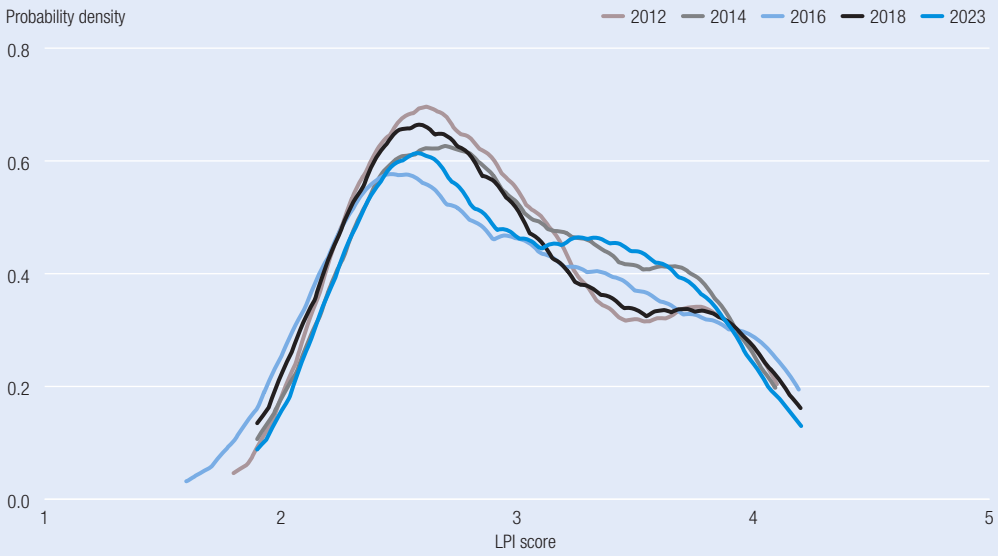
since 2018. This reflects logistics service providers' ability to adapt to dramatically changing circumstances—but it could also indicate the robustness of underlying data across LPI editions (table 1). Average scores among low-performing countries have increased over time.

In the 2023 LPI, the top 12 scorers are high-income economies. Singapore, with a score of 4.3, is at the top, a position it also held in 2007 and 2012. Of the top 12 scorers, 8 are in Europe (Finland, scoring 4.2; Denmark, the Netherlands, and Switzerland, scoring 4.1; and Austria, Belgium, Germany, and Sweden, scoring 4.0). They are joined by Hong Kong SAR, China; the United Arab Emirates; and Canada. Most of these economies have for years been dominant players across international supply chain networks.

The bottom 10 scorers are mostly low- and lower-middle-income countries and are located on several continents. They are either fragile economies affected by armed conflict, natural disasters, or political unrest or landlocked countries challenged by geography or economies of scale in connecting to global supply chains. Afghanistan and Libya have the lowest score (1.9), followed by Somalia (2.0), Angola, Cameroon, and Haiti (2.1).

The most frequent LPI score has increased over the past decade, implying that logistics performance overall has improved (figure 1). Between 2018 and 2023, a secondary, smaller peak emerged around a score of 3.5, meaning that more countries have relatively strong performance. In addition, the lowest scores have tended to increase, particularly in the 2023 LPI, but this is due partly to a sample of 139 countries compared with 160 in 2018. The 2018 sample included 20 countries with a score of 2.6 or

Figure 1 Distribution of LPI scores, 2012–23



Source: 2012, 2014, 2016, 2018, and 2023 Logistics Performance Index.
Note: To avoid composition effects, only countries with scores in all years are included in the analysis.

below (and an average score of 2.4) that were not included in the 2023 sample. This makes comparing the bottom tail difficult between the two years.

Despite this, a considerable gap in performance persists between the top and bottom scorers. Although the average score of low performers has increased, some countries have stayed at their previous levels. These are typically the poor logistics performers—those with severe logistics constraints (43 countries in the bottom performance quintile).[4] Partial performers have logistics constraints typically seen in low- and middle-income countries (46 countries in the middle quintile and the second quintile from the bottom). Countries in the top two performance groups typically received slightly higher scores in the 2023 LPI than in 2018 and earlier. They include consistent performers, countries rated better on logistics performance than most others in their income group (25 countries in the second quintile from the top)—and logistics-friendly countries, the top scorers, most of which are high income (25 countries in the top quintile).

Strong overall logistics performance is driven by good performance across all six LPI components

Several trends observed in past LPI reports still hold. The timeliness component outperforms the other components in all performance quintiles, except the top one, whereas the performance of customs and border agencies underperforms the other components. The quality of trade and transport infrastructure remains below the overall LPI score in the bottom three quintiles. But there is a clear deterioration in timeliness scores in absolute terms in all quintiles due to the effects of the supply chain crisis, which were felt most acutely in shipment delays. While absolute scores fell, the relative pattern of performance persisted.

The quality of logistics services is on par with overall performance, but the tracking and tracing component is as good as or better than overall performance in almost all performance quintiles. Taken as a whole, the LPI suggests that overall performance reflects the ability to perform well across all components—possibly indicating complementarity among them, as all stages of the value chain matter. Poor performance in one component drags down overall performance.

For countries with low LPI scores, infrastructure matters most to improving performance. But the key to sustained high logistics performance lies in a broader set of interventions covering policy and private sector development. One important objective should be to better predict when goods will arrive at their destination, as with supply chain visibility tools that facilitate traceability.

Measuring the speed of trade: New key performance indicators

This edition of *Connecting to Compete* incorporates new key performance indicators, derived from a Big Data approach, measuring the speed of trade around the world. These indicators are based on millions of actual international movements of containers, aviation shipments, and postal parcels. Global tracking initiatives—including Cargo iQ (supported by the International Air Transport Association), TradeLens, and the Universal Postal Union—made the raw data available to the World Bank.

The key performance indicators complement the assessment of logistics performance provided by the survey-based LPI with more specific measurements: Delays at ports and airports and international connectivity (for example, the number of international connections by country and by mode). The new indicators, measured in days or simple counts, are relatable to policymakers and practitioners concerned with the performance of key logistics hubs and gateways, such as ports or airports.

A more complex picture of trade bottlenecks

Understanding performance requires looking beyond average shipment times. Lead time (delay) of connections in international supply chains is widely dispersed and skewed to the

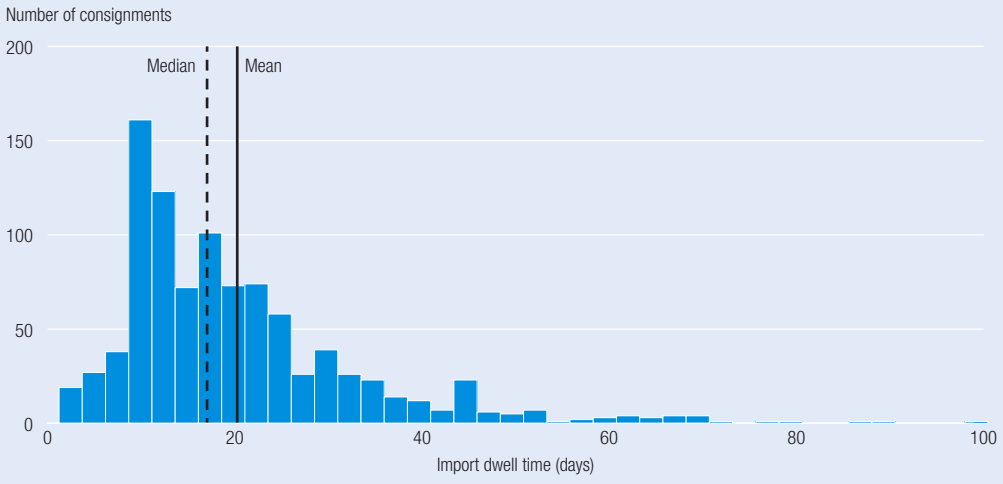
right of the mean, meaning there are many outliers with high dwell times.[5] The long tail of the distribution makes lengthy delays likely for the slowest shipments (see figure 2 for an example using the port of Algiers in Algeria). It means that they lack of reliability across the supply chain is more important than the average delay at links of the supply chain, especially if traceability along the supply chain and information flows are lost. Being unable to locate or predict the movement of containers—because, for example, they are stalled on ships or arbitrarily held up in customs—matters a lot to consignees.

Trade experiences much more dispersion in delays when not moving at ports, airports, or multimodal facilities than when moving on ships. Most time (two-thirds, on average) is spent in transit. Policies targeting these facilities, such as investing in port productivity or modernizing customs, can improve reliability. New technologies, such as supply chain visibility platforms, are even more promising.

Average delays at ports, at airports, or in postal delivery tend to be negatively correlated with a country's overall LPI score. Long delays are a sign of performance problems, but short delays do not necessarily indicate high overall logistics performance. Take import dwell time, or the mean time containers stay at ports before being removed for delivery: Most countries have dwell times of three to nine days. Few countries have a dwell time of more than 12 days. Delays can be caused by such factors as low port handling productivity, city congestion, slow preparation of trade documents to comply with exchange controls, or abuse of port storage by importers. Most outliers are in the Middle East and in North, Central, and West Africa. Similar patterns apply to aviation logistics, with shorter delays (typically one-third as long) and substantial overlaps of outliers.

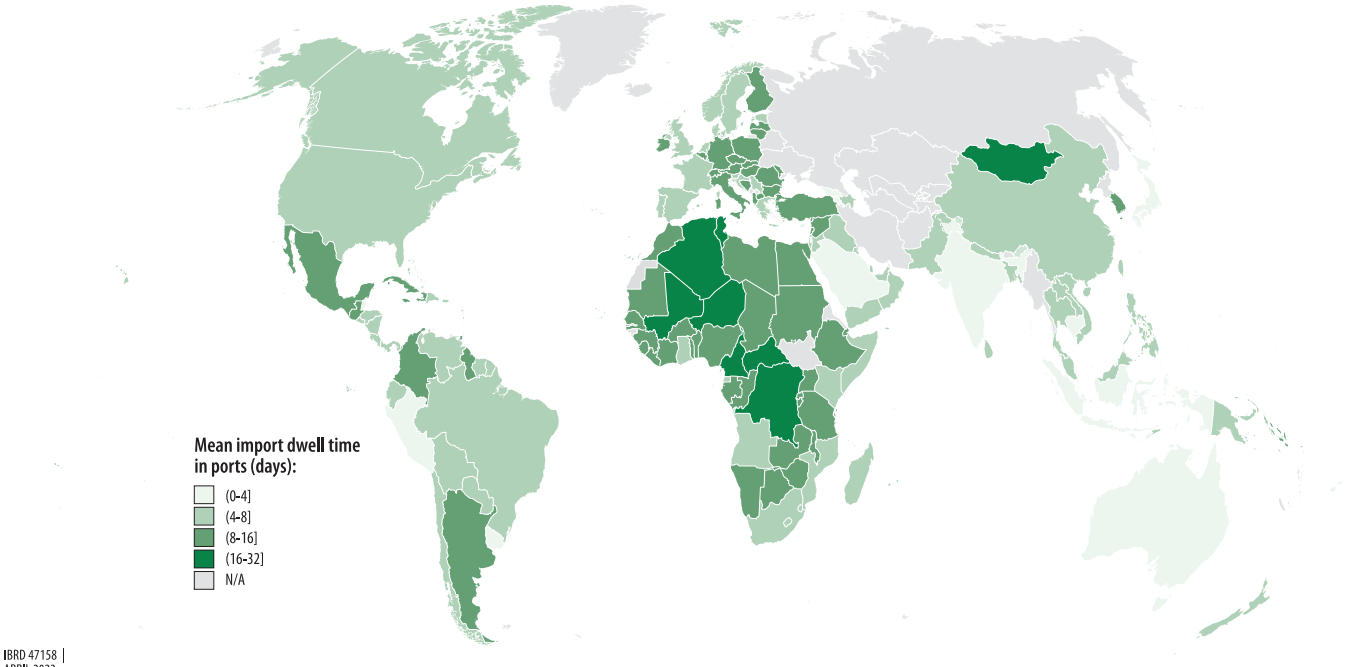
Dwell time is not clearly associated with income (map 1). Countries in Europe and North America do worse on this metric than other high-income and emerging economies. Singapore, for example, has a dwell time of around three days compared with more than seven for the United States. The recent turmoil in global logistics is a first explanation (the data on container movements are for May–October 2022). Countries in Northern Europe have been weathering the ripple impact of sanctions on Russian shipping. Emerging economies may also benefit from more recent investments in soft and hard port infrastructure. As for aviation logistics, airport dwell time is shorter than maritime dwell time, typically by a factor of three. Airport dwell time follows the same patterns as maritime dwell time, with substantial overlaps of outliers for both modes.

Figure 2 **Dispersion of time spent at port: Long tail distribution of containers in the port of Algiers, Algeria, May–October 2022**



Source: World Bank estimates based on TradeLens data.
Note: Consignments with an import dwell time of more than 100 days are excluded.

Map 1 **Mean import dwell time of containers around the world, May–October 2022**



Source: TradeLens and World Bank.

Landlocked developing countries and the importance of connectivity

Landlocked developing countries are logistically constrained. They may have short delays at destinations (for imports) but longer delays on transit corridors and at the port of entry. On average, the dwell time at the same port of entry is substantially longer for landlocked developing countries than for their coastal transit countries. Addressing these bottlenecks is beyond the scope of unilateral interventions and requires coordinated interventions across borders, such as robust transit regimes similar to the ones implemented in Europe (Transports Internationaux Routiers and the European transit system).

Connectivity, measured as the number of transport connections, is associated with logistics performance, irrespective of transport mode.[6] Having more connectivity options is positively associated with logistics performance through, for example, increasing competition for logistics services, higher hard and soft trade infrastructure investments (such as ports and information technology systems), the growing presence of global logistics operators, and exposure to best practices.

Transport connectivity is driven largely by economies of scale and the geography of global networks. Conversely, countries with few maritime connections, such as small maritime economies, trade through a chain of container transshipment ports. Transshipment hubs have a similar dispersion in port dwell time as destination ports. Small maritime economies experience not only longer lead time to trade but also less reliable connections, contributing to lower logistics performance. This is due to dependence on only a few transshipment hubs, which are able to charge markups; the higher cost of going through a transshipment hub than exporting from a full-fledged port; and—chiefly—the extra delays and lower reliability induced by transshipment.

Mounting regulatory and demand pressure toward environmental sustainability

As in 2018, the LPI survey links environmental sustainability and logistics performance by

asking how often shippers have asked for environmentally friendly options when sending goods to the surveyed countries.[7] The wording in this question is general because of the numerous shipping options and ways to measure their environmental impact. Environmentally friendly options in logistics range from shorter routes, source of propulsion, or better capacity utilization to minimize transport emissions. Therefore, the findings are indicative of the prevalence of such needs among shippers, as encountered by freight forwarding and logistics professionals.

Almost 75 percent of shippers had asked for such options "often" or "nearly always" when exporting to countries in the top two performance quintiles.[8] The share was slightly over 20 percent when exporting to countries in the middle performance quintile and well below 10 percent to countries to the two lowest performance quintiles. Despite the variation, demand forces are an important factor pushing logistics operations in a more sustainable direction (also see map A6.1 in appendix 6).

This trend is in line with the increasing number of global and national commitments to reduce logistics-related greenhouse gas emissions and other harmful emissions, for which targets are becoming ever more challenging in all transport modes. This regulatory pressure is mounting in air, road, and maritime transport. It drives the change to more environmentally friendly logistics processes and equipment, especially when they can generate economic savings. The pressure from demand forces is gaining momentum, particularly in high-income countries. For policymakers this means that the search for implementable "green logistics" policies is becoming more important.

CHAPTER 1

Key changes in global supply chains since 2018 and implications for the 2023 Logistics Performance Index

This seventh edition of *Connecting to Compete* complements the Logistics Performance Index (LPI) survey results with information derived from a Big Data approach using technological advances in tracking shipments across different modes of transport. A deeper understanding of logistics processes at the micro level is important in light of changing realities on the ground. Since its launch in 2007, the LPI has provided a simple assessment by professional sources of how easy it is to export to a target country in terms of the quality of infrastructure, the quality and availability of logistics activities, and public sector bottlenecks. The LPI and its components are best interpreted as a snapshot of where a country stands on logistics with respect to its peers or comparators. As such, it can serve as an entry point to a more comprehensive measurement of a country's logistics performance.

Understanding logistics performance and its determinants is now more important than ever

Measuring logistics performance and understanding its determinants are now more important than ever against a background of major changes in global markets since 2018 due to the COVID-19 pandemic, subsequent shipping and air freight disruptions (the latter from restrictions imposed on passenger air transport), and Russia's invasion of Ukraine (see also box 1.1 on vaccine logistics). During the COVID-19 pandemic, demand for some types of goods, such as electronics and home appliances, rose, while production and transport capacity fell. For example, the demand for microchips, a crucial component in electronics and most manufacturing industries, surged, but their supply was hampered by droughts and accidents in several major production sites—in addition to the effects of the pandemic. In many countries, the pandemic also affected the availability of truck drivers, train engineers, and port and warehouse workers, and it complicated crew changes on seagoing vessels. Some countries also applied strict zero-COVID policies, with extensive local lockdowns.

Energy and food prices increased because of discontinued exports from Belarus, Russia, and Ukraine in the wake of Russia's invasion of Ukraine. This generated cascading effects such as exports bans and overshooting demand. Container shipping was affected when most services to and from Russia were discontinued. Russia's and Belarus's trade and transport connections with Europe were largely cut off, including flights over Russian airspace and container rail services between Europe and Asia through Russia.

Container shipping disruptions in 2020–22

Container ships carry over half of world trade by value and, until early 2020, offered high reliability at low freight rates. Since then, freight rates have soared to unprecedented levels, and capacity constraints in seaports, vessels, and container availability have become endemic. As a result, service reliability plummeted to an all-time low toward the end of 2021 (figure 1.1). In summer 2022, about 12 percent of the world's container carrying capacity was onboard vessels outside seaports waiting to be unloaded.[9] Many of these bottlenecks could be traced to port lockdowns in East Asia or productivity constraints on the US West Coast, but with global impacts on shipping capacity and cascading effects along the supply chains. Toward the end of 2022, these problems eased considerably, and container freight rates are returning to pre–COVID-19 pandemic levels as demand drops.

Box 1.1 Vaccine logistics

Vaccines are vital public health products, even more so during the global COVID-19 pandemic. But many vaccines have special handling requirements that require substantial logistics capacity in sending and receiving countries. For instance, some COVID-19 vaccines have cold chain supply requirements—high-level logistics competence that many countries lack.

Logistics bottlenecks can contribute to slow movement of vaccines to and within countries. Better logistics performance is associated with higher vaccination rates, even after per capita income and government spending on health are controlled for.[1] A review of a range of studies on logistics requirements concluded that an efficient and resilient supply chain—which depends on strong logistics—was vital to ensuring that the COVID-19 vaccines reached their target populations.[2] Efficient cold chain management depends on regulatory requirements, logistics performance, and the chemical stability of the goods being moved.

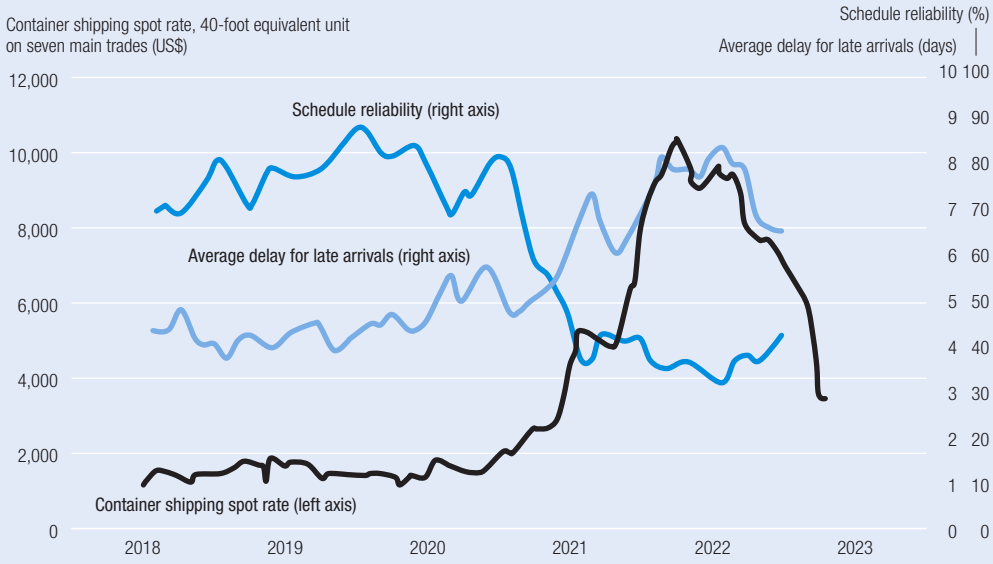
The capacity of logistics service providers is a key determinant of cold chain supply performance for vaccines.[3] Targeted investment along with strategic planning can mitigate the challenges posed by cold chain supply requirements for vaccines.[4]

The COVID-19 pandemic has resulted in huge losses, including in lives and livelihoods, around the world. Ensuring that vaccines are widely distributed on an ongoing basis is important not only from an equity point of view but also as part of support to the global economy. Given the special requirements of vaccines, logistics service providers can play an important role in realizing this vision.

Notes

1. Helble and Shepherd 2017.
2. Fahrni and others 2022.
3. Pambudi and others 2021.
4. Fleming, Okebukola, and Skiba 2021.

Figure 1.1 Container shipping schedule reliability, average delay for late arrivals, and spot rates, June 2018–22



Source: Data on schedule reliability and delays, Sea-Intelligence; data on spot rates, Drewry World Container Composite Index.

Air freight market disruptions in 2020–22

Approximately US$6 trillion worth of goods—35 percent of world trade by value—is transported each year as air freight.[10] The overall demand for international air freight has been stable since 2018. Variation in the supply by widebody passenger aircraft, which is offset only partly by changes in the capacity offered by dedicated air freighters, seems to drive air freight pricing. Before the COVID-19 pandemic, about half of air freight was carried in scheduled passenger aircraft. Ad hoc fluctuations in rates can happen due to a sudden local change in demand. Attracted by higher rates, nonscheduled freighter capacity usually takes several weeks to adjust supply and push prices to a new equilibrium (figure 1.2). Since January 2022, air freight prices have declined due to increased passenger widebody aircraft capacity on many routes. This happened first on transatlantic routes and later on most Europe–Asia routes.

The rapid emergence of e-commerce as an important channel for cross-border trade

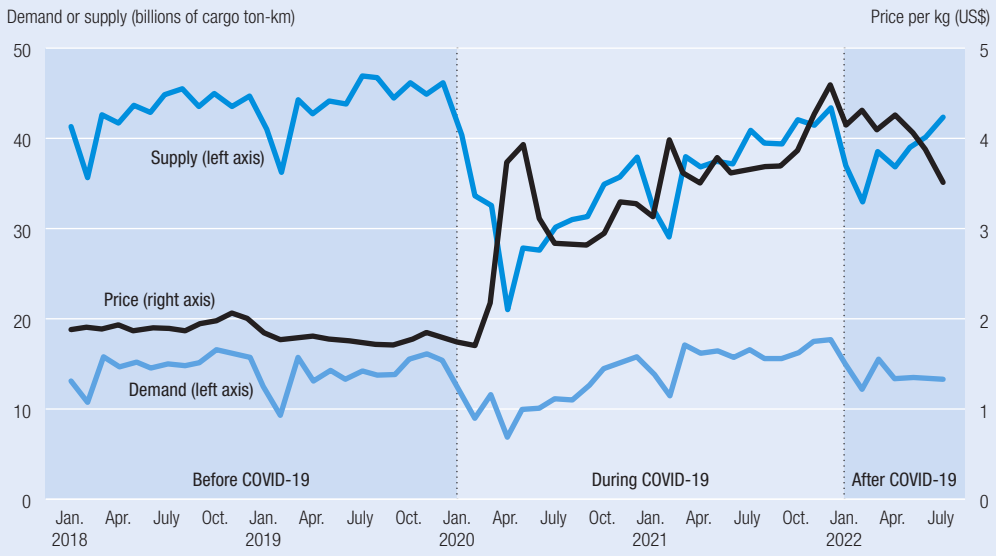
The volume of e-commerce has surged in the past decade. By 2030, cross-border e-commerce in goods is expected to grow to US$1–US$2 trillion in merchandise value from its current US$300 billion, resulting in substantial changes in supply chains.[11] E-commerce was equivalent to 30 percent of global GDP in 2019,[12] so its role and importance in economic development cannot be overlooked. Most cross-border e-commerce depends on postal-parcel services provided by members of the Universal Postal Union (a specialized UN agency) or the networks of global express operators (for example, DHL, FedEx, and UPS).

Universal Postal Union members handle two-thirds of cross-border deliveries of letter-parcel items (up to 2 kilograms). Therefore, information collected by the union is a source of comprehensive data for more than 190 member countries. It is probably the best unified source of information on e-commerce trade.[13]

The 2023 LPI measures structural factors of performance rather than supply chain disruptions

The recent supply chain crisis did not substantially change the relative pattern or even absolute scores in the 2023 LPI across countries compared with previous editions, except for a slight deterioration of the timeliness component since 2018. This may seem odd, given the severity of the

Figure 1.2 **Global air freight supply, demand, and prices, January 2018–July 2022**



Source: Dewulf and Van Broekstaele (2022) based on data from the Freightos Air Index, Cargo iQ (supported by the International Air Transport Association), and WorldACD.

impacts on container shipping freight and service levels, changes in air freight markets, various restrictions during the COVID-19 pandemic, and discontinued trade relations and cargo lanes. One possible explanation is the global scope of the supply chain crisis. With practically everybody affected by disruptions beyond their control almost simultaneously, it is difficult to assign the impact on individual countries.

In addition, the survey data were collected when supply chain disruptions had already greatly diminished. For example, the Global Supply Chain Pressure Index, a composite measure of global supply chain disruptions, peaked at 4.3 standard deviations above its historical mean at the end of 2021, declined to 2.8 in March 2022, temporarily increased in April 2022 due primarily to COVID-19 pandemic lockdowns in China and Russia's invasion of Ukraine, then declined for five months to almost normal levels (0.9) in September 2022, when the LPI survey went live. This may have contributed to recency bias among respondents.

Further, four of the six LPI components reflect deep structural factors that are not directly affected by the recent supply chain crisis (ease of working with customs and other border agencies, infrastructure, logistics services quality, and the ability to track and trace shipments). Performance on these metrics may have improved due to policy reforms and private sector capacity building over time, despite the constraints imposed by recent conditions. These factors also improve resilience against shocks.

New indicators based on tracking data, such as the time containers stay in ports or airports, look at the speed of trade. By nature they are more affected by major disruptions such as the recent ones than the survey-based LPI. With the exception of the postal data (which is for 2019), the data cover the same period as the LPI survey, mid-2022. The results are likely to be affected by the tail of the supply chain crisis or Russia's invasion of Ukraine (see map 1 in the executive summary). Unfortunately, precrisis data are not available for comparison.

Box 1.2 The 2023 LPI survey question on supply chain disruptions

This year's survey included a question on disruptions in logistics operations since 2019. The effects were far from equal across countries. Among respondents dealing with exports to high-income countries, 13 percent reported that operations had suffered major disruptions or had been discontinued. The same was true for 59 percent of those exporting to middle-income countries and for 75 percent of respondents exporting to low-income countries. When examined bilaterally by destination, shipments to high-income countries appeared to be the least disrupted, and shipments to low-income countries the most (see also map A6.2 in appendix 6).

In summary, respondents in low-scoring environments appear to perceive conditions abroad as much better, whereas those in high-scoring environments perceive them as much worse. The order and direction of ratings are consistent when analyzed by income group (see table 2.1 in chapter 2).

CHAPTER 2

The 2023 Logistics Performance Index

This chapter focuses on reporting and interpreting findings from the 2023 Logistics Performance Index (LPI) survey, taking account of new realities in the logistics marketplace, policy environment, and international setting. The methodology of this part of the report is largely unchanged from previous editions. The scores and ranks of the 2023 LPI presented before the executive summary and in appendix 1 rely exclusively on the LPI survey. Box 2.1 summarizes the survey-based LPI's key features.

How to interpret the LPI

This edition differs from previous editions of *Connecting to Compete* in how it presents data. Previous reports presented LPI scores and ranks, along with confidence intervals for both (box 2.2). Scores and confidence intervals were rounded to two decimal places, and rankings were based on those rounded figures. While raw results of this kind are useful for some purposes, they risk overinterpretation. LPI scores reflect a survey-based quantification of qualitative perceptions and are thus subject to concerns about noise.

Similarly, sampling is nonrandom since respondents choose whether to participate. Issues such as these create difficulties when comparing small changes between countries. An additional issue relates to year-on-year comparisons, which suffer from the limitation that respondents grade performance on a qualitative scale that could suffer from indexing issues.

The approach this year differs. First, scores and confidence intervals are rounded to a single decimal place. The rationale for this change is that the survey uses whole numbers on a Likert scale for country ratings, so countries with similar but not identical response patterns receive identical scores.

Second, the presentation of results focuses more on groups of countries with broadly similar performance than on small differences in scores between countries. Where it is important from a policy perspective to highlight differences across countries, the analysis focuses on those differences at the country group level rather than at the individual country level.

This approach still allows for summarizing broad trends across geographic areas and income groups, which the following sections do. But it reduces the likelihood of users overinterpreting scores and rankings. The intention is to shift the focus to policy-relevant differences across countries from survey-based scores and rankings that can vary due in part to sampling and measurement error and perhaps exceptional situations such as the COVID-19 pandemic.

As before, the main caveat is that this part of the LPI is based on a survey. So, country-level outcomes can be affected by low numbers of respondents, which is the case for some small and low-income countries. Efforts to collect the maximum amount of information on these countries do not always pay off. This dynamic is an additional reason for presenting results by country group rather than individually. As a perception-based indicator, the LPI might exhibit differences from county-level indicators. Likewise, the LPI does not measure reforms.

Features of the 2023 survey

The 2023 LPI survey employed broadly the same methodology as the previous six editions, though with a simplified approach for the questionnaire. Until 2018, the questionnaire had two parts: international and domestic. In the international questionnaire, respondents evaluated six indicators of logistics performance in up

Box 2.1 The six components of the LPI

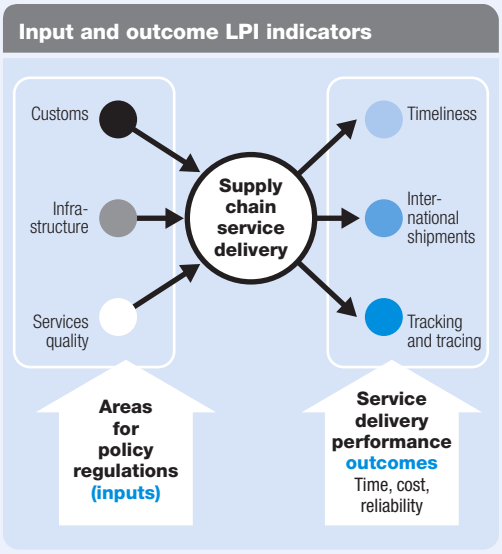
The World Bank's Logistics Performance Index (LPI) analyzes countries through six components:

1. The efficiency of customs and border management clearance.
2. The quality of trade- and transport-related infrastructure.
3. The ease of arranging competitively priced international shipments.
4. The competence and quality of logistics services.
5. The ability to track and trace consignments.
6. The frequency with which shipments reach consignees within the scheduled or expected delivery time.

The indicators were chosen based on theoretical and empirical research and the practical experience of logistics professionals involved in international freight forwarding. The figure maps the six LPI indicators to two main categories:

- Areas for policy regulation, indicating main inputs to the supply chain: customs, infrastructure, and services (indicators 1, 2, and 4 above).
- Supply chain performance outcomes: cost, reliability, and time (indicators 3, 5, and 6 above).

The LPI uses standard statistical techniques to aggregate the data into a single indicator, converting qualitative information into quantitative information, before aggregating and weighting (see appendix 5 for details of the methodology).[1] It relies on an online survey of logistics professionals from multinational freight forwarders and the main express carriers. Their views matter because they directly affect the choice of shipping routes and gateways, thereby influencing firms' decisions on production location, choice of suppliers, and target markets. While the pool of participants is not constant over time (due to staffing and organizational changes in the industry), participating logistics professionals is central to the quality and credibility of the LPI, and their involvement and feedback have been essential in developing and refining the survey over time.



See the 2023 LPI questionnaire at https://lpi.worldbank.org.

Note

1. In all editions of the LPI, statistical aggregation has yielded an overall score that is close to the simple average of country scores across the six components.

to eight partner countries. In the domestic questionnaire, respondents provided qualitative and quantitative data for the logistics environment in the country where they work.

The 2023 LPI survey used only the international part of the survey, so comparisons over time reflect solely that part. The domestic part was cut for two reasons. First, to counter survey fatigue among respondents. Second, because most of the data covered by the domestic part of the survey can be gleaned more easily and accurately from the new supply chain tracking datasets in chapter 3.[14] The 2023 survey, conducted from September 6 to November 5, 2022, included 4,090 assessments of 139 countries by logistics professionals.

Key findings of the 2023 LPI survey

Over the past decade, high-income countries have occupied the top positions in the LPI rankings (see table A3.1 in appendix 3). Geographically, top scorers are concentrated in Europe, but East Asia and Pacific, North America, and the Middle East and North Africa are also represented. There are 12 economies atop the logistics performance leaderboard in 2023, all with a score of 4 or higher, compared with 11 in 2018. These economies have traditionally dominated international supply chain networks, and the composition of the group has been steady over time. The recent supply chain crisis has not significantly changed this relative

Box 2.2 How precise are LPI scores?

Although the Logistics Performance Index (LPI) and its components offer the most comprehensive and comparable data on country logistics and trade facilitation environments, they have a narrow domain of validity because of the limited experience of survey respondents with respect to the countries they assess and because of the high dependence of the logistics of landlocked countries and small island states on the logistics of other countries.

To account for the sampling error created by the survey-based dataset, LPI scores are presented with approximately 80 percent confidence intervals, which yield upper and lower bounds for a country's score (see appendix 5). Confidence intervals must be examined to determine whether a difference between two scores is statistically significant. An improvement in a country's performance is considered statistically significant only if the lower bound of its 2023 score exceeds the upper bound of its 2018 score. Because of the LPI's narrow domain of validity and the need for confidence intervals to account for sampling error, a country's exact score might be less relevant to policymakers than its proximity to others in a wider performance group or its statistically significant improvement.

pattern of results across countries because the crisis is global in scope.

By contrast, the bottom 10 scorers[15] are mostly low-income and lower-middle-income countries, all with an LPI score of 2.2 or lower (see table A3.2 in appendix 3). That only 10 countries meet this criterion is a major change from 2018, when 22 countries did. It partly reflects a smaller survey sample (139 countries versus 160 countries), but it could also be linked to improvements in performance—a point revisited below. Given that four of the six LPI components reflect deep structural factors that are not directly affected by the supply chain crisis, it is plausible that performance on these metrics has improved due to policy reforms and private sector capacity building over time, despite the constraints imposed by recent conditions. For the most part, the countries in this group are fragile economies affected by armed conflict, natural disasters, or political unrest or face challenges of geography, such as being landlocked, or diseconomies of scale in connecting to global supply chains, where countries are too small to be connected widely. There is more movement in and out of the bottom group than in and out of the top group.

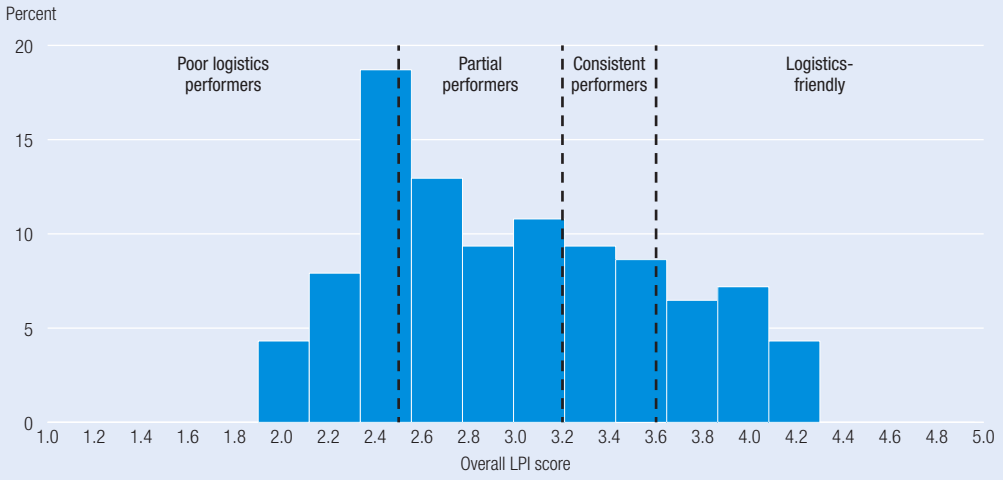
Identifying logistics performance groups

LPI scores are broken down into four performance groups, based on score quintiles:[16]

- *Poor logistics performers.* Countries with severe logistics constraints, such as the least developed countries (43 countries in the bottom quintile).
- *Partial performers.* Countries with a level of logistics constraints most often seen in low- and middle-income countries (46 countries in the middle quintile and the second quintile from the bottom).
- *Consistent performers.* Countries rated better on logistics performance than most others in their income group (25 countries in the second quintile from the top).
- *Logistics-friendly.* Top-performing countries, most of which are in the high-income group (25 countries in the top quintile).

The groups track relative performance for the set of countries captured in a single year of the LPI. As a result, average scores across groups as well as measures of dispersion within and across groups can be relevant to understanding how countries compare in a single year. Country scores are bunched at the low and middle ranges (corresponding to the bottom three quintiles)—a key reason for the change in reporting practice with this edition (figure 2.1). When countries are grouped closely, it is more informative for policymakers to focus on broadly defined country groups than on individual country scores and ranks.

Figure 2.1 Histogram of scores of the 139 countries and four performance groups in the 2023 LPI



Source: 2023 Logistics Performance Index.
Note: Vertical lines correspond to score cutoffs for the four performance groups identified in the main text. Four groups are displayed because the partial performers group includes two quintiles (the middle and the second from the bottom).

Bilateral LPI assessments between income groups

Given that the LPI assesses logistics performance by eliciting ratings from professionals outside the country being scored, breaking results out bilaterally (that is, between the respondent's country and the assessed country) provides additional insight.

Respondents from all income groups rated the high-income group the highest, followed by the upper-middle-income and lower middle-income groups, then the low-income group (table 2.1). Hence, ratings are consistent in a rank order sense across income groups. However, income groups differ noticeably in the average scores they gave other groups: the low-income group gave the highest average score (3.7), followed by the lower-middle-income group (3.1), the upper-middle-income group (3.0), and the high-income group (2.7). So, respondents' context affects how they score performance abroad.[17] These findings are consistent with a model of perception formation in which respondents compare performance abroad to performance in their home country. This dynamic is an additional reason for preferring analysis of LPI scores using broad country groups rather than high-precision scores and limits the extent to which differences in score can lead to concrete policy interpretations.

Table 2.1 Bilateral LPI assessments in 2023, by income group

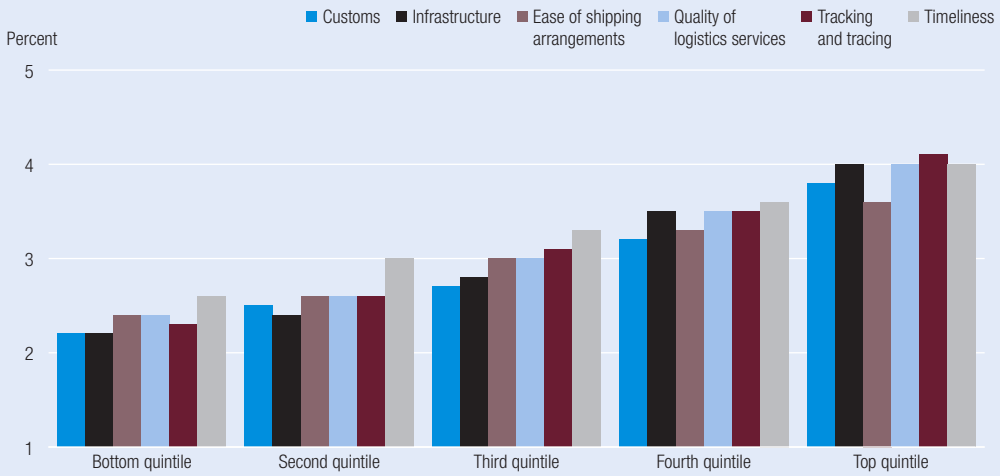
	Assessed country				
Respondent's country	High income	Upper middle income	Lower middle income	Low income	Average
High income	3.7	2.7	2.4	2.0	2.7
Upper middle income	3.7	3.0	2.6	2.5	3.0
Lower middle income	3.8	3.2	3.1	2.3	3.1
Low income	4.3	4.2	3.4	2.9	3.7

Source: 2023 Logistics Performance Index.

Strong overall logistics performance is driven by good performance across all LPI components

Performance on LPI components differs by overall LPI quintile. The timeliness component outperforms the others in all quintiles except the top one (figure 2.2). And the performance of customs and border agencies and the quality of trade and transport infrastructure are particularly weak in the bottom quintile. The bottom quintile is also characterized by lower quality of logistics services. In the two top-performing quintiles, performance is more consistent across the six components.

Figure 2.2 **LPI component scores, by overall LPI quintile, 2023**



Source: 2023 Logistics Performance Index.

The dynamics of LPI scores over 2012–23

Caution should be used in interpreting changes in scores over time. But examining the full distribution of scores by year can be informative because the analysis can focus on such issues as clustering and dispersion at particular points. In general, the most frequent LPI score has increased over the past decade, which could signal a trend toward rising scores, subject to the caveat that this year's sample is smaller than in previous years and lacks some smaller, lower income countries (figure 2.3). The change is most pronounced from 2018 to 2023, in particular with the emergence of a secondary, smaller peak at a score of around 3.5. This finding is plausible because four of the six LPI components relate to deep structural factors that are not directly affected by the supply chain crisis.

This change means that the survey sample has more countries with strong performance. Perhaps more importantly, the lowest scores have tended to increase, particularly from 2016 to 2023. So, while there is still a considerable range of performance, countries with lower scores are improving over time.

What is the impact of the supply chain crisis?

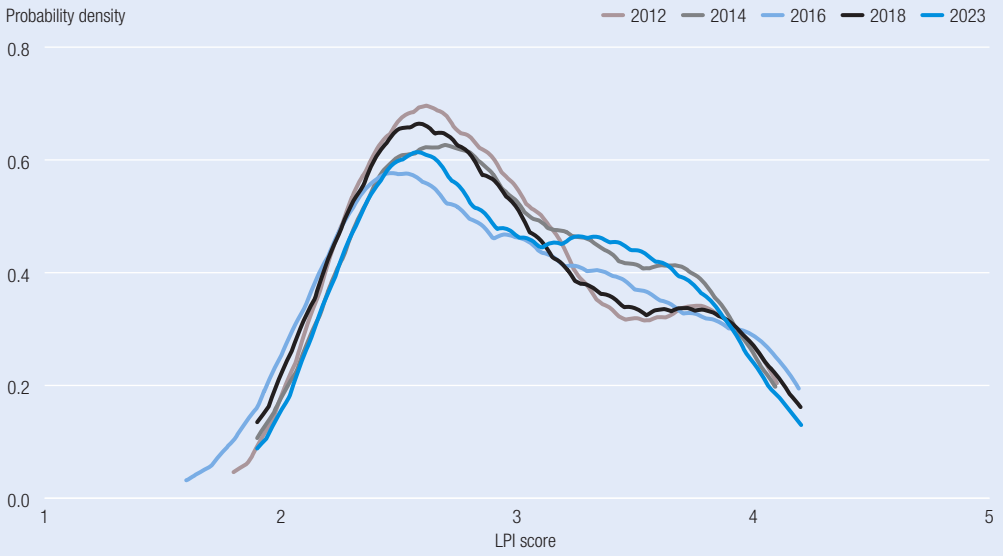
How is it possible to reconcile the apparent increase in LPI scores over time with the recent supply chain crisis discussed in chapter 1? The data collection for the LPI is part of the answer. Of the six components that respondents rate, four relate to deep country characteristics that were not affected by the crisis. Difficult supply chain conditions were not related to problems with customs, deficiencies in infrastructure quality, a lack of quality logistics services providers, or difficulties in tracking and tracing shipments. The crisis was due to a combination of supply- and demand-side factors related to the COVID-19 pandemic and efforts to control it.

But data for one LPI component suggest that LPI survey respondents were conscious of the new supply chain realities when rating countries. Ratings for the timeliness component fell in all performance quintiles except the second from the top between 2018 and 2023 (figure 4). Given that a key aspect of the supply chain crisis was delays, this finding suggests that the timeliness component captures some of the disruption, subject to the caveat that data collection was undertaken as crisis conditions were easing.

Logistics performance is determined by more than income

There is a noticeable gap in LPI scores between high- and low-income countries (figure 2.5). High-income countries have a much higher median LPI score than low-income countries. Moreover, among the 33 top-performing

Figure 2.3 Distribution of LPI scores, 2012–23

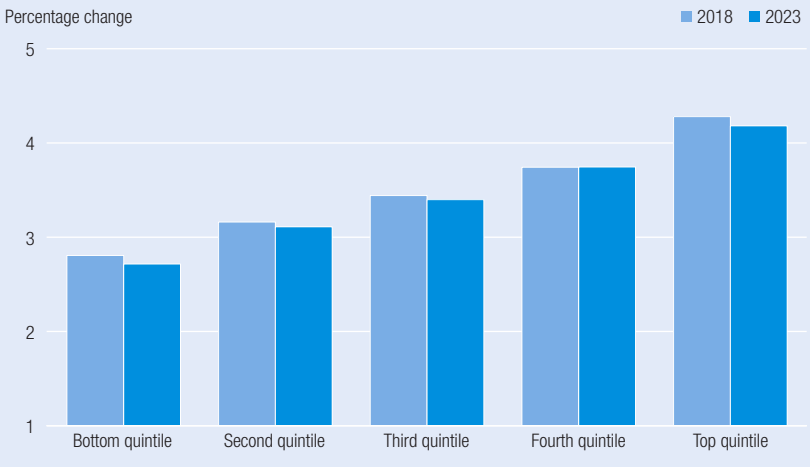


Source: 2012, 2014, 2016, 2018, and 2023 Logistics Performance Index.
Note: To avoid composition effects, only countries with scores in all years are included in the analysis.

countries in the 2023 LPI, 30 are high income—a finding that has changed little from past LPI editions, despite the new reality of global trade. This point is about the distribution of scores rather than absolute levels and is thus consistent with the idea that the supply chain crisis is global in scope rather than affecting just a small number of countries or regions.

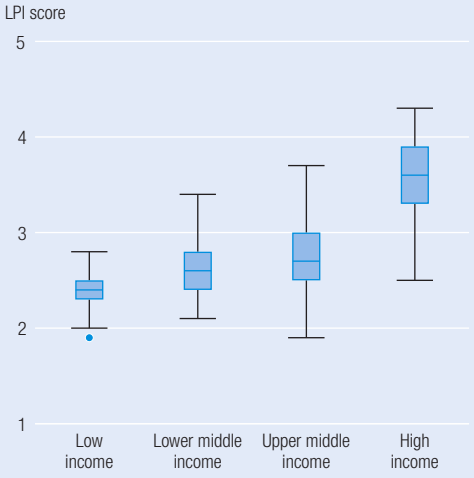
Nevertheless, countries can still outperform their income group peers despite the performance gap, as indicated by the dispersion of scores within income groups (see figure 2.5). In all groups, there is a wide range of country performance. Clearly, a variety of factors beyond income, from policy to private sector development, affect logistics performance.

Figure 2.4 Timeliness score, by LPI quintile, 2018 and 2023



Source: 2018 and 2023 Logistics Performance Index.

Figure 2.5 Distribution of 2023 LPI scores by income group



Source: 2023 Logistics Performance Index.
Note: The median is denoted by the bar in the square. The shaded areas are the middle 50 percent of scores.

CHAPTER 3

Supply chain lead time around the world: Where are the delays?

The supply chain disruptions of 2021–22 underscore the importance of reliability, which is captured as "timeliness of delivery" in the Logistics Performance Index (LPI) survey (see chapter 2).[18] During this recent crisis, firms and consumers worldwide experienced goods not arriving on time as expected due to disruptions in vessel movements and to shipments staying at hub and gateway facilities for longer than usual.

In an environment of low inventory, unexpectedly long delivery times can translate into human hardship, as with the shortage of baby formula in the United States[19] or fertilizer in Sub-Saharan Africa.[20] Addressing disruptions such as these cuts across a wide range of policy areas, but focusing on supply chain management highlights the importance of time spent at maritime or aviation hubs and gateways. This is one area where investments in productivity, increasing the fluidity of information flow, and enhancing logistics service provision can contribute to better outcomes.

The 2023 edition of *Connecting to Compete* seeks to build understanding of these areas by bringing new information derived from a Big Data approach. This chapter provides a global comparison of delays at ports and airports based on massive numbers of observations representing a substantial share of, if not all, actual movements. The data come from tracking sources in container shipping, aviation, and postal services. Indicators, expressed as time in days or simple counts, have intuitive meanings and are relatable to policymakers and practitioners concerned with the performance of key logistics hubs or gateways, such as ports and airports. The analysis looks at the composition of total shipment times and their component parts, as well as the reliability of delivery times, measured using indicators of dispersion around a central tendency, such as the median (box 3.1). The analyses are aggregated at the country level to be relatable to the LPI survey results.

Lead time dispersion and supply chain reliability

Understanding the speed of trade, as well as the magnitude and nature of delays, requires looking beyond averages. Figure 3.1 breaks down the lead time of containers from entering the port of origin to exiting the port of destination and its variability. Dwell time at hubs and gateways has considerably more dispersion than is observed in international freight transport. On average across all potential routes, a container takes 44 days from entering the port of export to exiting the destination port, with a standard deviation of 10.5 days. Over 60 percent of this time is spent on ships, with the rest split between stays at ports of export, import, or transshipment.

Yet supply chain legs when containers are not in motion, especially at the port of import, contribute disproportionately to the variability of supply chain lead time. So, while the bulk of the time required to trade goods internationally is accounted for by shipping, the largest contributor to low reliability of delivery times is processes in the importing country.

Consistent with this analysis, each link of a supply chain is subject to some uncertainty due to factors such as operational constraints, variations in productivity across operators, and process unreliability. One way of capturing the uncertainty is through the statistical distribution of lead time by link.

While different links and modes have distinguishing features, there are also similarities. Figure 3.2 shows the distribution of dwell time for Le Havre (a container port) in 2022 and

Box 3.1 Measuring performance using tracking indicators: Sources and definitions

Since the first Logistics Performance Index (LPI) in 2007, the ecosystem of supply chains and logistics services has changed radically, driven largely by digitalization. Through this process, efficient, timely, and accurate digitized data have been translated into knowledge that helps create highly interconnected, transparent, and flexible supply chain systems. The shift has improved operational efficiency and reduced costs across supply chains.[39]

Digitalizing supply chain operations generates granular high-frequency datasets by recording data at each step in a supply chain process (box figure). This Big Data approach also brings new business opportunities (relevant for the private sector) and analytical applications (relevant for both the private and public sectors), which push technological innovation further.

The raw data consist of timestamps of events—such as arrival, departure, loading, and unloading—localized by the United Nations Code for Trade and Transport Locations (representing ports, airports, and other facilities). Container trips start with an empty container being sent for stuffing by the exporter and finish with the return of the empty container by the importer. Aviation and postal data have a similar structure, albeit with fewer steps and fewer modal options.

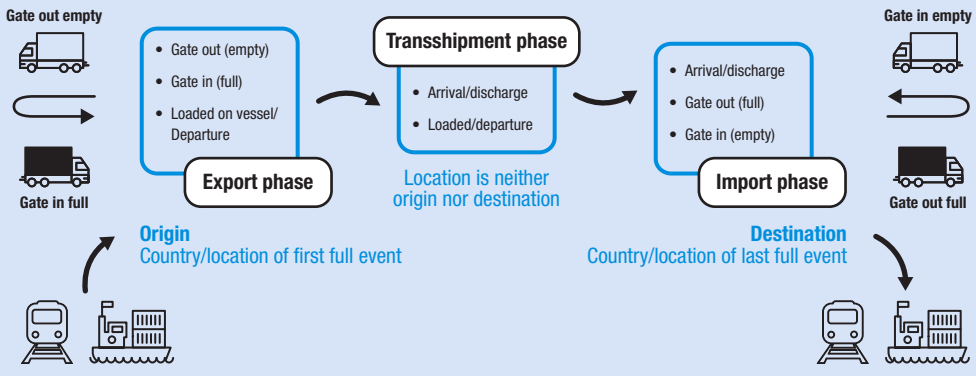
To construct a new set of indicators for the 2023 LPI, the World Bank collaborated with external data providers. The data consist of five high-frequency micro-level datasets: deployment of container liner shipping service from MDS Transmodal, air cargo tracking from Cargo iQ (supported by the International Air Transport Association), flow of international parcels from the Universal Postal Union, granular information on consignment activities from TradeLens for containerized trade, and worldwide container ship port calls from an Automatic Identification System data provider (MarineTraffic) (box table 1).

These tracking data are exhaustive for long distance international trade and cover container trade, air cargo, and parcels but exclude bulk shipping. While the data are global in scope, they are less representative of intraregional trade due to the lack of coverage of road and rail transport. High-precision tracking systems exist for trucks and freight trains at the country or regional level, but without a global repository, these modes cannot be analyzed in the same way as the others. Yet corridor performance information is available from container tracking data to and from inland destinations, which represents the trade of landlocked developing countries.

The key performance indicators focus on the major aspects of the data that are important from an international trade perspective: dwell time (delays experienced at the same place, such as at ports, airports, and inland facilities), connectivity information (such as the number of international connections at the origin for a given destination), and trade corridor lead time (time differences between events at different locations) (box table 2; see appendix 4 for information on the source of data and indicator definitions).

The objective of the 2023 LPI is to provide an example of how these detailed micro-data can be used to measure performance, complement existing data including the "classic" LPI, offer policy-relevant insights, and give information to operators on their options for bringing goods to destination. There is scope to extend the exercise to include a broader range of performance indicators and to inform future research that moves beyond measuring trade times only by averages or medians. *(continued)*

Tracking the supply chain steps



Source: World Bank elaboration based on TradeLens dataset.

Box 3.1 Measuring performance using tracking indicators: Sources and definitions (continued)

Potential interpretation issues with tracking key performance indicators

The key performance indicators provide a wealth of information on supply chain transactions across several modes but are subject to limits that affect interpretation:

Although the procedures to input timestamps are rigorously defined, the process is not fully automated in some countries and may depend on practices by local operators, more so for aviation and postal data than for maritime data. In agreement with the data partners, the data do not include countries where there is a strong suspicion of deficient recording.

The postal data date from 2019 (the most recent year available at the time of report writing). All other data were collected over six months in mid-2022, when global supply chains were still experiencing severe disruptions—for instance due to the ongoing effects of the COVID-19 pandemic and Russia's invasion of Ukraine.

There may be selection bias in the container tracking data (TradeLens). Economic operators with more efficient supply chains use advanced digital tracking solutions. This means that the container data, although massive, may underestimate delays.

The tracking data cover the responsibility of international carriers, not logistics by shippers upstream or consignees downstream. Supply chain practices vary across the world. Inefficient practices, such as early stripping of containers or compulsory warehousing, may be imperfectly reflected in the key performance indicators, such that delays may be underestimated.

The concepts used locally to measure delays may differ from the definitions used here to ensure global comparability. For instance, in many places, shipments are trucked from port terminals to satellite facilities in the same location. The key performance indicators merge the time spent at all facilities in the same port area, not just port terminals.

The port dwell time statistics exclude transshipped containers to other destinations for ports of transshipment.

These indicators measure different dimensions than indicators related to port and shipping already available from the World Bank and the United Nations Conference on Trade and Development (UNCTAD).

The World Bank publishes the Container Port Performance Index, which measures the productivity of terminal handling operations.[1] Dwell time measures how long containers stay at the port premises, which reflects other factors beyond productivity, including time to clear and incentives to remove containers fast.

UNCTAD publishes the Liner Shipping Connectivity Index, which averages several components, including the number of maritime connections proposed here in the LPI 2023, from the same source. Here, choosing the number of connections facilitates comparisons across modes.

Box table 1 Data sources and partners

Source name	Description and coverage	Data nature and period of observation
MDS Transmodal	Deployed capacity and information on ship parameters and operators servicing countries by regular containerized liner shipping services.	Deployed capacity and the list of countries that are connected to each other through direct liner shipping services (first and second quarters of 2022)
Cargo iQ	System of shipment planning and performance monitoring for air cargo based on definitions of common business processes and milestones.	Time difference between notification for readiness and delivery to consignee/agent (four quarters of 2019 and second quarter of 2022)
Universal Postal Union	Data from the Express Mail Service Events message category of the Electronic Data Interchange protocol used to track individual express mail service and parcel items, as well as registered, insured, and express letters.	Time difference between arrival at inward office of exchange and attempted and final delivery (2019)
TradeLens	Blockchain-based data- and document-sharing platform aiming at simplifying and speeding trade workflows for participants in the supply chain ecosystem. The TradeLens dataset used covers about 20 percent of global containerized shipping during the period covered (May–October 2022).	Timestamps of transport events associated with each consignment and container (May–October 2022)
MarineTraffic	Port calls for all container ships based on Automatic Identification System data.	Location, arrival, and departure dates of ships (January–July 2022)

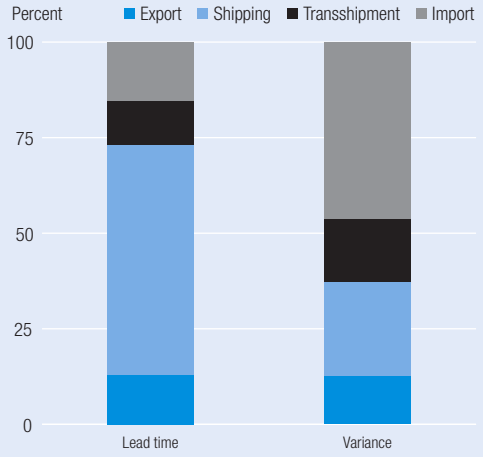
Box table 2 Definition of key performance indicators

Indicator	Source	Definition
Connectivity		
Maritime connectivity	MDS Transmodal	Number of partner countries accessible through direct service
Aviation connectivity	Cargo iQ	Number of direct air connections (countries)
Postal connectivity	Universal Postal Union	Number of international postal connections (countries)
Time		
Port dwell time	TradeLens	Time a container unit spends at a port (export or import)
Consolidated dwell time	TradeLens	Port dwell time plus time spent at inland multimodal clearance facilities for a container
Aviation dwell time	Cargo iQ	Time goods spend at an airport
Postal delivery time	Universal Postal Union	Delivery time of a postal item from arrival at country's postal office of exchange to final (or first unsuccessful attempted) delivery to recipient
Corridor lead time	TradeLens	Lead time of containers from port of origin to destination, estimated for selected landlocked countries
Turnaround time	MarineTraffic	Time container ships call at a port, excluding waiting time at anchorage

Note

1. World Bank 2021a.

Figure 3.1 Import lead time is the largest driver of variability in international shipping in 2022



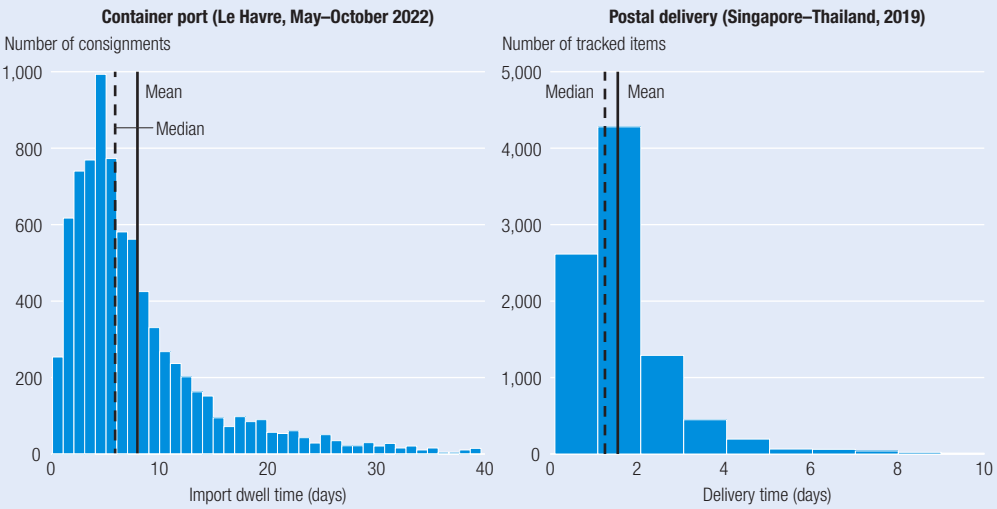
Source: TradeLens and World Bank modeling.
Note: Based on 2.5 million container movements that are representative of global container shipping trade lanes worldwide between May 2022 and October 2022. The model averages mean time and variability over all links in the maritime supply chains (port dwell time and lead time between pairs of ports), weighted by the number of observations for each. The estimation assumes that the performance of subsequent legs is statistically independent.

for postal delivery of parcels and express mail service courier shipments by air from Singapore to Thailand. In both cases, the distribution is asymmetric relative to a normal distribution (or bell curve). In particular, they have long right tails, which means that lengthy lead times relative to the average or median are common. Major delays are therefore part of the supply chain experience across modes. Major delays create risks that operators need to manage and that policymakers need to be aware of.

Some of this variability in dwell times may be connected with factors under the control of the owner of the goods or the freight forwarder (such as scheduling), but other factors may be out of their control (such as uncertainty as to when goods will be loaded and unloaded or cleared). So, dispersion of lead time reflects the overall reliability of the supply chain for the link under review[21] or, if aggregated, for the entire country. Traders facing the possibility of long delays must bear extra costs in establishing reliable connections to suppliers and buyers in foreign markets. From a policy perspective, this suggests that interventions targeting supply chain reliability at trade gateways have the most impact on the costs of trade, though these delays constitute a small fraction of the overall supply chain lead time.[22]

For each key performance indicator, the report provides estimates of the mean and quartiles (first, median, and third). The interquartile range of lead time (from the first quartile to the third) is a robust measure of dispersion. With import dwell time, dispersion measured by interquartile range is comparable to the median. In addition to dispersion of times for deliveries at individual locations,

Figure 3.2 Examples of the distribution of import dwell time



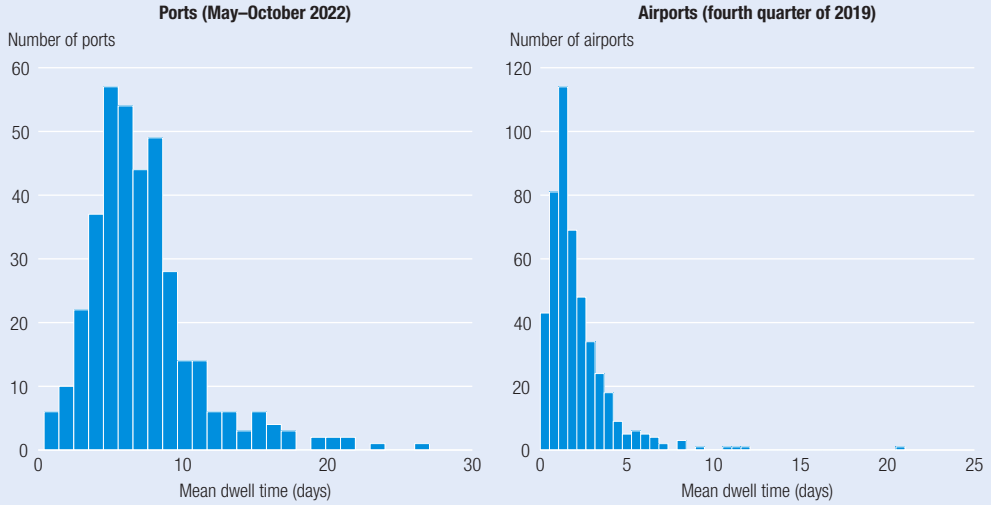
Source: TradeLens and the Universal Postal Union.
Note: The distribution for the container port example excludes 67 outliers, and the distribution for the postal delivery example excludes 55 outliers.

there is considerable variation in average dwell times across locations. This feature of the data is independent of the mode of transport (figure 3.3). Still, aviation dwell time is notably lower than container dwell time.[23] Understanding the reasons for the dispersion to identify measures that improve performance is an important area for future research. Similarly, analyzing the factors that influence the different shapes of the distributions between ports and airports will be important for informing policy.

Dwell time and logistics performance

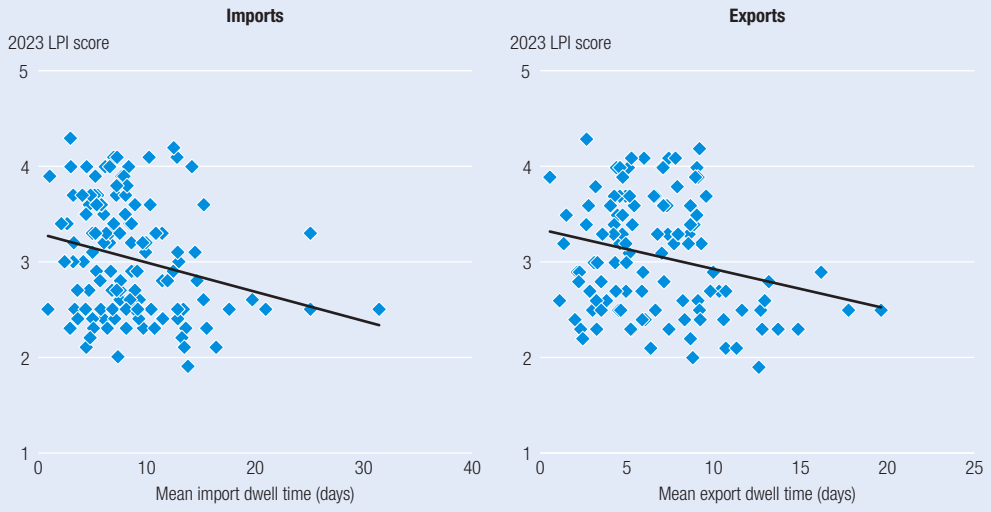
Port dwell time has a subtle connection to logistics performance. Most countries—low, middle, and high income—have similar average dwell times (4–8 days) (figure 3.4). A few outliers have a high dwell time with low logistics performance. Long delays imply low logistics performance, but low logistics performance does not necessarily imply long delays.

Figure 3.3 Dispersion of mean dwell time across the world



Source: TradeLens and Cargo iQ.
Note: Data on ports cover 370 ports, and data on airports cover 470 airports that had at least 120 records.

Figure 3.4 Import and export dwell time of containers, May–October 2022, versus 2023 LPI score, by country



Source: TradeLens and World Bank.

The lack of differentiation between lower- and higher-income countries points to a complex picture. The average dwell time for containers between May and October 2022 was 3 days for India and Singapore and 4 for the United Arab Emirates and South Africa but 7 for the United States and 10 for Germany. One explanation could be that the period for these estimates coincides with the tail end of an unprecedented supply chain crisis. Not only did ships have to wait before being serviced, but containers had to wait for trucks to be removed. Furthermore, sanctions against Russia (in response to its invasion of Ukraine), which disconnected it from most container shipping services, explain the high container dwell time in some countries around the Baltic Sea, such as Finland.

Another possibility is that some emerging economies invested more recently in modern facilities and technologies, leapfrogging industrialized countries. For example, since 2015, India has invested in soft and hard infrastructure to connect ports on both coasts to economic poles in the hinterland, including a supply chain visibility platform delivered through a public–private partnership (box 3.2). The poor performance of US ports in terms of productivity has received much scrutiny in recent months,[24] including specific productivity constraints, compounding the factors referred to in the previous paragraph. Finally, many small economies—for example, small island states[25]—see only small volumes that can be handled relatively quickly.

Export dwell time of container ports follows the same dispersion patterns and connection to LPI scores as import dwell time—but for different reasons. Overall, export and import dwell times are positively associated, but with considerable dispersion around the average relationship, resulting in a correlation of only 0.1 (figure 3.5). Exports are less scrutinized by border agencies than imports, but they face a hard scheduling constraint and depend on the quality and sophistication of available logistics services. Export containers must reach the port in advance to catch the ship they are scheduled to take. The worse the inland logistics or the lower the frequency of shipping, the more buffer time the exporter includes to avoid missing the shipping connection. For containers, shipping lines and terminal operators typically impose deadlines of 48 hours ahead of scheduled ship departure.

What causes long port delays?

Few countries other than landlocked ones with port delays in the transit country have excessive import port dwell times (more than 12 days). Most countries with excessive dwell times are in the Middle East and North Africa and in Central and West Africa (figure 3.6). Countries with excessive dwell times likely face serious constraints in port infrastructure and terminal productivity, as measured by the World Bank's Container Port Performance Index.[26] Controls of import transactions and goods (such as customs and exchange controls) contribute

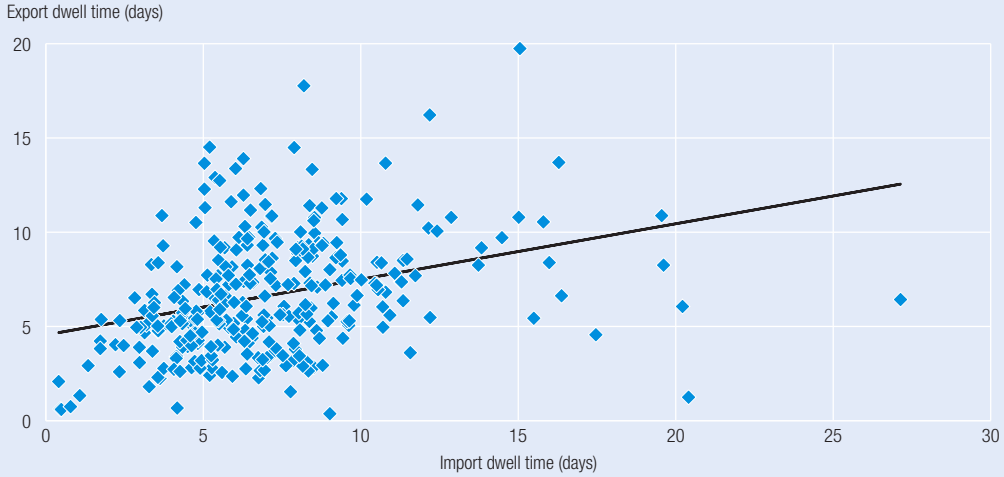
Box 3.2 India: Boosting performance with supply chain digitalization

Since 2015, the government of India has invested in trade-related soft and hard infrastructure connecting port gateways on both coasts to the economic poles in the hinterland. Technology has been a critical component of this effort, with implementation under a public-private partnership of a supply chain visibility platform,[1] which contributed to remarkable reductions of delays. NICDC Logistics Data Services Limited applies radio frequency identification tags to containers and offers consignees end-to-end tracking of their supply chain. Implementation started in 2015 on the Indian east coast and was generalized in 2020. With the introduction of cargo tracking, dwell time in the eastern port of Visakhapatnam fell from 32.4 days in 2015 to 5.3 days in 2019.

Note

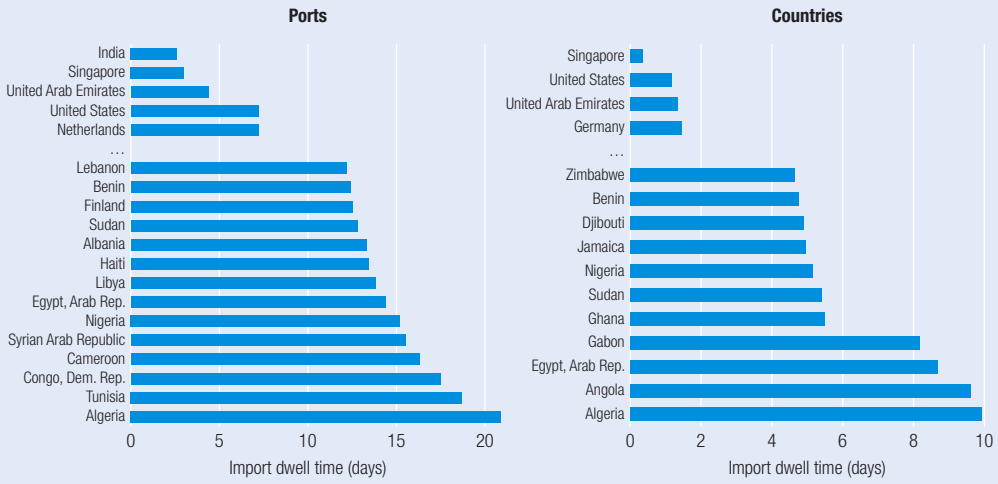
1. See https://nldsl.in/.

Figure 3.5 Export dwell time versus import dwell time of container ports



Source: TradeLens and World Bank.
Note: Data cover 309 ports with more than 100 observations for both exports and imports for May–October 2022.

Figure 3.6 Outliers for import dwell time and comparators, May–October 2022



Source: World Bank estimate from TradeLens and Cargo iQ data.
Note: For ports, outliers are countries with import dwell times of more than 12 days, and for airports, outliers are countries with import dwell times of more than 4 days.

to delays, as does abuse of port space as storage by importers in some African countries, especially those where terminal fees are low.[27] The removal of units in congested port cities may also contribute to delays. Yet each outlier needs to be assessed on a case-by-case basis to determine the main reasons for delays. For instance, in Algeria, the most important contribution to dwell time is the time banks take to validate imports for exchange control purposes prior to submitting an import declaration. By contrast, in Tunisia, low container handling productivity is the binding constraint.[28]

Aviation dwell times exhibit similar patterns to those of maritime dwell times. Excessive dwell time for airports is defined as more than 4 days. There is substantial overlap between countries with excessive dwell times in each mode, which points to serious structural issues with logistics performance. In line with expectations, airport delays are one-quarter to one-half as long as port delays.

Which interventions help reduce these delays?

The speed of trade can be boosted by combining policy interventions in the LPI pillars related to infrastructure, customs, logistics competence, and tracking and tracing. Diagnosis must be implemented on a country or even port/corridor basis to identify binding constraints and prioritize interventions.

A combination of reforms to enhance port productivity, including private sector participation in terminal operations, could improve the situation in outlier countries.[29] Implementing electronic port community systems also improves performance by facilitating the flow of information between the numerous participants in port logistics.[30] Many underperforming countries have yet to modernize customs and border agencies with a focus on automation, risk management, and integrity.[31]

The emerging economies with the shortest delays have gone beyond these packages and have implemented bold tracking and tracing solutions. India's very low dwell time (2.6 days) is one example (see box 3.2). The 2023 LPI data partners (see box 1.1 in chapter 1) have proposed similar tracking and tracing solutions.

Measures to speed up the transit of goods require adequate private sector capacity to handle the logistics of goods beyond the gates, and often in the vicinity, of ports, airports, or multimodal facilities. This requires integrated logistics services (such as third party logistics) and proper facilities (such as logistics zones). Adequately regulating logistics services and land planning (zoning) is key to promoting quality and competition. High-performing countries have also invested in education and training, promoting the right skill sets across jobs (blue collar, technical, and administrative managerial), as developed in a World Bank toolkit applied in several countries.[32]

Finally, private public dialogue is critical for developing a common fact-based diagnosis and designing impactful interventions. This could involve ad hoc task forces, which should include agencies and stakeholders, tasked with a time-limited mandate. Countries with a strong logistics sector have permanent institutions, such as Dinalog in the Netherlands.[33]

Logistical constraints in landlocked developing countries

Landlocked developing countries are more logistically constrained than their coastal neighbors. The development challenges of landlocked developing countries have been a constant focus of international organizations and assistance programs.[34] The key performance indicators in this report provide information on the time it takes containers to reach landlocked countries through transport corridors that link them to ports in transit countries. Data are available for landlocked African, European, and South Asian countries.

Relevant key performance indicators for landlocked developing countries include dwell time at port of entry, consolidated dwell time adding to port dwell time at inland facilities, and lead time on corridors (which combines time in actual motion with, for instance, idle time at land border crossings) (see appendix 2). While covering the bulk of international trade for landlocked developing countries, these data are less representative for EU countries, where direct trucking is favored over containerized trade to destination facilities.

Landlocked developing countries face three types of delays:

- Longer delays in ports than in corresponding coastal countries. A first explanation might be the additional complexity of organizing removal of containers from a distance, as opposed to local removal. Often ports in the country of transit offer longer free time for containers destined for a landlocked country.[35]
- Corridor delays, which reflect the efficiency of the transit system. Nepal and Mali tend to have the longest corridor delays (over a week), while in East and Southern African landlocked developing countries the delays tend to be much shorter.
- Overall dwell time inland, including at the destination.

Improving the connectivity of landlocked developing countries goes beyond unilateral policy interventions. Central to landlocked

connectivity is the design of transit systems.[36] Transit systems regulate freight services, notably trucking, combining quality-oriented regulation of entry and operations (typically from the perspective of customs security). Transit systems also provide for cross-border traceability of shipments for customs purposes. Modern transit systems, such as in the European Union, promote regionally integrated markets of authorized operators that meet quality and environmental requirements, along with interoperability of financial guarantees across borders and digitalization of transit manifests. The benchmark of an efficient transit system is the Transports Internationaux Routiers (International Road Transport, or TIR). That system is superseded by the European transit system in Western Europe but remains important to countries in Central Asia and the Middle and North Africa. Few regions beyond Europe have been able to follow the TIR model, though one exception is the International Transit of Goods in Central America.[37]

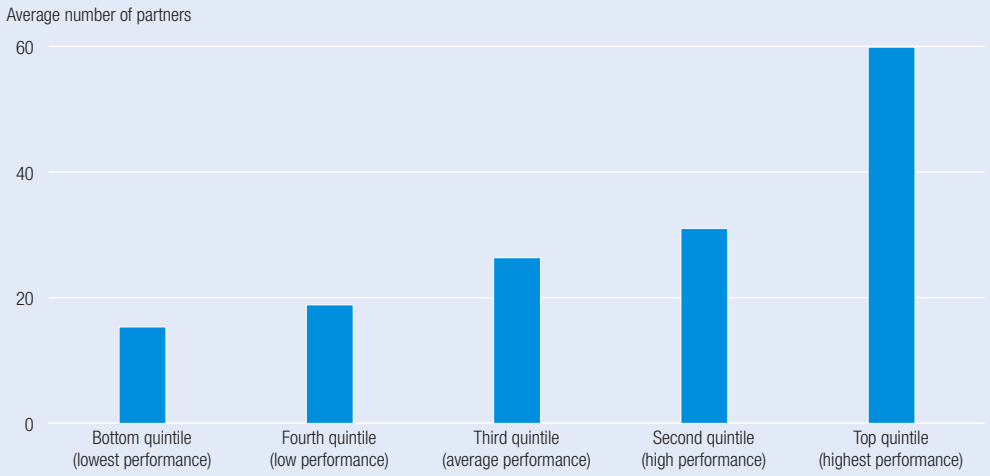
Connectivity and logistics performance in small maritime economies

The key performance indicators measure connectivity for each mode (container shipping, aviation, and postal) as a simple count of the international partners (that is, countries) that a country connects to. The United Nations Conference on Trade and Development's Liner Shipping Connectivity Index combines more subindicators (such as number of services and shipping alliances) from the same sources.[38] Connectivity metrics are closely associated with logistics performance, especially for top performers and countries with high liner shipping connectivity (figure 3.7). LPI scores are more strongly associated with the connectivity-related key performance indicators than with the delay-related key performance indicators.

Logistics connectivity enhances logistics performance through several channels. First, it increases exposure to global operators and practices, with positive spillovers on the quality of domestic services. Second, it implies that logistics operators have to deal with a more complex set of operations with more partners, which incentivizes higher productivity and use of technology. Third, increased connectivity means more operators and competition.

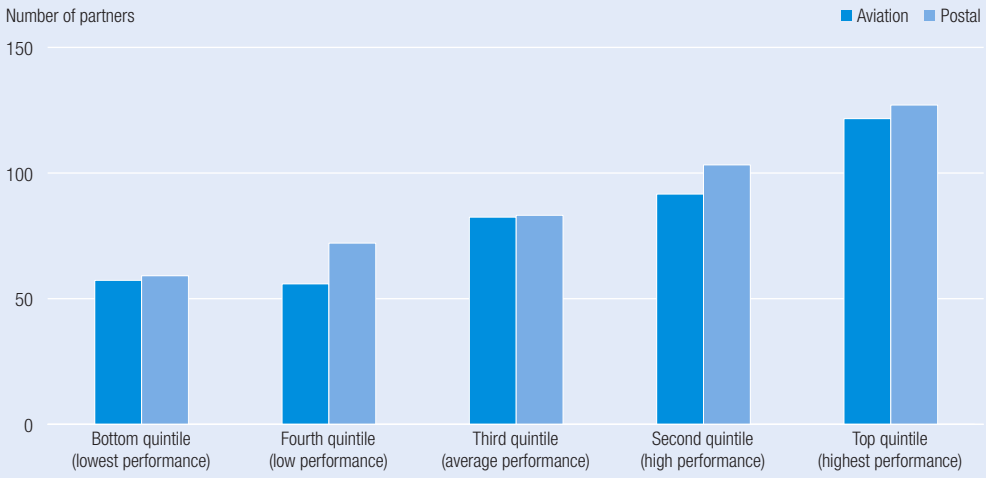
Conversely, countries with limited connections, such as small island states, require attention. Their limited connections means that they depend on transshipments to access major markets. Viewed across all countries, about 44 percent of containers are shipped port-to-port; the majority require transshipment (figure 3.9). Distribution of

Figure 3.7 The association between average connectivity in container shipping and 2023 LPI score quintiles



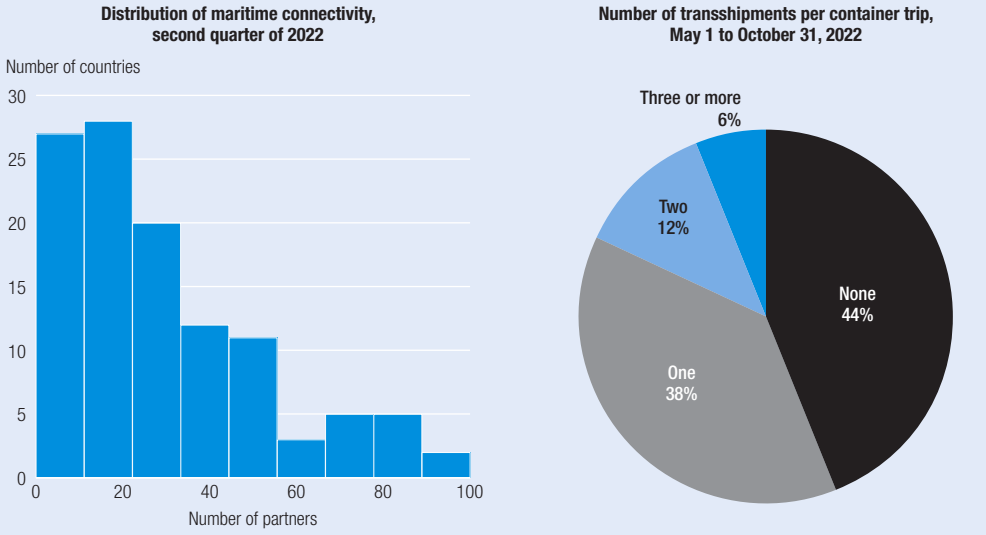
Source: World Bank calculations based on data from MDS Transmodal.
Note: Connectivity data refer to the second quarter of 2022.

Figure 3.8 The association between average inbound connectivity in aviation and postal services and 2023 LPI score quintiles



Source: World Bank calculations based on data from Cargo iQ and UPU.
Note: Postal connectivity data refer to 2019. Country-level aviation connectivity data refer to the second quarter of 2022.

Figure 3.9 Most maritime economies have less than 20 shipping connections and depend on transshipment



Source: World Bank calculations based on data from MDS Transmodal and TradeLens.
Note: Connectivity is the number of direct international container shipping connections without transshipment.

dwell time in transshipment follows the same dispersion patterns as those for export and import. Hence, the more dependent a country is on transshipment, the more it suffers additional delays and unreliability, increasing the cost of trade.

The connectivity of island states—even more than that of landlocked developing countries—depends on factors beyond their policy realm. Competition in shipping markets, logistics and shipping network structure, and frequency of services are difficult to influence and may not yet have received sufficient attention from policymakers and international organizations.

CHAPTER 4

Conclusions

Global supply chains have turned out to be surprisingly resilient during the recent disruptions

Given the recent supply chain crisis, the relative pattern of LPI scores in 2023 across countries has changed little compared with previous editions; only scores in the timeliness component have deteriorated slightly since 2018. In addition to the robust nature of the data underlying the LPI (box table 1 in box 3.1 of chapter 3), there are several possible explanations.

First, when almost every country is affected by similar disruptions beyond their control almost simultaneously, it is difficult to assign the impact to individual countries.

Second, survey data were collected when supply chain disruptions had already substantially diminished, as indicated by the Global Supply Chain Pressure Index,[40] for example. The index peaked at the end of 2021 before returning to normal levels in September 2022, when the LPI survey went live. This may have contributed to recency bias among respondents.

Third, most LPI components relate to structural factors that are not directly affected by supply chain disruptions. Trade logistics performance may have improved due to policy reforms and private sector capacity building over time, despite the constraints imposed by recent conditions. In other words, today's performance should be higher than what it was five years ago, but the impact of the supply chain crisis may have prevented some of this development from showing up in the survey data.

Fourth, most shippers, logistics service providers, and authorities have absorbed the impacts of the recent crisis well. In the big picture, trade logistics operations have been surprisingly resilient.

The top and bottom performers: Performance is steady or improving, but the gap persists

Since the 2018 LPI, global logistics networks have experienced unprecedented disruptions, and the operational environment in logistics has grown more complex. Yet logistics performance in 2022, as measured by LPI scores for the 139 countries covered, remained stable or improved slightly. At the same time, the gap between the top and bottom performers widened slightly, as measured by average LPI scores by quintile. Thus the fundamental messages of previous editions hold true.

Countries in the bottom performance quintile still need core reforms and modernization, especially in soft infrastructure such as customs and border management and operational procedures in ports. Investments in hard transport infrastructure are also needed—but they must be aligned with the reforms and investments in soft infrastructure to improve logistics performance.

Countries in the middle performance quintile and the second quintile from the top likely face the most challenging policy agenda in view of their available resources. They need to reconcile the need for consistency and depth of reforms with a set of priorities wider than those facing top performers, which are farther along, or countries in the bottom two quintiles, which can focus on fewer issues.

Consistency is an important driver of logistics performance

The leading countries in overall logistics performance exhibit strong performance across all six LPI components. Lower performing countries

tend to have patchier performance across components. This distinction highlights the need for reforms in logistics markets to cover a variety of areas rather than focus on just one. For instance, building physical infrastructure without developing service provider capacity would be unlikely to lead to the expected economic benefits.

Hence, a key lesson of the LPI for low- and middle-performing countries is that their reform agenda needs to encompass not only physical infrastructure but also border procedures and private sector development. Information flow is key to designing effective policy reforms, which means that both the logistics industry and users of logistics services need a voice in the reform process.[41]

Logistics performance and key performance indicators derived from a Big Data approach

Chapter 3 introduced a set of key performance indicators derived from a Big Data approach and related to actual movements of international trade by mode (container, air freight, and parcels) complement survey-based LPI scores. No single indicator can fully explain countrywide logistics performance, but the key performance indicators provide partial information that policymakers and operators can easily interpret on such topics as delays for specific supply chain links (a port, for example) or the number of connections.

LPI scores are closely associated with the number of direct international connections through shipping, air, or postal networks, especially for top logistics performers and countries with high liner shipping connectivity. Logistics connectivity enhances logistics performance —for example, by increasing exposure to global operators and practices—with positive spillovers on the quality of domestic logistics services through higher productivity and use of latest technology. Increased connectivity usually also means more operators and competition.

Beyond averages, the new data provide detailed information on the structure of delays such as distribution of time spent at ports or airports. Dwell time at hubs and gateways—when containers are not in motion—contributes disproportionately to the variability of lead time and reduce supply chain reliability. This supports the policy focus on trade facilitation and on soft and hard infrastructure at trade gateways and hubs, such as ports and multimodal facilities. These interventions may both reduce trade times and increase supply chain reliability.

Delay key performance indicators, such as port dwell time, point to a more complex picture because they are less strongly associated with income group than LPI score is. That industrialized economies often have longer delays than emerging economies will have to be confirmed over time, as it may reflect the magnitude of the supply chain disruptions of 2021–22 in Europe and North America.

Three groups of countries with outlying key performance indicators overlap with the bottom two LPI score quintiles and require specific policy attention. They include maritime countries with large dwell times, most of which are located in the Middle East and North Africa as well as Sub-Saharan Africa; landlocked developing countries, which experience additional inland delays, as well as longer delays than the transit country at the port of entry; and countries with limited maritime connectivity, which are heavily penalized by delays in multiple transshipments.

The World Bank intends to produce these new key performance indicators annually and to expand the scope of supply chain features that they cover. The current report does not exhaust the potential for research on global logistics based on micro-data. Further research on reliability, value of time, and connections between delays and other outcomes such as port productivity, international connectivity, and even regulations should be considered.

Policymaking priorities when managing logistics as a sector of the economy

Improving logistics performance requires countries to consider it a cross-cutting policy area. The work crosses the administrative boundaries of transportation, commerce, infrastructure, industry, finance, social issues, and the environment.

And it requires mechanisms that involve the private sector and the ability to absorb best practices from high-performing countries.

The complexity of these issues highlights the need for detailed research using the best available data, including the tracking data presented in chapter 3. One question relates to the extent to which trade facilitation practices around the world increase reliability and reduce average lead times. No high-quality quantitative evidence explains how much unreliable delivery times contribute to higher trade costs that hold back international integration.

Quantifying the social costs and benefits of supply chain characteristics—such as length, diversity, network characteristics, and resilience—has become important in light of recent disruptions. Developing policy-relevant tools could help decisionmakers identify instances where policy could play a constructive role in increasing logistics performance. Academic research has touched on these areas, but there is a global public goods case for developing specific policy-relevant insights that can support updated and innovative toolkits for policymakers.

Logistics creates new concerns because of its environmental footprint. Some logistics regulations apply to movements of goods as well as to facilities and assets. Those regulations may also influence competition at both the national and international levels. Strengthening the legal and regulatory status of logistics as a sector of the economy is likely to be most important in countries in the middle performance quintile and the second quintile from the top.

The need to attract skilled people to logistics jobs has become acute, especially in developed countries—and not just because of the experiences during the COVID-19 pandemic. In many parts of the world, there is an almost endemic lack of truck drivers, warehouse staff, and seagoing personnel.

The 2020s is a decade of transformation for global supply chains

Effective supply chains have enabled unprecedented growth of globalization over the past decades. Relying on reliable, affordable, and high-capacity logistics services, globally minded manufacturers have expanded their operations in new and existing markets. However, the 2020s are turning into a period of transformation for global supply and value chains, which have turned out to be surprisingly resilient during the recent disruptions.

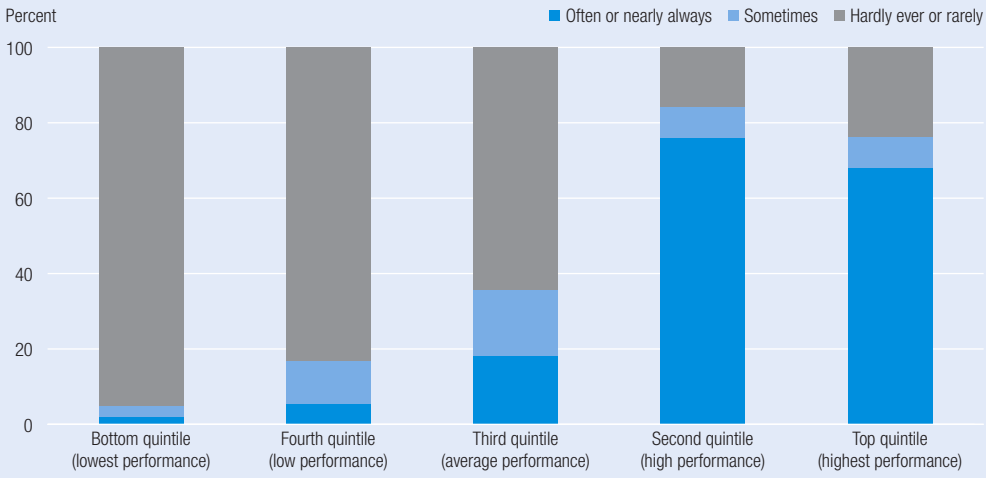
First, fundamental trends such as decarbonization, sustainability, and growing digitalization predate the recent supply chain turmoil. Second, the recent increase in the use of trade instruments in geopolitics; manufacturing job losses in advanced economies; disruptions to supplies of food, energy, pharmaceuticals, and semiconductors; and countries' failure to align incentives to curb greenhouse gas emissions are affecting the pace and nature of global trade. These events, among others, have raised the profile of supply chain management and logistics and have accelerated the path of transformation.

Businesses and governments are concerned about increasing the resilience and robustness of supply chains, in addition to efficiency—in particular, where goods of primary necessity are concerned (see box 1.1 in chapter 1). One way to do this is to seek jurisdictions where supply chain operations are less exposed to risk. Other means are tightening vertical integration (such as buying up suppliers that firms rely on), diversifying the supplier base, and building up inventory buffers along the supply chain.

In addition, the regulatory pressure to reduce logistics-related harmful emissions appears to be the main driver for stakeholders to switch to more environmentally friendly processes or equipment, especially when it can be combined with economic savings. But pressure from demand is growing, especially in high-performance countries (figure 4.1). Hence, implementable "green logistics" policies have become more important.

Efficient management and use of information technology solutions in both the private and public sectors are tools for high-quality logistics. Here, the importance of digitalization is growing, boosted by the rapid advancement of software, hardware, and innovation. One obvious area of development is to increase supply

Figure 4.1 Demand for environmentally friendly shipping options, by destination LPI score quintile



Source: 2023 Logistics Performance Index.
Note: Refers to the percentage of countries in each quintile reporting the listed average responses, based on how often shippers ask for environmentally friendly options when shipping to destination countries in each group.

chain visibility, the benefits of which were made clear by the recent turmoil. Managing Big Data approaches also brings new business opportunities, as well as analytical applications, which push technological innovation further. More efficient use of Big Data approaches is an increasingly important policy issue both domestically and in trade facilitation. Yet digitalizing supply chain processes can pose challenges for low- and middle-income countries, where access to technology and reliability of basic infrastructure (particularly electricity), may constrain the ability to access them. Building capacity, ensuring access to appropriate technologies, and supporting infrastructure need to remain part of the policy agenda.

Notes

1 The six LPI components are the efficiency of customs and border management clearance, the quality of trade and transport infrastructure, the ease of arranging competitively priced shipments, the competence and quality of logistics services, the ability to track and trace consignments, and the frequency of on-time deliveries.

2 While the Covid-19 induced supply chain crisis had largely subsided by the time of the survey, many of the respondents' perceptions were likely to have been influenced by their experience over previous months.

3 Global GDP grew by 2.6 percent in 2019, decreased by 3.1 percent in 2020, and grew by 5.9 percent in 2021. So, global GDP was higher in 2021 than in 2019 (https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG).

4 The quintiles have different numbers of countries because of tied scores in some cases.

5 Lead time refers to the duration of a logistics process, irrespective of the location of the initial and end events defining the process. In contrast, dwell time refers to the lead time between the first and last events at the same location in a supply chain and is used mostly in the context of ports and airports.

6 Transport connections refer to the number of countries a country is connected to by one of the three modes analyzed here (air, shipping, or postal).

7 The question in the LPI survey refers only to how often shippers asked for these options, not how often they were chosen.

8 "Shipper" refers to the owner of goods being transported.

9 World Bank estimate based on Automatic Identification System data.

10 IATA 2022.

11 Beretzky and others 2022.

12 UNCTAD 2021a.

13 Beretzky and others 2022.

14 The cross-country datasets measure exports, shipping, and imports. The export and import legs help get logistics information between owners of goods and international gateways (ports, airport, and land border crossings).

15 The analysis is in terms of the top 12 countries and the bottom 10 countries because of tied scores at one decimal point.

16 The quintiles have different numbers of countries because of tied scores.

17 The observed differences do not rise to the level of systematic biases. The LPI is based on respondent ratings. It does not weight scores from different income groups or geographic regions differently. The survey engine for the LPI ensures geographic diversity in the respondent base for the countries assessed (see appendix 5 for details on the LPI methodology).

18 "Timeliness of delivery" is defined in the LPI as "the frequency with which shipments reach consignees within the scheduled or expected delivery time."

19 See https://www.hhs.gov/formula/index.html.

20 Shah 2022.

21 Arvis, Marteau, and Raballand 2010.

22 The economic literature has identified time as a major determinant of country-level export performance. Djankov, Freund, and Pham (2010) focus on time spent at the border, while Hummels and Schaur (2013) examine transport time between exporting and importing countries. However, there has been no good identification of the role of dispersion in time or reliability. Future research could examine this question in detail, as existing studies do not focus on reliability, even when they use highly detailed data comparable to those presented here (for example, Volpe Martincus, Carballo, and Graziano 2016).

23 See https://resilientmaritimelogistics.unctad.org/.

24 Lynch 2021.

25 The practice of stripping containers at ports in some low- and middle-income countries may explain some low dwell time. In the context of island states with low shipping frequencies, consignees are incentivized to move back containers as soon as possible to avoid demurrage fees.

26 World Bank 2022.

27 Raballand and others 2012.

28 World Bank 2020b, 2021b.

29 World Bank 2007.

30 World Bank 2020a.

31 World Bank 2011. The World Bank has published several handbooks to support policy reform in these areas (see World Bank 2010, 2011, 2013, 2014).

32 McKinnon et al. 2017 [add to reference list].

33 See https://www.dinalog.nl/en/.

34 See, for example, https://www.un.org/ohrlls/content/landlocked-developing-countries.

35 The data for European landlocked countries point to the same phenomenon. However, it is less representative of the time to trade, unlike in developing countries. Most maritime imports for EU landlocked countries are cleared at the country of entry and reconsolidated to destination rather than containerized to destination.

36 Arvis and others 2011.

37 See https://www.portaltim.sieca.int/TIM/Portal/archivos/Manual_PortalTIM.pdf.

38 UNCTAD 2021b.

39 See, for example, Gupta and others (2020) and Seyedghorban and others (2020).

40 https://www.newyorkfed.org/research/policy/gscpi#/overview.

41 Users of logistics services are owners of goods and customers of logistics service providers.

APPENDIX 1

2023 LPI results

	LPI				Customs		Infrastructure		International shipments		Logistics competence and equality		Timeliness		Tracking and tracing	
Economy	Grouped rank	Score	Lower bound	Upper bound	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank
Singapore	1	4.3	4.2	4.4	4.2	1	4.6	1	4.0	2	4.4	1	4.3	1	4.4	1
Finland	2	4.2	4.0	4.4	4.0	4	4.2	5	4.1	1	4.2	3	4.3	1	4.2	3
Denmark	3	4.1	4.0	4.2	4.1	2	4.1	9	3.6	14	4.1	9	4.1	10	4.3	2
Germany	3	4.1	4.0	4.2	3.9	7	4.3	3	3.7	8	4.2	3	4.1	10	4.2	3
Netherlands	3	4.1	4.0	4.2	3.9	7	4.2	5	3.7	8	4.2	3	4.0	17	4.2	3
Switzerland	3	4.1	4.0	4.2	4.1	2	4.4	2	3.6	14	4.3	2	4.2	4	4.2	3
Austria	7	4.0	3.8	4.2	3.7	14	3.9	16	3.8	4	4.0	11	4.3	1	4.2	3
Belgium	7	4.0	3.9	4.1	3.9	7	4.1	9	3.8	4	4.2	3	4.2	4	4.0	16
Canada	7	4.0	3.9	4.1	4.0	4	4.3	3	3.6	14	4.2	3	4.1	10	4.1	11
Hong Kong SAR, China	7	4.0	3.9	4.1	3.8	12	4.0	14	4.0	2	4.0	11	4.1	10	4.2	3
Sweden	7	4.0	3.8	4.2	4.0	4	4.2	5	3.4	26	4.2	3	4.2	4	4.1	11
United Arab Emirates	7	4.0	3.9	4.1	3.7	14	4.1	9	3.8	4	4.0	11	4.2	4	4.1	11
France	13	3.9	3.8	4.0	3.7	14	3.8	19	3.7	8	3.8	20	4.1	10	4.0	16
Japan	13	3.9	3.8	4.0	3.9	7	4.2	5	3.3	38	4.1	9	4.0	17	4.0	16
Spain	13	3.9	3.8	4.0	3.6	20	3.8	19	3.7	8	3.9	14	4.2	4	4.1	11
Taiwan, China	13	3.9	3.7	4.1	3.5	22	3.8	19	3.7	8	3.9	14	4.2	4	4.2	3
Korea, Rep.	17	3.8	3.7	3.9	3.9	7	4.1	9	3.4	26	3.8	20	3.8	25	3.8	23
United States	17	3.8	3.7	3.9	3.7	14	3.9	16	3.4	26	3.9	14	3.8	25	4.2	3
Australia	19	3.7	3.5	3.9	3.7	14	4.1	9	3.1	47	3.9	14	3.6	35	4.1	11
China	19	3.7	3.6	3.8	3.3	31	4.0	14	3.6	14	3.8	20	3.7	30	3.8	23
Greece	19	3.7	3.5	3.9	3.2	37	3.7	25	3.8	4	3.8	20	3.9	21	3.9	20
Italy	19	3.7	3.6	3.8	3.4	24	3.8	19	3.4	26	3.8	20	3.9	21	3.9	20
Norway	19	3.7	3.5	3.9	3.8	12	3.9	16	3.0	57	3.8	20	4.0	17	3.7	29
South Africa	19	3.7	3.5	3.9	3.3	31	3.6	30	3.6	14	3.8	20	3.8	25	3.8	23
United Kingdom	19	3.7	3.6	3.8	3.5	22	3.7	25	3.5	22	3.7	28	3.7	30	4.0	16
Estonia	26	3.6	3.3	3.9	3.2	37	3.5	39	3.4	26	3.7	28	4.1	10	3.8	23
Iceland	26	3.6	3.4	3.8	3.7	14	3.6	30	3.3	38	3.5	38	3.6	35	3.7	29
Ireland	26	3.6	3.4	3.8	3.4	24	3.5	39	3.6	14	3.6	33	3.7	30	3.7	29
Israel	26	3.6	3.4	3.8	3.4	24	3.7	25	3.5	22	3.8	20	3.8	25	3.7	29
Luxembourg	26	3.6	3.3	3.9	3.6	20	3.6	30	3.6	14	3.9	14	3.5	46	3.5	37
Malaysia	26	3.6	3.4	3.8	3.3	31	3.6	30	3.7	8	3.7	28	3.7	30	3.7	29
New Zealand	26	3.6	3.4	3.8	3.4	24	3.8	19	3.2	43	3.7	28	3.8	25	3.8	23
Poland	26	3.6	3.5	3.7	3.4	24	3.5	39	3.3	38	3.6	33	3.9	21	3.8	23
Bahrain	34	3.5	3.1	3.9	3.3	31	3.6	30	3.1	47	3.3	46	4.1	10	3.4	41
Latvia	34	3.5	3.1	3.9	3.3	31	3.3	44	3.2	43	3.7	28	4.0	17	3.6	34
Qatar	34	3.5	3.1	3.9	3.1	43	3.8	19	3.1	47	3.9	14	3.5	46	3.6	34
Thailand	34	3.5	3.3	3.7	3.3	31	3.7	25	3.5	22	3.5	38	3.5	46	3.6	34
India	38	3.4	3.3	3.5	3.0	47	3.2	47	3.5	22	3.5	38	3.6	35	3.4	41
Lithuania	38	3.4	3.0	3.8	3.2	37	3.5	39	3.4	26	3.6	33	3.6	35	3.1	62
Portugal	38	3.4	3.1	3.7	3.2	37	3.6	30	3.1	47	3.6	33	3.6	35	3.2	54
Saudi Arabia	38	3.4	3.2	3.6	3.0	47	3.6	30	3.3	38	3.3	46	3.6	35	3.5	37

Economy	LPI				Customs		Infrastructure		International shipments		Logistics competence and equality		Timeliness		Tracking and tracing	
	Grouped rank	Score	Lower bound	Upper bound	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank
Türkiye	38	3.4	3.3	3.5	3.0	47	3.4	43	3.4	26	3.5	38	3.6	35	3.5	37
Croatia	43	3.3	3.0	3.6	3.0	47	3.0	55	3.6	14	3.4	42	3.2	65	3.4	41
Czechia	43	3.3	3.0	3.6	3.0	47	3.0	55	3.4	26	3.6	33	3.7	30	3.2	54
Malta	43	3.3	3.0	3.6	3.4	24	3.7	25	3.0	57	3.4	42	3.2	65	3.4	41
Oman	43	3.3	3.1	3.5	3.0	47	3.2	47	3.4	26	3.2	53	3.1	76	3.9	20
Philippines	43	3.3	3.0	3.6	2.8	59	3.2	47	3.1	47	3.3	46	3.9	21	3.3	49
Slovak Republic	43	3.3	3.0	3.6	3.2	37	3.3	44	3.0	57	3.4	42	3.5	46	3.3	49
Slovenia	43	3.3	3.0	3.6	3.4	24	3.6	30	3.4	26	3.3	46	3.3	59	3.0	65
Vietnam	43	3.3	3.1	3.5	3.1	43	3.2	47	3.3	38	3.2	53	3.3	59	3.4	41
Brazil	51	3.2	3.1	3.3	2.9	56	3.2	47	2.9	68	3.3	46	3.5	46	3.2	54
Bulgaria	51	3.2	3.0	3.4	3.1	43	3.1	52	3.0	57	3.3	46	3.5	46	3.3	49
Cyprus	51	3.2	2.9	3.5	2.9	56	2.8	63	3.1	47	3.2	53	3.5	46	3.4	41
Hungary	51	3.2	2.9	3.5	2.7	65	3.1	52	3.4	26	3.1	57	3.6	35	3.4	41
Kuwait	51	3.2	2.9	3.5	3.2	37	3.6	30	3.2	43	2.9	65	2.8	101	3.3	49
Romania	51	3.2	3.0	3.4	2.7	65	2.9	59	3.4	26	3.3	46	3.6	35	3.5	37
Botswana	57	3.1	2.6	3.6	3.0	47	3.1	52	3.0	57	3.4	42	3.3	59	3.0	65
Egypt, Arab Rep.	57	3.1	2.9	3.3	2.8	59	3.0	55	3.2	43	2.9	65	3.6	35	2.9	72
North Macedonia	57	3.1	2.8	3.4	3.1	43	3.0	55	2.8	75	3.2	53	3.5	46	3.2	54
Panama	57	3.1	2.9	3.3	3.0	47	3.3	44	3.1	47	3.0	61	3.4	55	2.9	72
Bosnia and Herzegovina	61	3.0	2.8	3.2	2.7	65	2.6	76	3.1	47	2.9	65	3.2	65	3.2	54
Chile	61	3.0	2.8	3.2	3.0	47	2.8	63	2.7	85	3.1	57	3.2	65	3.0	65
Indonesia	61	3.0	2.9	3.1	2.8	59	2.9	59	3.0	57	2.9	65	3.3	59	3.0	65
Peru	61	3.0	2.8	3.2	2.6	74	2.5	80	3.1	47	2.7	81	3.4	55	3.4	41
Uruguay	61	3.0	2.7	3.3	2.9	56	2.7	68	2.7	85	3.1	57	3.2	65	3.3	49
Antigua and Barbuda	66	2.9	2.7	3.1	2.2	110	2.7	68	2.9	68	2.9	65	3.4	55	3.2	54
Benin	66	2.9	2.5	3.3	2.7	65	2.5	80	2.9	68	3.0	61	2.7	109	3.2	54
Colombia	66	2.9	2.7	3.1	2.5	84	2.9	59	3.0	57	3.1	57	3.2	65	3.1	62
Costa Rica	66	2.9	2.8	3.0	2.8	59	2.7	68	2.8	75	2.9	65	3.2	65	2.9	72
Honduras	66	2.9	2.7	3.1	2.8	59	2.7	68	3.0	57	2.7	81	3.2	65	2.6	94
Mexico	66	2.9	2.7	3.1	2.5	84	2.8	63	2.8	75	3.0	61	3.5	46	3.1	62
Namibia	66	2.9	2.3	3.5	2.8	59	2.8	63	3.0	57	2.9	65	2.9	93	2.8	80
Argentina	73	2.8	2.6	3.0	2.7	65	2.8	63	2.7	85	2.7	81	3.1	76	2.9	72
Montenegro	73	2.8	2.5	3.1	2.6	74	2.5	80	2.8	75	2.8	76	3.2	65	3.2	54
Rwanda	73	2.8	2.5	3.1	2.5	84	2.9	59	2.4	111	3.0	61	3.1	76	3.0	65
Serbia	73	2.8	2.6	3.0	2.2	110	2.4	89	2.9	68	2.7	81	3.4	55	2.9	72
Solomon Islands	73	2.8	2.4	3.2	2.4	90	2.6	76	2.9	68	2.9	65	3.2	65	2.9	72
Sri Lanka	73	2.8	2.6	3.0	2.5	84	2.4	89	2.8	75	2.7	81	3.3	59	3.0	65
Bahamas, The	79	2.7	2.5	2.9	2.7	65	2.5	80	3.1	47	2.5	103	3.0	87	2.6	94
Belarus	79	2.7	2.4	3.0	2.6	74	2.7	68	2.6	91	2.6	92	3.1	76	2.6	94
Djibouti	79	2.7	2.5	2.9	2.6	74	2.3	108	2.5	102	2.8	76	3.6	35	2.7	87
El Salvador	79	2.7	2.5	2.9	2.4	90	2.2	118	2.6	91	2.7	81	3.2	65	2.9	72
Georgia	79	2.7	2.4	3.0	2.6	74	2.3	108	2.7	85	2.6	92	3.1	76	2.8	80
Kazakhstan	79	2.7	2.5	2.9	2.6	74	2.5	80	2.6	91	2.7	81	2.9	93	2.8	80
Papua New Guinea	79	2.7	2.4	3.0	2.4	90	2.4	89	2.6	91	2.7	81	3.3	59	3.0	65

	LPI				Customs		Infrastructure		International shipments		Logistics competence and equality		Timeliness		Tracking and tracing	
Economy	Grouped rank	Score	Lower bound	Upper bound	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank
Paraguay	79	2.7	2.5	2.9	2.4	90	2.5	80	2.7	85	2.6	92	3.0	87	2.8	80
Ukraine	79	2.7	2.4	3.0	2.4	90	2.4	89	2.8	75	2.6	92	3.1	76	2.6	94
Bangladesh	88	2.6	2.3	2.9	2.3	101	2.3	108	2.6	91	2.7	81	3.0	87	2.4	105
Congo, Rep.	88	2.6	2.3	2.9	2.3	101	2.1	125	2.6	91	2.9	65	2.9	93	2.7	87
Dominican Republic	88	2.6	2.3	2.9	2.6	74	2.7	68	2.4	111	2.6	92	3.1	76	2.4	105
Guatemala	88	2.6	2.4	2.8	2.3	101	2.4	89	2.8	75	2.7	81	2.6	116	2.7	87
Guinea-Bissau	88	2.6	2.2	3.0	2.7	65	2.4	89	2.9	68	2.9	65	2.4	129	2.3	117
Mali	88	2.6	2.1	3.1	2.6	74	2.0	130	2.6	91	2.5	103	3.1	76	2.7	87
Nigeria	88	2.6	2.3	2.9	2.4	90	2.4	89	2.5	102	2.3	119	3.1	76	2.7	87
Russian Federation	88	2.6	2.5	2.7	2.4	90	2.7	68	2.3	121	2.6	92	2.9	93	2.5	98
Uzbekistan	88	2.6	2.1	3.1	2.6	74	2.4	89	2.6	91	2.6	92	2.8	101	2.4	105
Albania	97	2.5	2.1	2.9	2.4	90	2.7	68	2.8	75	2.3	119	2.5	124	2.3	117
Algeria	97	2.5	2.1	2.9	2.3	101	2.1	125	3.0	57	2.2	126	2.6	116	2.5	98
Armenia	97	2.5	2.3	2.7	2.5	84	2.6	76	2.2	128	2.6	92	2.7	109	2.3	117
Bhutan	97	2.5	2.3	2.7	2.7	65	2.2	118	2.3	121	2.6	92	2.6	116	2.3	117
Central African Republic	97	2.5	1.9	3.1	2.4	90	2.6	76	2.1	132	2.9	65	2.6	116	2.4	105
Congo, Dem. Rep.	97	2.5	2.2	2.8	2.3	101	2.3	108	2.5	102	2.4	110	2.8	101	2.5	98
Ghana	97	2.5	2.2	2.8	2.7	65	2.4	89	2.4	111	2.5	103	2.7	109	2.2	129
Grenada	97	2.5	2.3	2.7	2.6	74	2.5	80	2.6	91	2.2	126	3.1	76	2.3	117
Guinea	97	2.5	2.3	2.7	2.4	90	2.4	89	2.2	128	2.7	81	2.5	124	2.7	87
Jamaica	97	2.5	2.3	2.7	2.2	110	2.4	89	2.4	111	2.5	103	2.9	93	2.8	80
Mauritius	97	2.5	2.3	2.7	2.4	90	2.5	80	1.9	137	2.5	103	3.1	76	2.9	72
Moldova	97	2.5	2.1	2.9	1.9	133	1.9	132	2.7	85	2.8	76	3.0	87	2.8	80
Mongolia	97	2.5	2.2	2.8	2.5	84	2.3	108	2.5	102	2.3	119	2.7	109	2.4	105
Nicaragua	97	2.5	2.2	2.8	2.0	129	1.9	132	2.8	75	2.8	76	2.9	93	2.4	105
Tajikistan	97	2.5	2.2	2.8	2.2	110	2.5	80	2.5	102	2.8	76	2.9	93	2.0	134
Togo	97	2.5	2.2	2.8	2.3	101	2.3	108	3.0	57	2.4	110	2.8	101	2.3	117
Trinidad and Tobago	97	2.5	2.3	2.7	2.2	110	2.4	89	2.5	102	2.4	110	2.9	93	2.5	98
Zimbabwe	97	2.5	2.3	2.7	2.2	110	2.4	89	2.5	102	2.3	119	2.8	101	2.7	87
Bolivia	115	2.4	2.2	2.6	2.1	120	2.4	89	2.5	102	2.4	110	2.4	129	2.5	98
Cambodia	115	2.4	2.0	2.8	2.2	110	2.1	125	2.3	121	2.4	110	2.7	109	2.8	80
Gabon	115	2.4	2.0	2.8	2.0	129	2.2	118	2.6	91	2.0	135	3.0	87	2.5	98
Guyana	115	2.4	2.2	2.6	2.3	101	2.4	89	2.1	132	2.6	92	2.6	116	2.2	129
Iraq	115	2.4	2.2	2.6	2.1	120	2.2	118	2.5	102	2.2	126	3.0	87	2.4	105
Lao PDR	115	2.4	2.1	2.7	2.3	101	2.3	108	2.3	121	2.4	110	2.8	101	2.4	105
Liberia	115	2.4	1.8	3.0	2.1	120	2.4	89	2.8	75	2.4	110	2.3	133	2.4	105
Sudan	115	2.4	2.2	2.6	2.1	120	2.3	108	2.4	111	2.4	110	2.7	109	2.3	117
Burkina Faso	123	2.3	1.8	2.8	2.0	129	2.3	108	2.4	111	2.4	110	2.4	129	2.2	129
Fiji	123	2.3	2.0	2.6	2.3	101	2.2	118	2.3	121	2.3	119	2.3	133	2.2	129
Gambia, The	123	2.3	2.0	2.6	1.8	135	2.3	108	2.6	91	2.3	119	2.6	116	2.4	105
Iran, Islamic Rep.	123	2.3	2.1	2.5	2.2	110	2.4	89	2.4	111	2.1	133	2.7	109	2.4	105
Kyrgyz Republic	123	2.3	2.1	2.5	2.2	110	2.4	89	2.4	111	2.2	126	2.4	129	2.3	117
Madagascar	123	2.3	2.0	2.6	1.8	135	1.8	136	2.9	68	2.2	126	2.6	116	2.0	134

	LPI				Customs		Infrastructure		International shipments		Logistics competence and equality		Timeliness		Tracking and tracing	
Economy	Grouped rank	Score	Lower bound	Upper bound	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank	Score	Grouped rank
Mauritania	123	2.3	1.9	2.7	2.1	120	2.0	130	2.2	128	2.5	103	2.8	101	2.5	98
Syrian Arab Republic	123	2.3	2.1	2.5	2.2	110	2.2	118	2.3	121	2.2	126	2.5	124	2.3	117
Venezuela, RB	123	2.3	2.0	2.6	2.1	120	2.4	89	2.0	135	2.5	103	2.5	124	2.3	117
Cuba	132	2.2	1.8	2.6	2.0	129	2.2	118	2.1	132	2.2	126	2.6	116	2.4	105
Yemen, Rep.	132	2.2	1.8	2.6	1.7	137	1.9	132	1.7	139	2.6	92	2.8	101	2.3	117
Angola	134	2.1	1.8	2.4	1.7	137	2.1	125	2.4	111	2.3	119	2.1	138	2.3	117
Cameroon	134	2.1	1.8	2.4	2.1	120	2.1	125	2.2	128	2.1	133	2.1	138	1.8	136
Haiti	134	2.1	1.8	2.4	2.1	120	1.8	136	2.3	121	2.0	135	2.5	124	2.1	133
Somalia	137	2.0	1.7	2.3	1.5	139	1.9	132	2.4	111	1.8	139	2.3	133	1.8	136
Afghanistan	138	1.9	1.7	2.1	2.1	120	1.7	138	1.8	138	2.0	135	2.3	133	1.6	139
Libya	138	1.9	1.6	2.2	1.9	133	1.7	138	2.0	135	1.9	138	2.2	137	1.8	136

Source: World Bank.

APPENDIX 2

Lead time data from supply chain tracking datasets

Table A2.1 Lead time data for container shipping, 2022

Economy	Number of services	Number of alliances	Number of international connections	Turnaround time at port (days)		Interquartile range	Weighted by ship's twenty-foot equivalent unit capacity	
				Median	Mean		Median	Mean
Albania	3	0	7	1.2	1.4	0.5	1.2	1.4
Algeria	25	0	18	2.5	3.1	2.4	2.7	3.2
Angola	11	0	22	2.5	3.1	2.0	3.3	3.8
Antigua and Barbuda	4	0	22	0.5	0.5	0.1	0.5	0.5
Argentina	23	0	21	1.5	1.8	1.0	1.6	1.8
Australia	58	0	36	1.7	2.0	1.1	1.9	2.1
Bahamas, The	17	2	35	1.0	1.3	1.4	1.5	1.7
Bahrain	7	1	10	0.8	2.0	0.5	0.9	1.7
Bangladesh	32	0	12	3.0	2.9	1.0	3.0	3.1
Belgium	114	3	88	1.3	1.6	1.0	1.7	1.9
Benin	16	0	26	1.5	1.5	0.8	1.5	1.5
Brazil	33	0	34	0.8	1.0	0.5	0.9	1.0
Bulgaria	6	0	8	1.0	1.3	0.5	1.0	1.1
Cambodia	12	0	10	0.8	0.9	0.5	0.8	1.0
Cameroon	16	0	26	1.6	1.6	0.8	1.5	1.6
Canada	48	3	41	2.0	2.7	2.6	2.5	3.2
Chile	18	0	18	1.3	1.5	1.0	1.5	1.9
China	590	4	92	0.8	1.1	0.5	1.0	1.4
Colombia	52	1	55	0.6	0.7	0.4	0.8	0.8
Congo, Dem. Rep.	6	0	7	1.8	1.8	1.4	1.0	1.7
Congo, Rep.	15	0	23	1.8	2.4	1.2	1.9	2.1
Costa Rica	27	0	31	0.6	0.7	0.3	0.6	0.7
Croatia	7	2	15	0.8	1.1	0.9	1.7	1.6
Cuba	7	0	15	1.0	1.4	1.2	1.2	1.5
Cyprus	12	0	13	0.6	0.7	0.5	0.7	0.8
Denmark	17	1	20	0.5	0.8	0.5	1.0	1.3
Djibouti	13	1	24	0.8	0.8	0.4	0.8	0.9
Dominican Republic	35	1	51	0.9	1.1	0.6	1.2	1.4
Egypt, Arab Rep.	69	3	46	1.1	1.3	0.7	1.2	1.4
El Salvador	4	0	7	1.2	1.3	0.4	1.2	1.3
Estonia	8	0	11	0.8	1.0	0.8	1.1	1.2
Fiji	14	0	25	1.2	1.4	0.8	1.3	1.4
Finland	30	0	15	1.3	1.4	1.1	1.4	1.6
France	71	4	76	1.1	1.5	1.1	1.7	2.0
Gabon	9	0	16	1.5	1.5	1.0	1.5	1.5
Gambia, The	3	0	3	6.8	6.7	2.7	6.9	6.8
Georgia	5	0	5	1.4	1.7	0.6	1.5	1.6
Germany	119	3	70	1.3	1.7	1.3	2.0	2.4
Ghana	22	0	29	1.1	1.2	0.5	1.1	1.2
Greece	55	3	44	1.2	1.4	0.7	1.3	1.4
Grenada	4	0	17	0.3	0.4	0.2	0.3	0.4
Guatemala	29	0	19	0.6	0.7	0.5	0.7	0.8

Economy	Number of services	Number of alliances	Number of international connections	Turnaround time at port (days)		Interquartile range	Weighted by ship's twenty-foot equivalent unit capacity	
				Median	Mean		Median	Mean
Guinea	4	0	10	2.0	2.0	0.8	2.0	2.0
Guinea-Bissau	2	0	4	3.9	3.5	1.1	3.7	3.5
Guyana	9	0	16	1.5	1.4	0.6	1.5	1.4
Haiti	10	0	10	0.8	0.8	0.6	0.8	0.8
Honduras	20	0	13	0.5	0.6	0.3	0.5	0.6
Hong Kong SAR, China	183	4	59	0.6	0.7	0.3	0.7	0.8
Iceland	8	0	10	0.6	0.8	0.9	0.8	0.9
India	117	2	58	0.9	1.1	0.7	1.0	1.1
Indonesia	118	1	17	1.1	1.8	0.9	1.1	1.5
Iran, Islamic Rep.	15	0	11	1.1	1.7	1.0	2.0	2.9
Iraq	10	2	16	1.5	1.6	1.1	1.7	1.9
Ireland	23	0	16	1.2	1.3	1.0	1.1	1.3
Israel	36	2	35	1.2	1.5	1.0	1.3	1.6
Italy	94	4	74	1.0	1.3	1.0	1.5	1.9
Jamaica	33	0	46	1.1	1.4	0.6	1.2	1.6
Japan	206	3	42	0.3	0.5	0.3	0.5	0.6
Korea, Rep.	268	5	78	0.7	1.0	0.6	1.0	1.3
Kuwait	8	0	7	0.8	0.9	0.5	0.8	0.9
Latvia	9	0	10	1.3	1.4	1.1	1.4	1.5
Liberia	3	0	5	2.0	2.3	0.8	2.0	2.3
Libya	16	0	24	2.0	2.4	1.6	2.0	2.4
Lithuania	16	0	23	0.7	0.8	0.5	0.9	1.1
Madagascar	8	0	9	0.9	0.9	0.4	0.9	0.9
Malaysia	208	4	70	1.0	1.2	0.7	1.0	1.4
Malta	22	1	45	1.2	1.3	0.7	1.3	1.4
Mauritania	7	0	5	2.1	2.6	1.3	2.0	2.6
Mauritius	13	0	26	1.3	1.5	0.8	1.1	1.4
Mexico	49	3	46	0.9	1.1	0.6	1.0	1.3
Montenegro	3	0	7	0.4	0.4	0.2	0.4	0.4
Myanmar	12	0	11	2.0	2.0	1.1	2.0	2.0
Namibia	6	0	18	1.3	1.3	0.6	1.2	1.2
Netherlands	137	3	87	0.9	1.3	1.1	1.8	2.0
New Zealand	32	0	33	1.1	1.6	1.0	1.2	1.5
Nicaragua	6	0	8	1.1	1.2	0.7	1.2	1.2
Nigeria	23	0	30	2.9	3.4	2.7	2.9	3.4
Norway	30	0	14	0.3	0.5	0.3	0.3	0.4
Oman	30	3	40	0.8	0.9	0.4	0.9	1.0
Panama	65	4	56	0.9	1.1	0.7	1.0	1.2
Papua New Guinea	19	0	18	1.5	1.9	1.1	1.6	1.8
Paraguay	3	0	2	0.0	0.0	0.0	0.0	0.0
Peru	25	0	31	0.8	0.9	0.5	0.9	0.9
Philippines	66	0	15	1.0	1.3	0.8	1.1	1.3
Poland	29	2	33	0.9	1.4	0.7	2.1	2.4
Portugal	50	1	48	0.8	1.1	0.7	1.0	1.4
Qatar	17	1	25	0.6	0.7	0.5	0.7	0.8
Romania	13	1	20	1.5	2.5	1.6	2.1	2.4
Russian Federation	45	0	34	1.8	2.2	1.5	1.9	2.3
Saudi Arabia	63	3	49	0.8	1.1	0.6	0.9	1.1

Economy	Number of services	Number of alliances	Number of international connections	Turnaround time at port (days)		Interquartile range	Weighted by ship's twenty-foot equivalent unit capacity	
				Median	Mean		Median	Mean
Singapore	240	5	81	1.0	1.2	0.6	1.2	1.3
Slovenia	14	2	19	0.9	1.3	0.7	2.4	2.2
Solomon Islands	7	0	18	1.6	1.8	1.4	1.6	1.9
Somalia	9	0	14	1.0	1.2	1.3	1.0	1.3
South Africa	26	0	37	2.8	3.3	2.6	3.0	3.5
Spain	144	4	90	0.7	1.0	0.7	1.1	1.4
Sri Lanka	67	3	50	1.0	1.3	0.6	1.0	1.3
Sudan	4	0	1	6.6	6.2	3.4	6.9	6.6
Sweden	30	1	25	0.8	1.0	0.7	1.1	1.3
Syrian Arab Republic	5	0	12	0.9	1.2	0.8	0.9	1.3
Taiwan, China	141	3	61	0.5	0.8	0.5	0.8	1.0
Thailand	89	3	33	0.8	1.0	0.8	1.1	1.4
Togo	25	0	30	1.1	1.4	0.5	1.2	1.4
Trinidad and Tobago	16	0	27	0.8	0.9	0.5	0.8	1.0
Türkiye	109	3	50	0.7	1.0	0.6	1.0	1.2
Ukraine	N/A	N/A	0	0.9	1.2	0.8	1.2	1.3
United Arab Emirates	85	3	55	1.1	1.6	1.0	1.2	1.6
United Kingdom	133	3	90	0.9	1.2	0.9	1.3	1.8
United States	223	5	102	1.5	2.1	1.4	1.9	2.7
Uruguay	19	0	23	0.9	1.2	0.8	1.0	1.1
Venezuela, RB	6	0	7	1.6	2.0	1.3	1.8	2.2
Vietnam	180	3	34	0.8	0.9	0.5	0.9	1.0
Yemen, Rep.	9	0	8	2.8	3.6	2.1	3.1	3.7

Source: World Bank calculations based on data from MDS Transmodal and MarineTraffic.
Note: Data on the number of international connections are for the second quarter of 2022, and data on turnaround time at ports are for June 2022.

Table A2.2 Lead time data for aviation, second quarter of 2022

Economy	Average number of partners (incoming and outgoing)	Aviation import dwell time (time from advisory to the consignee of the freight's arrival to delivery) (days)		
		Median	Mean	Interquartile range
Algeria	52.5	10.3	9.9	12.9
Angola	59.5	10.0	9.6	11.8
Argentina	84.5	1.4	1.4	2.6
Armenia	53	2.6	4.0	5.2
Australia	98.5	1.3	0.8	2.0
Austria	122	0.9	0.7	1.7
Bahamas, The	15	4.8	2.4	6.7
Bahrain	71	1.5	1.9	3.0
Bangladesh	73	4.9	3.8	8.0
Belgium	141	0.9	0.9	1.5
Benin	35	4.6	4.7	5.2
Brazil	116.5	2.6	1.7	3.6
Bulgaria	83.5	1.1	1.3	2.3
Cambodia	56.5	3.1	3.5	5.2
Cameroon	54.5	3.7	2.9	4.1
Canada	147	1.8	1.3	2.2

Economy	Average number of partners (incoming and outgoing)	Aviation import dwell time (time from advisory to the consignee of the freight's arrival to delivery) (days)		
		Median	Mean	Interquartile range
Chile	63.5	2.0	1.5	4.6
China	127	3.4	2.5	4.7
Colombia	80	2.0	1.7	2.8
Congo, Dem. Rep.	42	1.7	1.8	3.9
Congo, Rep.	32	3.3	3.0	4.7
Costa Rica	55	1.8	1.7	2.9
Croatia	68.5	2.2	2.6	3.0
Cuba	31.5	8.3	1.4	10.4
Cyprus	89	1.8	1.3	2.5
Czechia	115.5	1.8	1.8	2.3
Denmark	123	1.3	1.8	2.2
Djibouti	24	5.0	4.9	12.0
Dominican Republic	53	2.7	2.8	5.1
Egypt, Arab Rep.	107.5	8.3	8.7	11.0
El Salvador	21	1.6	1.6	2.2
Estonia	69.5	1.8	1.7	3.0
Finland	104	1.2	1.7	2.1
France	149.5	2.1	1.3	2.8
Gabon	32	12.7	8.2	74.3
Georgia	67.5	2.7	2.9	3.2
Germany	149.5	2.8	1.5	3.3
Ghana	80.5	4.7	5.5	6.1
Greece	111.5	1.9	2.2	2.8
Guatemala	32.5	0.8	1.5	3.6
Guinea	41	0.0	0.0	6.9
Honduras	16.5	2.5	1.8	10.6
Hong Kong SAR, China	135.5	1.6	0.7	2.0
Hungary	101	1.0	1.1	1.6
Iceland	10.5	1.9	1.7	2.1
India	133	3.0	1.9	3.8
Indonesia	104	2.6	2.4	3.7
Iran, Islamic Rep.	77	3.9	2.9	6.1
Iraq	68.5	2.1	2.6	2.5
Ireland	114.5	1.3	1.6	2.2
Israel	100.5	2.7	3.2	4.3
Italy	144.5	3.0	2.6	4.0
Jamaica	27.5	4.8	4.9	7.9
Japan	135	2.6	1.8	3.4
Kazakhstan	53	5.0	2.8	8.5
Korea, Rep.	129	1.4	1.0	2.1
Kuwait	94	2.8	2.7	4.8
Latvia	64.5	3.0	2.1	3.9
Lithuania	75.5	2.9	2.4	2.4
Luxembourg	68	0.8	0.8	1.5
Madagascar	52	2.1	2.6	2.3
Malaysia	111	1.1	0.8	2.1
Mali	50.5	2.7	3.0	4.1
Malta	66	1.8	2.0	3.1

Economy	Average number of partners (incoming and outgoing)	Aviation import dwell time (time from advisory to the consignee of the freight's arrival to delivery) (days)		
		Median	Mean	Interquartile range
Mauritius	63	2.0	2.2	3.8
Mexico	100.5	1.9	1.9	3.3
Myanmar	49	0.9	0.4	1.4
Netherlands	145	1.6	0.8	3.1
New Zealand	74.5	0.8	1.0	1.3
Nigeria	93.5	4.7	5.2	7.8
Norway	108	1.2	1.6	2.3
Oman	82.5	2.2	2.5	3.7
Panama	55	1.9	2.3	2.9
Peru	56	3.6	2.6	10.9
Philippines	92.5	2.9	2.4	5.8
Poland	104	2.1	2.5	2.7
Portugal	110.5	1.9	2.1	3.0
Romania	91.5	1.8	1.9	2.2
Russian Federation	85	2.7	2.5	3.5
Rwanda	31.5	2.6	1.4	3.7
Saudi Arabia	99.5	3.4	2.6	5.4
Singapore	124.5	1.6	0.3	2.5
Slovenia	73	1.9	2.1	3.1
South Africa	132	1.9	1.3	3.1
Spain[a]	136.5	2.1	1.8	2.9
Sri Lanka	76	2.5	3.0	4.6
Sudan	62	7.9	5.4	5.9
Sweden	116.5	1.7	2.0	2.6
Switzerland	142.5	1.6	1.0	2.2
Taiwan, China	104	1.3	1.3	2.3
Thailand	120	2.1	2.1	3.1
Togo	33.5	4.0	3.8	5.0
Trinidad and Tobago	23	4.7	4.0	8.7
Türkiye	119	3.5	3.0	4.1
United Arab Emirates	136	2.5	1.3	3.4
United Kingdom	152.5	2.0	1.0	3.0
United States	158	4.1	1.2	5.2
Uruguay	39.5	5.1	0.1	9.0
Vietnam	98	2.6	2.4	3.5
Zimbabwe	45.5	4.5	4.6	4.9

Source: Cargo IQ.
a. Includes the Canary Islands.

Table A2.3 Lead time data for postal parcels, 2019

Economy	Average number of partners (countries)	Delivery time (days)		
		Median	Mean	Interquartile range
Afghanistan	42.5	9.7	5.2	11.1
Albania	80.5	1.7	0.9	1.1
Algeria	87	6.7	5.0	5.1
Angola	53.5	13.0	4.9	16.7
Argentina	80.5	27.0	21.1	34.8
Armenia	62	6.3	4.2	5.0
Australia	147	3.7	2.9	3.0
Austria	138	3.8	1.8	3.4
Bahamas, The	25.5	2.2	0.0	0.0
Bahrain	75	7.9	6.7	7.8
Bangladesh	97	6.9	5.2	4.0
Belarus	105	4.1	2.8	4.0
Belgium	107.5	5.6	2.8	5.9
Benin	59.5	3.5	0.2	2.0
Bhutan	25	5.5	2.2	8.0
Bosnia and Herzegovina	76	4.6	3.1	3.8
Botswana	33.5	15.9	12.1	14.9
Brazil	128.5	23.2	19.2	17.9
Bulgaria	107	8.0	2.1	10.2
Burkina Faso	71	3.3	0.1	4.1
Cambodia	57.5	4.0	0.3	4.0
Cameroon	63	10.6	6.0	11.0
Canada	150	4.8	3.2	4.9
Chile	103	8.7	4.6	7.7
China	121.5	5.6	4.1	3.9
Colombia	91	2.4	0.8	2.0
Congo, Dem. Rep.	45	61.2	31.1	109.1
Congo, Rep.	32	16.4	10.0	21.1
Costa Rica	75	10.1	6.2	14.9
Croatia	106.5	2.0	1.1	2.0
Cuba	73	19.4	16.2	17.2
Cyprus	108	2.1	1.2	2.4
Czechia	128.5	4.1	2.3	3.9
Denmark	138	4.7	2.1	5.6
Djibouti	39	3.4	1.0	3.7
Dominican Republic	65	2.0	0.2	0.2
Egypt, Arab Rep.	89	10.2	2.1	13.1
El Salvador	34	4.1	2.1	3.7
Estonia	113	4.5	2.0	5.3
Fiji	59.5	3.8	1.3	2.4
Finland	134	2.5	1.3	2.1
France	141	3.0	2.2	1.3
Gabon	22	11.9	5.0	16.1
Georgia	82	1.8	1.0	1.1
Germany	150.5	1.7	0.9	1.6
Ghana	90.5	2.4	1.0	2.7
Greece	131.5	4.8	3.0	5.0

Economy	Average number of partners (countries)	Delivery time (days)		
		Median	Mean	Interquartile range
Guatemala	25	28.7	18.9	31.0
Guinea	32	6.7	2.9	7.0
Guyana	31.5	5.0	0.8	8.1
Haiti	22	11.2	4.9	15.3
Honduras	32	8.5	5.1	9.1
Hong Kong SAR, China	134	1.8	1.2	1.3
Hungary	116.5	2.5	1.5	1.9
Iceland	110.5	2.7	1.3	2.7
India	140	10.4	7.9	8.1
Indonesia	117	13.3	7.2	11.1
Iran, Islamic Rep.	98	4.4	3.0	3.9
Iraq	64.5	14.6	7.9	15.9
Ireland	103	1.6	0.9	1.4
Israel	99	7.1	5.9	7.0
Italy	142.5	4.5	2.1	4.0
Jamaica	80	17.9	9.9	12.2
Japan	140	2.5	1.8	1.5
Kazakhstan	101	8.1	5.9	6.8
Korea, Rep.	120.5	1.8	1.0	2.0
Kuwait	82.5	6.9	3.3	9.2
Kyrgyz Republic	49.5	6.0	3.2	7.3
Lao PDR	50	4.4	2.0	4.1
Latvia	108.5	1.8	1.6	1.9
Liberia	32.5	2.7	0.0	0.2
Libya	42.5	15.2	1.1	10.1
Lithuania	119	5.6	2.2	5.8
Luxembourg	104	2.5	1.2	2.1
Madagascar	36.5	3.9	0.9	6.8
Malaysia	123	5.2	2.9	4.5
Mali	43.5	1.3	0.1	1.2
Malta	105	5.1	1.7	6.0
Mauritania	30	4.8	1.0	3.8
Mauritius	79.5	7.6	4.9	8.1
Mexico	87.5	12.5	7.6	10.9
Moldova	87	2.7	2.0	2.9
Mongolia	62	2.6	0.9	2.8
Montenegro	56	4.7	2.1	5.3
Myanmar	46	1.8	1.0	1.8
Namibia	46	16.0	11.8	17.6
Netherlands	148.5	1.5	0.9	0.7
New Zealand	128.5	2.9	1.8	2.3
Nicaragua	43.5	7.3	5.0	7.3
Nigeria	102.5	6.4	3.2	10.7
North Macedonia	72.5	6.8	4.1	7.8
Norway	139.5	4.9	3.9	5.5
Oman	90	5.6	2.3	6.0
Panama	68	7.7	2.7	5.8
Papua New Guinea	27	8.4	5.0	8.8

Economy	Average number of partners (countries)	Delivery time (days)		
		Median	Mean	Interquartile range
Paraguay	59.5	27.6	18.0	39.9
Peru	97	11.7	7.3	10.0
Philippines	116	18.9	13.7	22.2
Poland	136.5	3.0	1.9	2.1
Portugal	113	13.2	6.8	20.7
Qatar	99.5	5.9	3.1	5.9
Romania	122	2.3	1.1	2.1
Russian Federation	144.5	7.9	5.8	6.6
Rwanda	61.5	5.5	3.0	4.7
Saudi Arabia	116	6.6	4.1	6.2
Serbia	104	9.3	7.7	9.9
Singapore	116	1.9	1.1	1.5
Slovak Republic	110	2.2	1.3	2.0
Slovenia	106.5	3.6	1.9	4.1
Solomon Islands	25.5	7.8	1.0	9.8
South Africa	130	15.9	11.0	13.6
Spain	142	5.8	3.0	5.0
Sri Lanka	87.5	19.0	12.2	27.0
Sudan	42	5.0	1.9	5.4
Sweden	137	2.8	1.9	3.1
Switzerland	145.5	3.0	1.9	3.1
Syrian Arab Republic	44.5	9.6	7.0	13.0
Taiwan, China	103	2.9	2.1	2.8
Tajikistan	29	0.0	0.0	0.0
Thailand	121	2.6	2.1	2.0
Togo	67.5	8.0	3.0	6.2
Trinidad and Tobago	50.5	18.8	14.2	14.1
Türkiye	133.5	9.6	5.4	9.9
Ukraine	129.5	5.0	3.9	3.6
United Arab Emirates	131.5	5.5	1.1	1.5
United Kingdom	139.5	2.4	1.0	2.5
United States	149.5	5.1	3.9	3.8
Uruguay	85.5	9.9	4.7	12.9
Uzbekistan	33.5	5.5	4.0	3.3
Venezuela, RB	37	37.7	21.1	47.6
Vietnam	103.5	8.2	5.0	8.9
Zimbabwe	58	15.2	8.9	16.5

Source: Universal Postal Union.

Table A2.4 Import delays, May–October 2022

Economy	Number of observations	Consolidated dwell time (days)				Port dwell time (days)			
		Mean	Median	Q25	Q75	Mean	Median	Q25	Q75
Albania	1,039	13.6	6.6	3.7	14.7	13.3	6.4	3.5	14.5
Algeria	2,362	20.9	16.4	10.9	24.6	20.9	16.4	10.9	24.6
American Samoa	20	18.4	17.0	4.9	32.6	18.4	17.0	4.9	32.6
Angola	10,064	6.9	4.8	2.9	8.1	4.4	4.0	2.4	5.5
Argentina	14,350	11.4	9.2	6.4	13.6	11.4	9.2	6.4	13.6
Armenia	12	3.8	3.3	2.7	5.1	3.3	3.3	0.7	5.1
Aruba	927	3.3	2.0	1.0	5.0	3.3	2.0	1.0	5.0
Australia	53,319	3.2	3.0	2.1	4.0	3.2	3.0	2.1	3.9
Austria	227	18.0	13.6	9.1	22.9	14.1	11.0	6.0	18.9
Azerbaijan	48	5.2	4.3	3.5	5.1	4.0	3.6	0.5	5.0
Bahamas, The	25	4.7	3.2	2.1	5.5	4.7	3.2	2.1	5.5
Bahrain	45	6.3	5.5	2.7	9.1	6.0	4.6	2.6	9.1
Bangladesh	14,145	8.1	5.5	3.5	9.4	7.7	5.4	3.5	9.0
Barbados	12	8.7	6.6	5.1	10.8	0.5	0.5	0.5	0.6
Belgium	24,991	10.4	6.6	4.0	12.8	8.3	5.8	3.7	10.1
Belize	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Benin	5,791	12.4	8.7	5.2	15.0	12.4	8.7	5.2	15.0
Bolivia	273	6.0	3.9	1.4	9.0	6.0	3.9	1.4	9.0
Bonaire, Sint Eustatius and Saba	18	4.0	2.2	1.6	5.7	3.8	1.9	1.5	5.6
Bosnia and Herzegovina	24	12.9	12.4	8.7	17.5	12.9	12.4	8.7	17.5
Botswana	69	13.4	9.0	4.4	18.8	9.9	6.1	3.8	9.2
Brazil	44,205	6.7	4.4	1.9	8.6	6.6	4.4	1.9	8.5
Brunei Darussalam	2,149	2.8	2.3	1.1	4.3	2.8	2.3	1.1	4.3
Bulgaria	3,022	8.6	6.1	3.5	8.9	8.6	6.1	3.5	8.9
Burkina Faso	131	21.4	19.4	12.3	28.5	13.6	12.7	6.9	17.2
Burundi	12	15.1	15.8	9.7	18.4	11.9	9.7	8.6	16.5
Cabo Verde	696	7.9	4.7	2.7	10.7	7.7	4.7	2.7	9.7
Cambodia	7,951	3.6	2.1	1.0	4.1	3.6	2.1	1.0	4.1
Cameroon	6,102	16.4	11.9	7.3	20.2	16.3	11.9	7.3	20.1
Canada	20,359	8.8	5.8	3.2	10.9	6.1	4.2	1.7	7.4
Cayman Islands	27	6.6	4.9	1.9	9.9	0.8	0.8	0.5	1.0
Central African Republic	8	31.3	30.2	26.1	34.0	31.3	30.2	26.1	34.0
Chad	20	15.2	15.5	7.5	18.4	15.2	15.5	7.5	18.4
Chile	20,991	4.1	3.2	1.9	4.5	4.1	3.2	1.9	4.5
China	87,910	5.5	3.7	1.9	6.6	5.5	3.7	1.9	6.6
Colombia	21,401	8.8	7.2	5.1	10.2	8.8	7.2	5.1	10.2
Congo, Dem. Rep.	6,198	18.1	14.7	9.9	22.1	17.5	14.6	9.9	22.0
Congo, Rep.	3,436	9.6	6.6	3.8	11.9	9.3	6.2	3.7	11.7
Costa Rica	9,353	7.6	6.1	3.1	9.4	5.4	3.4	1.9	6.6
Côte d'Ivoire	7,004	10.8	7.9	4.6	13.3	10.7	7.9	4.4	13.3
Croatia	3,879	7.1	4.4	2.9	8.6	6.6	4.3	2.8	7.9
Cuba	24	13.2	13.2	5.8	19.5	13.2	13.2	5.8	19.5
Curaçao	640	7.3	7.0	3.2	10.4	7.3	7.0	3.2	10.4
Cyprus	2,557	3.3	1.8	1.0	4.4	3.3	1.8	1.0	4.4

Economy	Number of observations	Consolidated dwell time (days)				Port dwell time (days)			
		Mean	Median	Q25	Q75	Mean	Median	Q25	Q75
Czechia	4,891	17.6	15.9	10.7	22.1	11.4	9.9	6.2	14.6
Denmark	13,462	8.4	5.9	2.5	9.3	6.9	5.4	2.3	7.8
Djibouti	7,030	9.0	6.0	3.4	10.4	8.9	5.9	3.4	10.4
Dominican Republic	5,772	7.7	5.5	3.2	9.5	7.5	5.4	3.1	9.3
Ecuador	9,234	7.3	5.8	3.5	9.1	7.3	5.8	3.5	9.0
Egypt, Arab Rep.	17,735	16.9	12.2	6.0	21.7	14.4	9.4	4.9	18.3
El Salvador	6,850	7.2	5.5	3.6	9.0	7.2	5.4	3.6	9.0
Equatorial Guinea	804	6.7	4.5	1.1	10.0	6.7	4.5	1.1	10.0
Estonia	411	4.7	4.0	1.8	5.9	4.7	4.0	1.8	5.9
Eswatini	121	4.4	4.0	3.0	4.4	4.1	3.9	3.0	4.4
Ethiopia	147	11.0	4.6	3.4	9.9	10.9	4.6	3.4	9.5
Faroe Islands	15	1.4	0.5	0.2	1.8	0.8	0.4	0.2	0.8
Fiji	850	2.9	2.4	1.7	3.6	2.9	2.4	1.7	3.6
Finland	3,137	12.5	6.8	3.4	14.7	12.5	6.8	3.4	14.7
France	18,617	8.1	5.7	3.5	9.8	7.9	5.6	3.5	9.5
Gabon	934	11.4	8.8	5.8	13.9	11.4	8.8	5.8	13.9
Gambia, The	2,644	9.7	6.7	3.9	10.7	9.7	6.7	3.9	10.7
Georgia	4,717	4.6	2.5	1.1	5.1	3.6	1.6	0.5	3.7
Germany	51,995	12.1	8.6	5.1	15.3	10.2	7.6	4.7	12.8
Ghana	18,882	7.4	4.6	2.0	9.4	5.7	3.0	1.1	7.5
Greece	8,585	5.2	3.2	1.9	5.5	5.2	3.2	1.9	5.4
Grenada	16	8.9	8.0	5.8	12.0	0.9	0.6	0.6	1.0
Guadeloupe	2,147	5.1	3.3	1.4	6.4	5.1	3.3	1.4	6.4
Guatemala	8,759	8.4	6.8	4.1	10.9	8.4	6.8	4.1	10.9
Guinea	7,892	8.8	6.2	4.0	10.8	8.8	6.2	4.0	10.8
Guyana	871	11.5	8.7	4.1	16.8	11.4	8.7	4.0	16.8
Haiti	610	13.4	10.7	5.8	16.1	13.4	10.7	5.8	16.1
Honduras	6,688	6.9	5.5	2.6	9.3	6.7	5.4	2.4	8.9
Hong Kong SAR, China	13,300	3.1	2.4	0.9	4.1	3.0	2.3	0.9	4.1
Hungary	3,747	14.7	12.3	6.5	20.1	9.9	7.9	4.6	13.5
India	71,765	5.3	2.7	1.2	7.5	2.6	1.5	0.9	3.0
Indonesia	41,619	3.4	2.3	1.2	4.2	3.2	2.2	1.2	4.0
Iraq	1,760	7.0	5.1	3.6	7.8	7.0	5.1	3.6	7.8
Ireland	4,678	9.0	5.7	3.7	10.3	8.9	5.7	3.7	10.2
Israel	13,890	6.8	4.6	2.8	7.5	5.8	4.1	2.5	6.3
Italy	23,629	9.0	6.2	3.7	11.0	8.0	5.9	3.3	9.8
Jamaica	1,536	9.2	7.9	4.7	12.0	9.2	7.9	4.7	12.0
Japan	35,216	7.4	5.5	3.3	8.9	1.0	0.4	0.3	0.6
Jordan	6,741	5.5	3.3	1.6	6.9	5.5	3.3	1.6	6.9
Kenya	21,764	6.9	5.0	2.9	8.8	5.1	3.4	1.9	6.5
Korea, Rep.	35,154	8.5	5.7	2.6	10.5	8.2	5.6	2.6	10.4
Kuwait	7,772	6.0	4.6	3.1	6.9	6.0	4.6	3.1	6.9
Lao PDR	5	6.8	2.9	2.8	3.3	5.0	0.6	0.3	1.1
Latvia	1,365	8.0	5.5	3.3	10.2	8.0	5.5	3.3	10.2
Lebanon	3,195	12.2	9.9	6.4	14.5	12.2	9.9	6.4	14.5
Lesotho	183	5.9	5.1	3.5	6.2	5.0	4.9	3.4	6.0
Liberia	4,175	9.2	6.2	3.1	12.1	9.2	6.2	3.1	12.1
Libya	3,109	13.8	10.2	7.3	15.8	13.8	10.2	7.3	15.8

Economy	Number of observations	Consolidated dwell time (days)				Port dwell time (days)			
		Mean	Median	Q25	Q75	Mean	Median	Q25	Q75
Lithuania	3,059	8.5	5.4	2.4	9.3	8.4	5.4	2.4	9.2
Luxembourg	5	15.2	16.5	12.3	17.3	15.2	16.5	12.3	17.3
Madagascar	4,421	6.3	4.7	1.8	7.9	6.3	4.7	1.8	7.9
Malawi	115	12.7	11.7	7.0	16.3	10.6	9.9	6.3	14.2
Malaysia	39,582	5.8	3.6	1.8	6.6	5.8	3.6	1.8	6.6
Maldives	176	1.5	0.1	0.1	2.1	1.5	0.1	0.1	2.1
Mali	128	22.7	11.2	8.8	23.9	19.7	10.3	8.1	16.5
Malta	91	25.0	20.0	7.1	39.3	25.0	20.0	7.1	39.3
Martinique	1,509	5.4	5.0	2.0	6.3	5.4	5.0	2.0	6.3
Mauritania	3,327	10.7	7.1	4.6	13.0	10.7	7.1	4.6	13.0
Mauritius	8,315	4.3	3.2	2.0	5.0	4.3	3.2	2.0	5.0
Mexico	41,736	8.8	6.2	3.6	10.2	8.6	6.0	3.5	9.9
Moldova	4	10.4	10.5	10.0	10.9	10.4	10.5	10.0	10.9
Mongolia	2	25.1	25.1	20.0	30.3	25.0	25.0	19.9	30.1
Morocco	16,266	10.7	7.2	4.2	12.4	10.2	7.1	4.1	12.2
Mozambique	5,713	7.5	5.6	3.6	9.3	7.4	5.6	3.6	9.2
Myanmar	13,635	8.1	5.0	3.1	9.6	8.1	5.0	3.1	9.6
Namibia	1,097	9.1	6.8	4.1	10.4	9.1	6.8	4.1	10.4
Nepal	2,454	11.6	10.6	6.0	15.5	6.1	3.7	2.0	8.8
Netherlands	72,974	9.4	5.8	3.1	11.2	7.2	5.2	3.0	9.1
New Zealand	24,995	6.5	4.7	2.7	9.3	5.4	3.9	2.2	7.2
Nicaragua	4,077	6.8	5.2	3.4	8.2	6.8	5.2	3.4	8.2
Niger	33	16.6	15.3	7.5	24.0	16.6	15.3	7.5	24.0
Nigeria	26,953	16.2	12.5	7.5	20.2	15.2	11.6	7.0	19.1
North Macedonia	14	13.0	9.0	4.9	12.2	12.8	9.0	4.9	12.2
Norway	4,314	5.0	3.6	1.1	6.1	4.8	3.5	1.1	6.0
Oman	8,864	5.0	3.2	1.6	6.3	5.0	3.1	1.6	6.3
Pakistan	10,834	10.0	6.8	3.7	11.8	6.4	3.7	1.8	7.9
Panama	17,467	6.0	4.5	2.9	7.1	5.0	3.9	2.4	6.1
Papua New Guinea	965	6.8	5.2	3.2	7.5	6.8	5.2	3.2	7.5
Paraguay	739	7.6	6.4	3.9	10.0	7.5	6.3	3.8	10.0
Peru	15,294	2.5	1.8	1.2	2.7	2.5	1.8	1.2	2.7
Philippines	43,236	6.4	5.0	3.0	8.0	6.2	4.9	2.8	8.0
Poland	35,325	11.2	7.5	4.4	13.4	10.3	6.4	4.1	11.8
Portugal	7,805	7.7	5.0	2.8	9.8	6.9	4.8	2.7	8.7
Puerto Rico	2,377	5.8	5.0	3.2	7.1	5.8	5.0	3.2	7.1
Qatar	8,626	4.4	3.0	1.3	5.1	4.3	3.0	1.3	5.1
Réunion	4,786	6.3	5.2	2.3	7.5	6.3	5.2	2.3	7.5
Romania	7,409	10.3	6.6	4.6	11.8	9.6	6.4	4.5	11.2
Rwanda	67	16.5	13.6	8.5	17.6	14.6	11.9	4.7	15.3
Samoa	5	6.0	4.2	4.2	5.2	6.0	4.2	4.2	5.2
Saudi Arabia	25,767	4.3	3.1	1.9	4.4	2.1	0.7	0.5	2.9
Senegal	15,548	8.1	6.4	3.0	9.6	8.0	6.4	3.0	9.6
Serbia	299	10.5	8.0	5.0	13.6	7.6	5.1	3.1	9.6
Seychelles	926	11.7	9.0	5.0	15.2	11.6	9.0	5.0	15.1
Sierra Leone	3,961	9.2	6.2	3.3	11.2	9.2	6.2	3.3	11.2
Singapore	13,621	3.0	1.5	0.8	2.6	3.0	1.5	0.8	2.6
Sint Maarten (Dutch part)	20	8.9	6.7	5.0	12.5	0.8	0.6	0.6	0.9

Economy	Number of observations	Consolidated dwell time (days)				Port dwell time (days)			
		Mean	Median	Q25	Q75	Mean	Median	Q25	Q75
Slovak Republic	2,981	19.2	16.5	10.2	25.7	10.8	9.9	5.9	14.3
Slovenia	8,125	8.0	5.5	3.2	10.0	7.5	5.3	3.2	9.3
Solomon Islands	98	12.5	9.3	3.3	19.2	11.9	9.0	3.2	19.0
Somalia	3,767	7.3	5.0	3.0	9.0	7.3	5.0	3.0	9.0
South Africa	41,097	5.3	3.7	2.5	5.5	4.0	3.5	2.3	4.9
Spain	39,144	8.5	5.9	3.2	10.9	7.7	5.5	2.9	9.7
Sri Lanka	7,197	5.7	3.6	2.0	5.9	5.7	3.6	2.0	5.9
St. Kitts and Nevis	5	5.0	3.9	3.4	4.0	0.5	0.4	0.4	0.4
St. Lucia	1	9.5	9.5	9.5	9.5	0.5	0.5	0.5	0.5
St. Vincent and the Grenadines	8	4.3	3.6	2.4	5.6	0.8	0.6	0.5	1.0
Sudan	3,540	12.8	6.7	5.5	16.0	12.8	6.7	5.5	16.0
Suriname	729	5.3	3.8	2.0	6.8	5.3	3.8	2.0	6.8
Sweden	12,472	7.6	5.0	3.3	9.1	6.6	4.5	3.1	8.2
Switzerland	330	19.8	17.7	12.4	25.1	12.8	10.0	6.4	16.7
Syrian Arab Republic	160	15.5	12.1	7.5	18.1	15.5	12.1	7.5	18.1
Taiwan, China	11,273	6.8	5.2	3.1	8.8	5.2	3.9	1.8	6.8
Tanzania	11,265	13.9	9.4	4.4	17.8	10.3	5.1	2.8	12.6
Thailand	31,034	5.7	4.3	2.6	7.1	4.4	3.3	1.7	5.4
Timor-Leste	80	4.6	4.1	1.7	5.2	4.0	3.8	1.5	5.2
Togo	7,118	8.1	4.6	3.0	9.0	8.1	4.6	3.0	9.0
Tonga	5	4.4	3.0	3.0	6.1	4.4	3.0	3.0	6.1
Trinidad and Tobago	2,277	9.2	6.7	4.4	10.2	9.1	6.7	4.4	10.2
Tunisia	1,496	18.7	13.4	9.0	23.3	18.7	13.4	9.0	23.3
Türkiye	25,836	8.6	5.7	3.7	10.2	8.6	5.7	3.6	10.1
Turks and Caicos Islands	47	19.2	18.6	11.0	25.9	0.8	0.6	0.5	1.0
Uganda	535	18.2	14.7	9.5	24.1	9.3	8.1	4.9	11.5
United Arab Emirates	47,865	4.5	3.0	1.5	5.9	4.4	3.0	1.5	5.9
United Kingdom	78,224	8.5	5.5	3.3	9.3	7.2	5.0	2.9	8.4
United States	350,868	8.3	5.4	3.2	9.2	7.2	5.1	3.0	8.3
Uruguay	4,819	2.4	1.8	1.2	2.8	2.4	1.8	1.2	2.8
Venezuela, RB	3,861	5.1	3.6	2.4	6.7	5.1	3.6	2.4	6.7
Vietnam	50,207	5.4	3.6	1.8	7.1	5.3	3.6	1.8	7.0
Virgin Islands (U.S.)	7	5.7	4.0	1.1	8.9	0.9	0.9	0.5	1.0
Yemen, Rep.	2,366	4.8	4.1	3.1	6.2	4.8	4.1	3.1	6.2
Zambia	171	13.9	11.7	7.8	16.8	13.6	11.4	7.3	16.8
Zimbabwe	176	12.8	11.8	8.1	15.2	12.8	11.8	8.1	15.2

Source: TradeLens.

Table A2.5 Export delays, May–October 2022

Economy	Number of observations	Consolidated dwell time (days)				Port dwell time (days)			
		Mean	Median	Q25	Q75	Mean	Median	Q25	Q75
Albania	82	6.9	5.4	3.5	9.1	6.9	5.4	3.5	9.1
Algeria	418	3.4	0.7	0.4	1.9	3.4	0.7	0.4	1.9
Angola	24	10.9	7.0	3.9	15.4	10.9	7.0	3.9	15.4
Argentina	8,804	7.4	6.7	4.7	9.1	7.4	6.7	4.7	9.1
Aruba	9	6.6	6.3	2.2	8.5	6.6	6.3	2.2	8.5
Australia	16,744	5.3	4.6	3.5	6.2	5.3	4.6	3.5	6.2
Austria	164	13.4	10.6	7.2	16.4	9.3	6.9	4.0	10.7
Bahamas, The	25	10.5	9.4	3.7	11.9	10.5	9.4	3.7	11.9
Bahrain	335	4.8	3.8	2.8	6.3	4.8	3.8	2.8	6.3
Bangladesh	17,272	1.7	1.0	0.5	2.0	1.6	0.9	0.5	1.8
Belgium	26,348	7.7	6.3	4.0	9.6	7.3	6.0	3.9	9.0
Benin	491	16.2	13.8	9.8	20.2	16.2	13.8	9.8	20.2
Brazil	44,165	9.6	7.7	5.4	11.8	9.5	7.7	5.4	11.7
Brunei Darussalam	45	1.5	0.9	0.6	2.2	1.5	0.9	0.6	2.2
Bulgaria	1,508	8.4	7.7	5.9	10.1	8.0	7.3	5.7	9.7
Burkina Faso	3	14.2	15.3	8.6	20.4	12.9	13.3	6.6	19.4
Cabo Verde	80	18.2	14.3	6.4	25.5	18.2	14.3	6.4	25.5
Cambodia	10,461	2.4	1.4	1.0	3.0	2.4	1.4	1.0	3.0
Cameroon	1,301	6.7	5.4	3.6	8.2	6.7	5.4	3.6	8.2
Canada	7,550	5.7	5.1	2.3	7.3	4.8	4.7	0.0	6.8
Chile	13,309	4.7	4.2	2.9	5.8	4.7	4.2	2.9	5.8
China	790,942	5.2	4.5	3.1	6.4	4.9	4.3	2.9	6.2
Colombia	7,529	6.3	5.0	3.2	7.8	6.2	5.0	3.1	7.7
Congo, Dem. Rep.	34	21.4	13.2	8.2	22.8	19.6	12.4	7.5	21.9
Congo, Rep.	269	8.5	7.6	6.1	9.9	8.5	7.5	5.9	9.8
Costa Rica	6,046	2.8	2.1	1.3	3.5	2.6	1.9	1.3	3.2
Côte d'Ivoire	2,643	6.4	5.7	4.0	7.6	6.2	5.6	3.9	7.4
Croatia	799	8.8	8.5	6.2	10.7	8.8	8.5	6.2	10.7
Cuba	3	8.9	8.7	6.9	10.8	8.9	8.7	6.9	10.8
Curaçao	8	14.0	12.8	6.5	21.2	14.0	12.8	6.5	21.2
Cyprus	832	1.8	1.4	1.1	2.1	1.8	1.4	1.1	2.1
Czechia	3,222	13.8	12.5	9.5	16.9	7.6	6.7	4.2	9.7
Denmark	12,644	8.1	7.5	4.8	9.7	8.1	7.5	4.7	9.6
Djibouti	2,434	5.3	4.5	2.3	6.6	5.3	4.4	2.3	6.6
Dominican Republic	1,326	9.4	8.1	4.8	11.8	9.3	8.0	4.8	11.7
Ecuador	8,951	3.7	3.1	2.3	4.5	3.6	3.1	2.3	4.4
Egypt, Arab Rep.	18,712	5.6	4.9	3.4	6.7	5.5	4.8	3.4	6.6
El Salvador	544	10.0	8.6	5.9	13.2	10.0	8.6	5.9	13.2
Equatorial Guinea	73	12.9	11.0	6.4	14.8	12.9	11.0	6.4	14.8
Estonia	49	6.2	5.3	4.3	8.3	5.7	5.3	4.3	8.3
Ethiopia	18	11.6	14.0	9.2	15.3	6.4	4.7	3.4	7.9
Fiji	151	3.6	3.2	2.5	4.6	3.6	3.2	2.5	4.6
Finland	6,240	9.4	8.1	6.2	11.1	9.4	8.1	6.2	11.1
France	14,417	9.5	8.0	4.9	12.4	9.2	7.7	4.6	12.0
Gabon	442	6.4	6.1	4.1	[Q?]	9.2	7.7	4.6	12.0
Gambia, The	442	6.4	6.1	4.1	8.2	6.4	6.1	4.1	8.2

Economy	Number of observations	Consolidated dwell time (days)				Port dwell time (days)			
		Mean	Median	Q25	Q75	Mean	Median	Q25	Q75
Georgia	365	7.9	3.9	2.7	11.2	7.7	3.9	2.7	10.8
Germany	529	4.9	1.6	0.74.2	10.5	7.7	6.0	3.9	9.4
Ghana	1,411	5.3	4.1	3.0	5.8	4.9	3.8	2.7	5.4
Greece	4,624	4.6	3.8	2.8	5.2	4.6	3.8	2.8	5.2
Guadeloupe	101	6.8	4.6	3.1	9.4	6.8	4.6	3.1	9.4
Guatemala	5,328	4.2	3.3	1.9	5.6	4.2	3.3	1.9	5.6
Guinea	314	9.4	8.7	5.5	12.3	9.4	8.7	5.5	12.3
Guyana	250	8.6	7.3	3.6	11.6	8.6	7.3	3.6	11.6
Haiti	47	11.5	10.0	3.0	15.2	11.5	10.0	3.0	15.2
Honduras	4,268	2.8	2.0	1.6	3.1	2.7	2.0	1.6	3.1
Hong Kong SAR, China	5,794	5.0	4.8	3.4	6.3	5.0	4.8	3.4	6.3
Hungary	1,746	13.5	11.5	8.3	16.2	8.8	7.6	4.7	10.3
India	129,906	5.0	4.3	3.0	6.4	4.6	4.1	2.9	5.9
Indonesia	46,046	3.5	3.3	2.2	4.6	3.5	3.3	2.2	4.6
Iraq	4	6.2	6.1	4.8	7.5	6.2	6.1	4.8	7.5
Ireland	3,263	7.6	6.7	4.9	9.4	7.6	6.7	4.9	9.3
Israel	7,059	3.3	2.5	1.9	3.4	3.2	2.5	1.9	3.4
Italy	36,798	7.4	6.2	4.4	9.1	7.0	6.0	4.1	8.5
Jamaica	22	12.8	9.9	5.2	15.7	12.8	9.9	5.2	15.7
Japan	21,019	5.2	4.5	2.4	7.1	1.0	0.4	0.3	0.6
Jordan	2,287	5.3	4.8	3.6	6.6	5.3	4.8	3.6	6.6
Kenya	7,039	5.8	5.3	2.9	7.5	5.8	5.3	2.9	7.4
Korea, Rep.	40,400	3.7	2.8	2.1	3.8	3.6	2.8	2.0	3.8
Kuwait	1,329	4.9	4.5	3.0	6.5	4.9	4.5	3.0	6.5
Latvia	2,342	9.3	8.3	5.3	11.8	9.3	8.3	5.3	11.8
Lebanon	2,386	5.5	4.4	2.9	6.6	5.5	4.4	2.9	6.6
Liberia	243	9.5	8.1	5.7	10.9	9.4	8.0	5.7	10.9
Libya	28	12.7	7.5	4.5	14.9	12.7	7.5	4.5	14.9
Lithuania	1,903	9.2	8.3	5.7	11.9	9.1	8.3	5.6	11.8
Madagascar	1,698	2.8	2.1	1.4	3.0	2.8	2.1	1.4	3.0
Malaysia	32,484	4.4	3.6	2.4	5.5	4.4	3.6	2.4	5.5
Maldives	6	1.5	1.2	1.2	1.3	1.5	1.2	1.2	1.3
Mali	14	15.0	14.0	10.8	16.8	3.6	4.0	2.8	4.4
Malta	59	8.2	6.3	3.8	9.3	8.2	6.3	3.8	9.3
Martinique	139	12.9	10.4	4.4	18.6	12.9	10.4	4.4	18.6
Mauritania	388	15.0	12.8	8.1	19.8	14.9	12.7	8.0	19.8
Mauritius	1,615	3.9	3.3	2.4	4.7	3.9	3.3	2.4	4.7
Mexico	13,672	10.4	8.8	5.8	13.1	10.2	8.7	5.7	12.9
Morocco	4,222	6.4	5.8	3.9	8.1	6.4	5.7	3.9	8.1
Mozambique	345	8.5	7.3	5.8	11.0	8.4	7.3	5.7	11.0
Myanmar	9,036	5.6	5.1	3.6	7.0	5.6	5.1	3.6	7.0
Namibia	1,044	6.8	5.9	4.6	7.7	6.2	5.7	4.4	7.5
Nepal	5	11.5	9.3	9.2	15.7	6.9	7.1	4.5	9.1
Netherlands	35,175	6.5	5.1	3.7	7.0	5.6	4.7	3.4	6.3
New Zealand	27,086	9.1	8.0	5.3	11.4	8.9	7.8	5.1	11.2
Nicaragua	1,285	5.0	4.0	2.4	6.4	5.0	4.0	2.4	6.3
Nigeria	1,128	13.6	11.2	7.7	17.4	13.1	11.0	7.3	16.8
Norway	3,161	6.9	5.4	3.5	8.8	6.9	5.4	3.5	8.8
Oman	4,111	5.1	4.6	2.9	6.9	5.1	4.6	2.9	6.9

Economy	Number of observations	Consolidated dwell time (days)				Port dwell time (days)			
		Mean	Median	Q25	Q75	Mean	Median	Q25	Q75
Pakistan	17,594	5.8	5.1	3.4	7.3	5.7	5.0	3.3	7.0
Panama	4,088	7.4	5.7	3.6	9.2	7.3	5.6	3.5	9.1
Papua New Guinea	587	3.3	2.8	2.1	4.4	3.3	2.8	2.1	4.4
Paraguay	441	10.9	9.5	6.6	12.5	10.9	9.5	6.6	12.5
Peru	12,902	3.9	3.1	2.2	4.8	3.7	2.9	2.1	4.5
Philippines	13,153	4.7	3.3	2.1	5.9	4.6	3.2	2.1	5.9
Poland	17,139	8.1	6.9	5.3	9.7	7.4	6.6	5.0	8.7
Portugal	4,750	5.8	5.3	4.0	6.8	5.6	5.3	4.0	6.7
Puerto Rico	497	7.3	6.0	4.0	9.4	7.2	5.9	4.0	9.3
Qatar	2,104	1.9	1.1	0.6	2.1	1.9	1.1	0.6	2.1
Réunion	154	10.4	8.7	7.1	13.3	10.4	8.7	7.1	13.3
Romania	4,012	5.5	4.9	3.2	7.3	5.3	4.8	3.1	7.1
Saudi Arabia	19,317	5.2	4.5	3.1	6.4	3.1	2.1	0.6	4.4
Senegal	1,196	3.6	3.3	2.3	4.4	3.4	3.1	2.3	4.3
Serbia	4	16.9	17.7	15.2	19.4	13.3	13.2	12.0	14.5
Seychelles	468	7.9	3.0	1.8	9.1	7.7	3.0	1.3	9.0
Sierra Leone	138	8.6	7.2	4.9	11.0	8.6	7.2	4.9	11.0
Singapore	15,384	3.1	2.2	1.5	3.4	3.1	2.2	1.5	3.4
Slovak Republic	1,116	14.0	12.9	9.2	17.0	8.2	6.7	4.6	10.2
Slovenia	4,467	7.1	6.3	5.1	8.2	7.1	6.3	5.0	8.1
Solomon Islands	107	2.7	2.3	1.7	4.4	2.6	2.3	1.7	4.1
Somalia	31	9.0	7.5	6.3	10.4	9.0	7.5	6.3	10.4
South Africa	35,442	5.5	5.3	3.9	6.8	5.5	5.3	3.9	6.8
Spain	37,918	9.8	8.4	5.5	12.2	9.3	8.0	5.3	11.6
Sri Lanka	6,992	4.0	3.5	2.3	5.2	3.9	3.5	2.2	5.2
Sudan	363	10.8	7.1	5.5	13.2	10.8	7.1	5.5	13.2
Suriname	178	9.5	8.8	5.7	13.0	9.5	8.8	5.6	13.0
Sweden	7,074	7.7	6.2	4.7	9.9	7.4	6.1	4.4	9.0
Switzerland	130	16.5	12.6	8.7	19.8	6.3	5.7	4.0	7.1
Syrian Arab Republic	63	5.6	5.0	2.9	7.4	5.6	5.0	2.9	7.4
Taiwan, China	17,613	6.1	5.3	3.8	7.6	5.1	4.5	2.9	6.6
Tanzania	2,410	7.3	5.4	3.8	7.9	7.2	5.4	3.8	7.8
Thailand	48,034	5.8	5.1	3.5	7.4	5.1	4.5	3.0	6.5
Togo	279	17.8	15.6	11.7	21.5	17.8	15.3	11.7	21.0
Trinidad and Tobago	522	11.8	10.4	7.8	14.6	11.8	10.4	7.8	14.5
Tunisia	1,513	4.9	3.0	1.6	6.7	4.9	3.0	1.6	6.7
Türkiye	37,087	8.9	7.8	5.4	11.1	8.9	7.7	5.3	11.1
Uganda	2	15.0	15.0	14.1	15.9	9.2	9.2	6.9	11.5
Ukraine	27	17.5	10.3	6.5	19.5	6.2	5.9	3.7	8.0
United Arab Emirates	24,460	5.5	4.8	3.2	6.9	5.4	4.8	3.1	6.9
United Kingdom	22,041	10.3	8.7	6.2	12.7	9.8	8.3	5.8	12.1
United States	114,211	8.6	6.9	4.5	10.5	8.2	6.8	4.4	10.1
Uruguay	1,749	5.3	4.8	3.2	6.4	5.3	4.8	3.2	6.4
Venezuela, RB	781	13.9	12.5	8.5	16.4	13.8	12.5	8.5	16.2
Vietnam	83,093	4.7	4.1	2.5	6.3	4.0	3.2	1.9	5.4
Yemen, Rep.	73	6.8	6.5	4.5	7.7	2.9	0.0	0.0	5.2

Source: TradeLens.

Table A2.6 Dwell times for landlocked developing countries, 2022 (days)

Country	Port dwell time	Reference dwell time for transit countries	Inland and destination dwell time	Corridor dwell time
Armenia	3.3	3.6	0.4	—
Azerbaijan	4	3.6	1.2	—
Bolivia	6	4.1	0	—
Bosnia and Herzegovina	12.9	6.6	0	—
Botswana	9.9	4	3.6	—
Burkina Faso	13.6	10.7	7.8	—
Burundi	11.9	10.3	3.3	—
Chad	15.2	16.3	0	—
Ethiopia	10.9	8.9	0.2	—
Lao People's Dem. Rep.	5	4.4	1.8	—
Lesotho	5	4	0.9	—
Malawi	10.6	7.4	2.1	6.5
Mali	19.7	8	3.1	9.9
Moldova	10.4	9.6	0	—
Mongolia	25	5.5	0.1	—
Nepal	6.1	2.6	5.5	9.2
Niger	16.6	12.4	0	—
North Macedonia	12.8	5.2	0.1	—
Paraguay	7.5	11.4	0	—
Rwanda	14.6	5.1	2	—
Serbia	7.6	5.2	3	—
Uganda	9.3	5.1	8.8	4.4
Zambia	13.6	4	0.2	—
Zimbabwe	12.8	4	0	—

— is not available.
Source: World Bank calculations based on data from TradeLens.

APPENDIX 3

Top and bottom scorers on the LPI, overall and by income group

Table A3.1 Top 12 LPI scorers in 2023 and their top scorer status for 2018, 2016, 2014, and 2012

Economy	Top 10 scorer in 2018	Top 10 scorer in 2016	Top 10 scorer in 2014	Top 10 scorer in 2012
Austria	Yes	Yes	No	Yes
Belgium	Yes	Yes	Yes	Yes
Canada	No	No	Yes	No
Germany	Yes	Yes	Yes	Yes
Denmark	Yes	No	No	Yes
Finland	Yes	No	No	Yes
Hong Kong SAR, China	Yes	Yes	No	Yes
Netherlands	Yes	Yes	Yes	Yes
Singapore	Yes	Yes	Yes	Yes
Sweden	Yes	Yes	Yes	No
Switzerland	No	Yes	No	No
United Arab Emirates	Yes	No	No	No

Source: World Bank.
Note: Because of tied scores, the top 10 scores were attained by 12 countries. Countries are listed in alphabetical order.

Table A3.2 Bottom 12 LPI scorers in 2023 and their top scorer status for 2018, 2016, 2014, and 2012

Economy	Bottom 10 scorer in 2018	Bottom 10 scorer in 2016	Bottom 10 scorer in 2014	Bottom 10 scorer in 2012
Afghanistan	Yes	No	Yes	No
Angola	Yes	No	No	No
Cambodia	No	No	No	No
Cameroon	No	No	No	No
Cuba	No	No	Yes	No
Gambia, The	No	na	No	No
Haiti	Yes	Yes	No	Yes
Libya	Yes	No	No	No
Somalia	No	Yes	Yes	na
Yemen, Rep.	No	na	Yes	No

Source: World Bank.
Note: Countries are listed in alphabetical order. na is not applicable because an LPI score was not calculated for the economy in the year indicated.

Table A3.3 Top 11 upper-middle-income LPI scorers in 2023 and their top scorer status in 2018, 2016, 2014, and 2012

Economy	Top 10 upper-middle-income scorer in 2018	Top 10 upper-middle-income scorer in 2016	Top 10 upper-middle-income scorer in 2014	Top 10 upper-middle-income scorer in 2012
Bosnia and Herzegovina	No	No	No	Yes
Botswana	No	Yes	No	No
Brazil	Yes	Yes	Yes	Yes
Bulgaria	Yes	No	Yes	Yes
China	Yes	Yes	Yes	Yes
Malaysia	Yes	Yes	Yes	Yes
North Macedonia	No	No	No	No
Peru	No	Yes	No	No
South Africa	Yes	Yes	Yes	Yes
Thailand	Yes	Yes	Yes	Yes
Türkiye	Yes	Yes	Yes	Yes

Source: World Bank.
Note: Because of tied scores, the top 10 scores were attained by 11 countries. Upper-middle-income status is based on country status in fiscal year 2022/23. Countries are listed in alphabetical order.

Table A3.4 Top 13 lower-middle-income LPI scorers in 2023 and their top scorer status in 2018, 2016, 2014, and 2012

Economy	Top 10 lower-middle-income scorer 2018	Top 10 lower-middle-income scorer 2016	Top 10 lower-middle-income scorer 2014	Top 10 lower-middle-income scorer 2012
Benin	Yes	No	No	Yes
Djibouti	No	No	No	No
Egypt, Arab Rep.	Yes	Yes	Yes	Yes
El Salvador	No	Yes	Yes	Yes
Honduras	No	No	No	No
India	Yes	Yes	Yes	Yes
Indonesia	Yes	Yes	Yes	Yes
Papua New Guinea	No	No	No	No
Philippines	Yes	Yes	Yes	Yes
Solomon Islands	No	No	No	No
Sri Lanka	No	na	No	Yes
Uzbekistan	No	No	No	No
Vietnam	Yes	Yes	Yes	Yes

Source: World Bank.
Note: Because of tied scores, the top 10 scores were attained by 13 countries. Lower-middle-income status is based on country status in fiscal year 2022/23. Countries are listed in alphabetical order. na is not applicable because an LPI score was not calculated for the economy in the year indicated.

Table A3.5 Top 10 low-income LPI scorers in 2023 and their top scorer status in 2018, 2016, 2014, and 2012

Economy	Top 10 LI 2018	Top 10 LI 2016	Top 10 LI 2014	Top 10 LI 2012
Central African Republic	No	na	Yes	Yes
Congo, Dem. Rep.	Yes	Yes	No	No
Guinea	No	Yes	Yes	Yes
Guinea-Bissau	Yes	Yes	Yes	Yes
Liberia	No	Yes	Yes	Yes
Mali	Yes	Yes	Yes	na
Rwanda	Yes	Yes	Yes	No
Sudan	Yes	Yes	No	No
Syrian Arab Republic	Yes	No	No	Yes
Togo	Yes	Yes	Yes	Yes

Source: World Bank.
Note: Low-income status is based on country status in fiscal year 2022/23. Countries are listed in alphabetical order. na is not applicable because an LPI score was not calculated for the economy in the year indicated.

APPENDIX 4

Description of the new data sources for the LPI 2023

This appendix introduces the data sources on shipment tracking data. To construct new sets of indicators for the 2023 Logistics Performance Index (LPI), the World Bank collaborated with several external data providers. The data comprise the following micro-logistics high-frequency datasets: deployment of liner shipping service from MDS Transmodal, air cargo tracking from Cargo iQ (supported by the International Air Transport Association), flow of international letters and parcels from the Universal Postal Union (UPU), granular high-frequency information on consignment activities (container data) from TradeLens, and worldwide container ship port calls from an Automatic Identification System (AIS) data provider (MarineTraffic). For the first time, LPI data were not collected entirely in-house. This appendix covers the origin of the data, the country coverage, and the variables used for the processing of the key performance indicators.

MDS Transmodal

MDS Transmodal is an independent consultancy focusing on the international freight transport sector, including shipping, ports, road, rail, logistics, and distribution. It collects and aggregates several types of transport-related data and maintains databases related to freight transportation. A dataset of aggregates for country pairs and countries for January–June 2022 was derived from MDS Transmodal's Containership Databank, which covers shipping schedules and volumes offered on liner shipping routes.

Indicators available as part of the partnership agreement with MDS Transmodal include the number of services, number of operators, number of alliances, and average annual frequency of shipping service, as well as statistics (average, maximum, minimum) on the number of deployed ships, ship sizes, and ship ages. Under MDS Transmodal's definition, two economies (or ports) are connected if there is a shipping service between them. As shipping services operate in loops, not point to point like aviation, connections are counted irrespective of the actual port sequence.

Cargo iQ

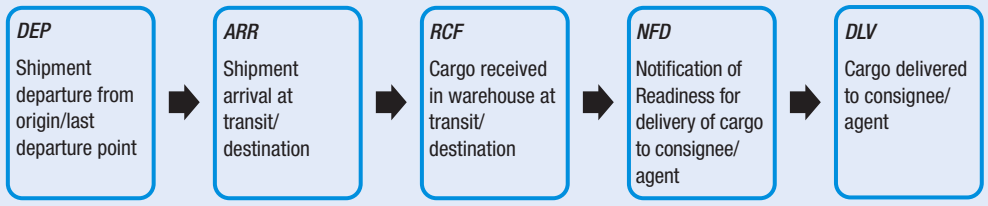
The air cargo dataset was provided by Cargo iQ, a nonprofit interest group created in 1997 by the International Air Transport Association to develop a system of shipment planning and performance monitoring for air cargo based on definitions of common business processes and milestones.[1] Cargo iQ is a pioneer in digitalization efforts in the air cargo industry, focusing on transparency, visibility, and quality improvement.

Cargo iQ brings together more than 60 participants, including forwarders, air carriers, ground handling companies, road carriers, and airports, to define the standards for shared processes and planning to control and evaluate performance of cargo shipments. Cargo iQ collects more than 110 million data lines a year, 12 million of which are airport-to-airport shipments. These records, covering information for about 650 airports in 184 countries and accounting for 45 percent of global air freight volume, were used to construct the aviation pillar of the 2023 LPI.

Cargo iQ's event recording follows a similar Electronic Data Interchange (EDI) protocol as the UPU, with a similar logical ordering of

1. See https://www.cargoiq.org/value-proposition.

Figure A4.1 Cargo iQ milestones



Source: Cargo iQ.

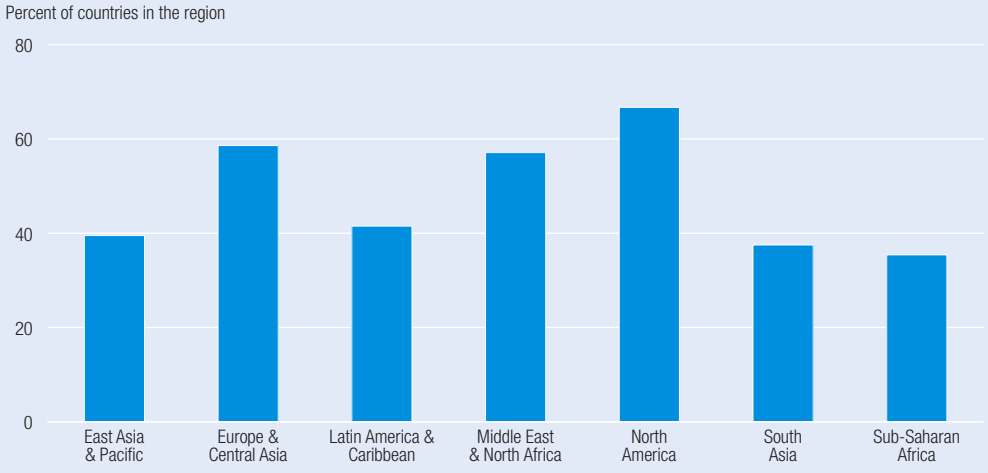
supply chain events. A shipment, commonly identified through an electronic airway bill is tracked through the system from the point of departure of the flight with cargo (DEP in figure A4.1) through its arrival (ARR) and check-in to a warehouse at a destination airport (RCF), followed by the advisory to the consignee of the freight's arrival (NFD), and the consignee's final collection of the freight from the carrier at the destination airport (DLV).

For all five milestones, it is the carriers' responsibility to enter the data in the system in a timely, consistent, and accurate manner. The time differences between the milestones provide information on the various aspects of the reliability and performance of individual carriers, freighters, and operators and (at the aggregate level) of airports and countries.

To avoid revealing commercially sensitive information for specific carriers, trade lanes with certain characteristics are excluded from the dataset. They are bilateral lanes representing more than 80 percent of total shipments to target countries with three or fewer carriers; these excluded 46 countries from the final set of key performance indicators, resulting in 141 countries in the 2023 LPI aviation pillar.

The data from Cargo iQ's system are based on a pair of milestones: advisory to the consignee of the freight's arrival to the consignee's final collection of the freight from the carrier at the destination airport. In other words, the time elapsed between the two events was computed for each electronic airway bill recorded in the system at a destination country given the validity of the time difference (meaning that both timestamps exist and the time difference between them is positive). The choice of this indicator was based on two considerations: best apparent quality of data and country coverage

Figure A4.2 Country coverage of Cargo iQ dataset, by World Bank region



Source: World Bank calculations based on data from Cargo iQ.

and interpretability. This indicator represents how fast air cargo shipments move at the destination, which is the equivalent of import dwell time. Future editions of *Connecting to Compete* may consider additional delay indicators.

Low-income countries have the lowest coverage: data are available for 25 percent of these countries. The East Asia and Pacific, South Asia, and Sub-Saharan Africa regions all have about 35–40 percent coverage (figure A4.2). Geographical coverage is lower for Cargo iQ than for the UPU.

Universal Postal Union

Most cross-border e-commerce depends on postal parcel services provided by UPU members or global express operators (for example, DHL, FedEx, and UPS). UPU members handle two-thirds of letter-parcel deliveries (up to 2 kilograms) across borders.[2] Therefore, information collected by UPU is a source of comprehensive data for more than 190 member countries and probably the best unified source of information on e-commerce trade.

UPU maintains technical standards and EDI message specifications used in the exchange of electronic information between postal services. To exchange information between members' postal services, UPU maintains EDI databases with records on volumes, frequencies, key cross-border activities, and other tracking data of postal items. This information is available via the Express Mail Service Events messaging standard, which is used to track parcels (packages up to 30 kilograms), letters (letter-post items and packages up to 2 kilograms), and express mail flows in the UPU network (table A4.1).

For an e-commerce item, after a consumer places an order, the shipper hands the item over to the origin post (event A in table A4.1). The post inducts the item into its domestic network, where it passes through several handling, sorting, and transport processes (event B). At the origin Office of Exchange, the item is assigned to a receptacle for international dispatch to the destination Office of Exchange, in which it departs from the country-of-origin (event C). After a few potential transiting events (events J–K), the item arrives at the destination (event D), where it is unloaded and handed over to the destination post. Event E describes the process of separating different items from the bundle (receptacle) that they were shipped in, retrieving the items, and clearing them through customs. Finally, the destination Office of Exchange inducts it into their domestic network for processing and potential relocation to the delivery office, from which a final delivery to the customer happens (event I). Unsuccessful deliveries are recorded using event H. The focus of the LPI has been on the performance at the destination, making the delay between events D and H/I the primary key performance indicator assessing postal logistics, covering the quality of postal infrastructure and speed of delivery.[3] The delivery events have also been found to have the most consistency and country coverage.

The dataset was constructed for the entire calendar year of 2019. The sample comprised countries with more than 100 inbound unique parcel shipments; this included 132 countries from all World Bank regions and income groups. After data cleaning, 40 percent of

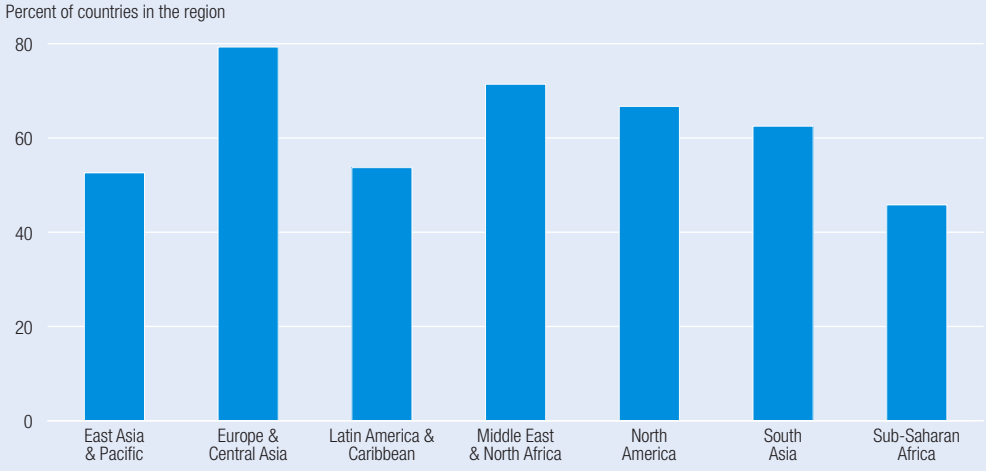
Table A4.1 The postal sequence of tracking messages

Message ID	Event description
Exporting events	
A	Posting/collection
B	Arrival at outwards office of exchange
C	Departure from outward office of exchange
Importing events	
D	Arrival at inward office of exchange
E	Held by import customs
F	Departure from inward office of exchange
G	Arrival at delivery office
H	Attempted/unsuccessful delivery
I	Final delivery
J	Arrival at transit office of exchange
K	Departure from transit office of exchange

Source: Universal Postal Union.

2. Beretzky and others 2022.
3. Boffa 2015.

Figure A4.3 **Country coverage of the Universal Postal Union dataset, by World Bank region**



Source: Universal Postal Union.

low-income countries were represented in the postal dataset, 50 percent of Sub-Saharan African countries were represented, and Europe and Central Asia had a representation of 79 percent (figure A4.3).

TradeLens

TradeLens was a highly secure data and document sharing platform aimed at simplifying and speeding trade workflows for all participants of the supply chain ecosystem. A collaboration between IBM and GTD Solution (a division of shipping conglomerate Maersk), the platform operated between 2018 and the first quarter of 2023. TradeLens used IBM Blockchain Platform, a permissioned blockchain system that offers immutability, privacy, and traceability of shipping documents. TradeLens brought together more than 1,000 major entities involved in the global supply chain, including more than 200 ports and terminals and more than 15 customs authorities, and by mid-2022, it was facilitating the information exchange of about 60 percent of containerized trade.[4] Its interoperability was supported through the adaptation of a data model and access control schema that were aligned with the Supply Chain Reference Data Model of the United Nations Centre for Trade Facilitation and Electronic Business (figure A4.4).

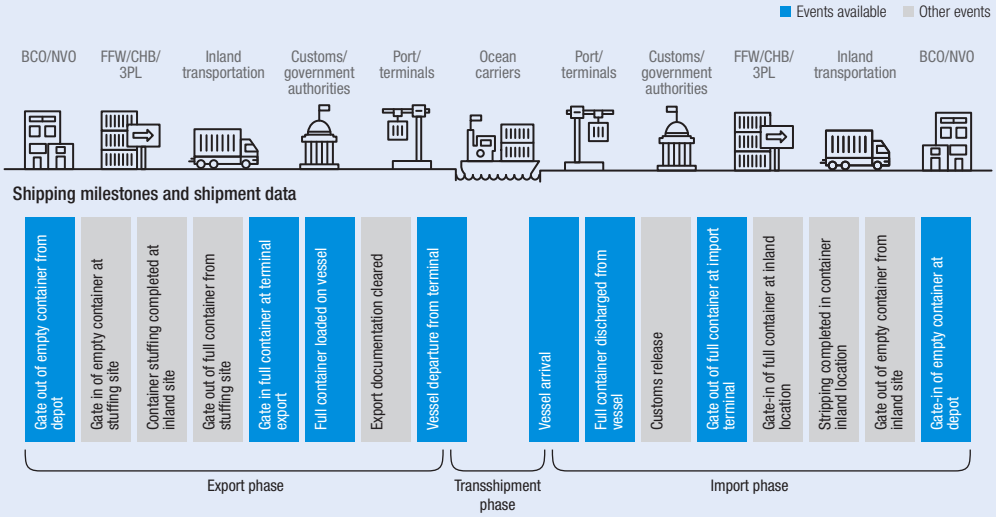
TradeLens used a simple, logical data model with three related classes: consignments, transport equipment, and shipments. The main purpose of this model was to track consignments, transport equipment (containers), and shipments while managing the identifiers and relationships between them. The platform allowed a consignment to be in multiple pieces of transport equipment, along with other consignments. It also allowed transport equipment to be part of multiple consignments.

The dataset extracted by TradeLens for the World Bank covers May 1–October 31, 2022. The sample contained timestamps for 11 events for four transport modes (ocean, road, barge, and rail) and two load statuses (full or empty), associated with more than 3 million unique tracked consignments and more than 30 million observations in total. The dataset covers more than 11,000 distinct United Nations Code for Trade and Transport Locations (UNLOCODE), including destinations, origins, and live locations (locations of specific event timestamps). On average, about 9.8 events are associated with each consignment.

To create the key performance indicators, the World Bank team focused on time

4. See https://www.tradelens.com/network.

Figure A4.4 TradeLens data model

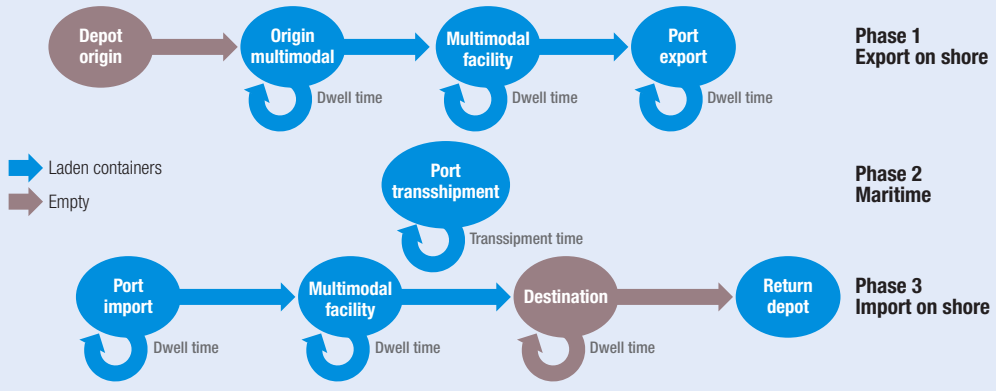


Source: TradeLens.

differences or lead time between subsequent events. Events can happen between different locations—for instance, on multimodal corridors or in shipping. Subsequent events may also occur at the same location, and the time that containers stay at the same place is typically referred to as dwell time. Data processing consisted of splitting container trips into a succession of transitions between subsequent events at the same or different locations. Key performance indicators were constructed by aggregating the lead time or dwell time for UNLOCODE or lead time between pairs of UNLOCODE. To facilitate interpretation, the global container supply chain is broken into three phases: export on shore, shipping and transshipment, and import onshore (figure A4.5).

The tracking data cover the responsibility of international logistics operators, not that of shippers upstream or consignees downstream. Supply chain practices by the latter may vary. But container data include information on the movement of empty containers, which proxies the time taken to stuff export containers or deliver full import containers at the destination. Information on repositioning and return of empty containers may lead to more meaningful indicators in the future.

Figure A4.5 The three phases of container trips



Source: 2023 LPI team.

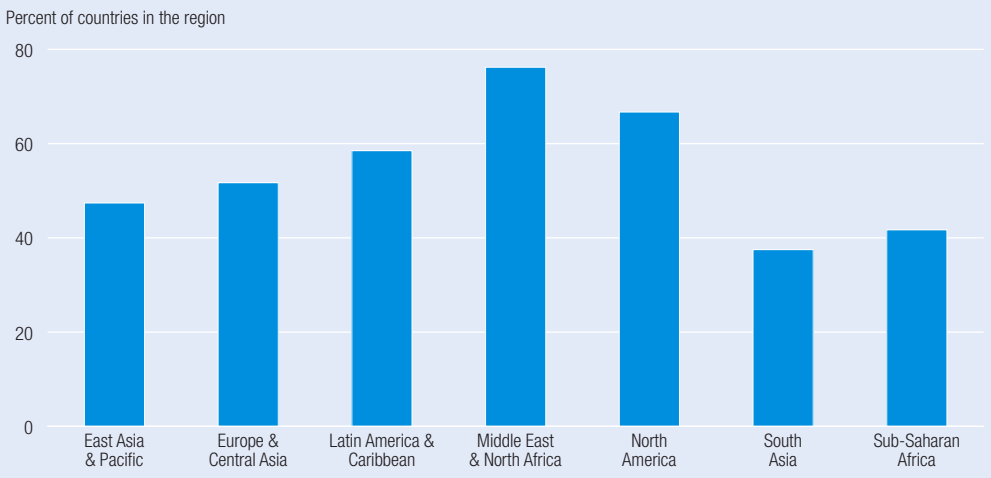
MarineTraffic

The port call dataset from MarineTraffic is a collection of records, processed from Automatic Identification System messages and enriched with proprietary information on ports and ship datasets sourced from the International Maritime Organization registry. Ship types ranging from small feeders with capacity up to 1,000 twenty-foot equivalent units to ultra large container vessels with capacity starting at 14,501 twenty-foot equivalent units. The information available includes timestamps of port arrivals and departures reported through Automatic Identification System signals via terrestrial and satellite receivers.

The dataset was prepared using MarineTraffic data on port calls that covered more than 5,000 container ships calling at more than 800 ports worldwide during the first two quarters of 2022. Based on estimated time differences between recorded arrivals and departures to port facilities, an indicator of turnaround time per port was constructed.

The data from MDS Transmodal and MarineTraffic cover 52 percent of World Bank members (figure A4.6). The United Nations Conference on Trade and Development uses the same sources when producing the Liner Container Shipping Connectivity Index and its own indicator of turnaround time.[5]

Figure **A4.6** **Country coverage of the MDS Transmodal and MarineTraffic dataset, by World Bank region**



Source: World Bank calculations based on data from MDS Transmodal and MarineTraffic.

5. UNCTAD 2021b.

Table **A4.2** **List of key performance indicators derived from tracking data**

Source	Indicator	Definition	Period	Why it matters
MDS Transmodal	Number of services	Total number of maritime services (operated through liner shipping companies on a predefined rotation) between the two countries.	Second quarter of 2022	Availability of services and frequency of connection.
	Number of alliances	Count of the number of alliances per destination country.	Second quarter of 2022	Competition between services.
	Number of partners (countries)	Count of distinct number of country partners per destination country.	Second quarter of 2022	Shipping connectivity metric.
Cargo iQ	Number of partners (countries)	Average number of partner countries	First and second quarters of 2022	Air cargo connectivity metric.
	Aviation dwell time (days)	Time difference between notification of readiness for delivery of cargo and cargo delivered to consignee at destination country. Median and quartiles are provided.	First and second quarters of 2022	Efficiency of handling and clearance and notification to consignee.
Universal Postal Union	Number of partners (countries)	Average number of country partners.	2019	Postal connectivity.
	Postal delivery time (days)	Median time difference between arrival at inward office of exchange and unsuccessful delivery or final delivery to recipient at the destination country. Median and quartiles are provided.	2019	Efficiency of clearance and postal logistics at destination.
TradeLens	Import and export dwell time (days)	Time spent at the same location (as defined by United Nations Code for Trade and Transport Locations) since expedition and before ship loading. Two variables are produced for each country: dwell time at port of departure and consolidated dwell time (including time spent at intermediate locations). Mean, median, and quartiles are provided. The statistics are based on all container trips originating in the country, irrespective of the export and import corridor.	May 1 to October 31, 2022	Critical indicator resulting from many factors, including goods clearance, removal, and land services and to some extent terminal and multimodal performance. Export dwell time is representative of domestic logistics.
	Corridors import lead time (days)	Estimation of mean time to import for corridors serving landlocked countries based on lead time between destination and port of import.	May 1 to October 31, 2022	Representative of road or rail corridor performance excluding multimodal transfer en route which are included in dwell time.
	Export container lead time (days)	Sum of consolidated dwell time and corridor time for export and stuffing time.	May 1 to October 31, 2022	Same concept for exports.
MarineTraffic	Turnaround time (days)	Time difference between first instance of arrival and last instance of departure for consecutive repeated port visits (if any) calculated for each port call (as defined by United Nations Code for Trade and Transport Locations). Aggregated directly from port call time differences to countries over six months. This indicator excludes waiting time at anchorage.	First and second quarters of 2022	Proxy of the performance of the ship to shore interface (including handling by the terminal operator).

Source: World Bank.

APPENDIX 5

The LPI methodology

Because logistics has many dimensions, measuring and summarizing performance across countries are challenging. Examining the time and costs associated with logistics processes—port processing, customs clearance, transport, and the like—is a good start, and in many cases this information is readily available. But even when complete, this information cannot be easily aggregated into a single, consistent, cross-country dataset, because of structural differences in countries' supply chains. Even more important, many critical elements of good logistics—such as process transparency and service quality, predictability, and reliability—cannot be assessed using only time and cost information.

Constructing the international LPI

The main part of the Logistics Performance Index (LPI) survey (questions 4 to 9 in the 2023 edition) provides the raw data for the international LPI. Each survey respondent rates up to eight overseas markets on six core components of logistics performance. The eight countries are chosen based on the most important export and import markets of the country where the respondent is located, on random selection, and—for landlocked countries—on neighboring countries that form part of the land bridge connecting them with international markets (table A5.1).

Respondents take the survey online. The survey for this edition was open from September 6

Table A5.1 Methodology for selecting country groups for survey respondents

	Respondents from low-income countries	Respondents from middle-income countries	Respondents from high-income countries
Respondents from coastal countries	Five most important export partner countries + Three most important import partner countries	Three most important export partner countries + The most important import partner country + Four random countries, one from each country group: a. Africa b. East Asia and Central Asia c. Latin America d. Europe less Central Asia and OECD	Two random countries from a list of the five most important export partner countries and five most important import partner countries + Four random countries, one from each country group: a. Africa b. East Asia and Central Asia c. Latin America d. Europe less Central Asia and OECD + Two random countries from the combined country groups a, b, c, and d
Respondents from landlocked countries	Four most important export partner countries + Two most important import partner countries + Two land-bridge countries	Three most important export partner countries + One most important import partner country + Two land-bridge countries + Two countries randomly, one from each country group: a. Africa, East Asia and Central Asia, and Latin America b. Europe less Central Asia and OECD	

Source: 2023 LPI team.

to November 5, 2022. The web engine for the survey underlying the 2023 LPI was the same as the engine put in place in 2012 (and used in subsequent editions). It incorporates the uniform sampling randomized approach to gain the most possible responses from underrepresented countries. Because the survey engine relies on a specialized country selection methodology for survey respondents based on high trade volume between countries, the uniform sampling randomized approach can help countries with lower trade volumes rise to the top during country selection.

The survey engine builds a set of eight countries for the survey respondents (see table A5.1). After 200 surveys, the uniform sampling randomized approach is introduced into the engine's process for country selection. For each new survey respondent, the approach solicits a response from a country chosen at random but with nonuniform probability—with weights chosen to evolve the sampling toward uniform probability. Specifically, a country i is chosen with a probability $(N–n_i) / 2N$, where n_i is the sample size of country i so far, and N is the total sample size. As country sample sizes grew above 100, the country selection engine excluded oversampled countries from the pool to increase responses from underrepresented countries.

The international LPI is a summary indicator of logistics sector performance, combining data on six core performance components into a single aggregate measure. Some respondents did not provide information for all six components, so interpolation was used to fill in missing values. The missing values were replaced with the country mean response for each question, adjusted by the respondent's average deviation from the country mean in the answered questions.

The six core components are:

- The efficiency of customs and border management clearance, rated from very low (1) to very high (5) in survey question 4.
- The quality of trade and transport infrastructure, rated from very low (1) to very high (5) in survey question 5.
- The ease of arranging competitively priced shipments, rated from very difficult (1) to very easy (5) in survey question 6.
- The competence and quality of logistics services, rated from very low (1) to very high (5) in survey question 7.
- The ability to track and trace consignments, rated from very low (1) to very high (5) in survey question 8.
- The frequency with which shipments reach consignees within scheduled or expected delivery times, rated from hardly ever (1) to nearly always (5) in survey question 9.

The overall LPI score is constructed from these six indicators using principal component analysis, a standard statistical technique used to reduce the dimensionality of a dataset. In the LPI, the inputs for principal component analysis are country scores on questions 4–9, averaged across all respondents providing data on a given overseas market. Scores are normalized by subtracting the sample mean and dividing by the standard deviation before conducting the principal component analysis. The output from the analysis is a single indicator—the LPI score—which is a weighted average of those scores. The weights are chosen to maximize the percentage of variation in the LPI's original six indicators that is accounted for by the summary indicator.

The first (principal) eigenvalue of the correlation matrix of the six core indicators is greater than 1—and much larger than any other eigenvalue (see the first line of table A5.2). Standard statistical tests, such as the Kaiser Criterion and the eigenvalue scree plot, suggest that a single principal component be retained to summarize the underlying data. This principal component is the international LPI score. The international LPI accounts for 91 percent of the variation in the six components.

Table A5.2 Results of principal component analysis for the 2023 international LPI score

Component	Eigenvalue	Difference	Proportion	Cumulative
1	5.47139	5.27856	0.9119	0.9119
2	0.192832	0.034632	0.0321	0.9440
3	0.1582	0.0797762	0.0264	0.9704
4	0.0784234	0.0263933	0.0131	0.9835
5	0.0520301	0.00490627	0.0087	0.9921
6	0.0471239	na	0.0079	1.0000

Source: 2023 LPI team.
Note: na is not applicable.

Table A5.3 Component loadings for the 2023 international LPI score

Component	Weight
Customs	0.4105
Infrastructure	0.4133
International shipments	0.3931
Logistics quality and competence	0.4168
Tracking and tracing	0.4133
Timeliness	0.4021

Source: 2023 LPI team.
Note: na is not applicable.

To construct the international LPI score, normalized scores for each of the six original indicators are multiplied by their component loadings (table A5.3) and then summed. The component loadings represent the weight given to each original indicator in constructing the international LPI score. Since the loadings are similar for all six, the international LPI score is close to a simple average of the indicators. Although principal component analysis is rerun for each version of the LPI, the weights remain steady from year to year. There is thus a high degree of comparability across LPI editions.

Constructing the confidence intervals

To account for the sampling error created by the LPI's survey-based methodology, LPI scores are presented with approximate 80 percent confidence intervals. These intervals make it possible to provide upper and lower bounds for a country's LPI score. To determine whether a difference between two scores is statistically significant, confidence intervals must be examined carefully. For example, a statistically significant improvement in a country's performance should not be concluded unless the lower bound of the country's 2023 LPI score exceeds the upper bound of its 2018 score.

To calculate the confidence interval, the standard error of LPI scores across all respondents is estimated for a country. The upper and lower bounds of the confidence interval are then

$$LPI \pm \frac{t_{(0.1,\,N-1)}S}{\sqrt{N}},$$

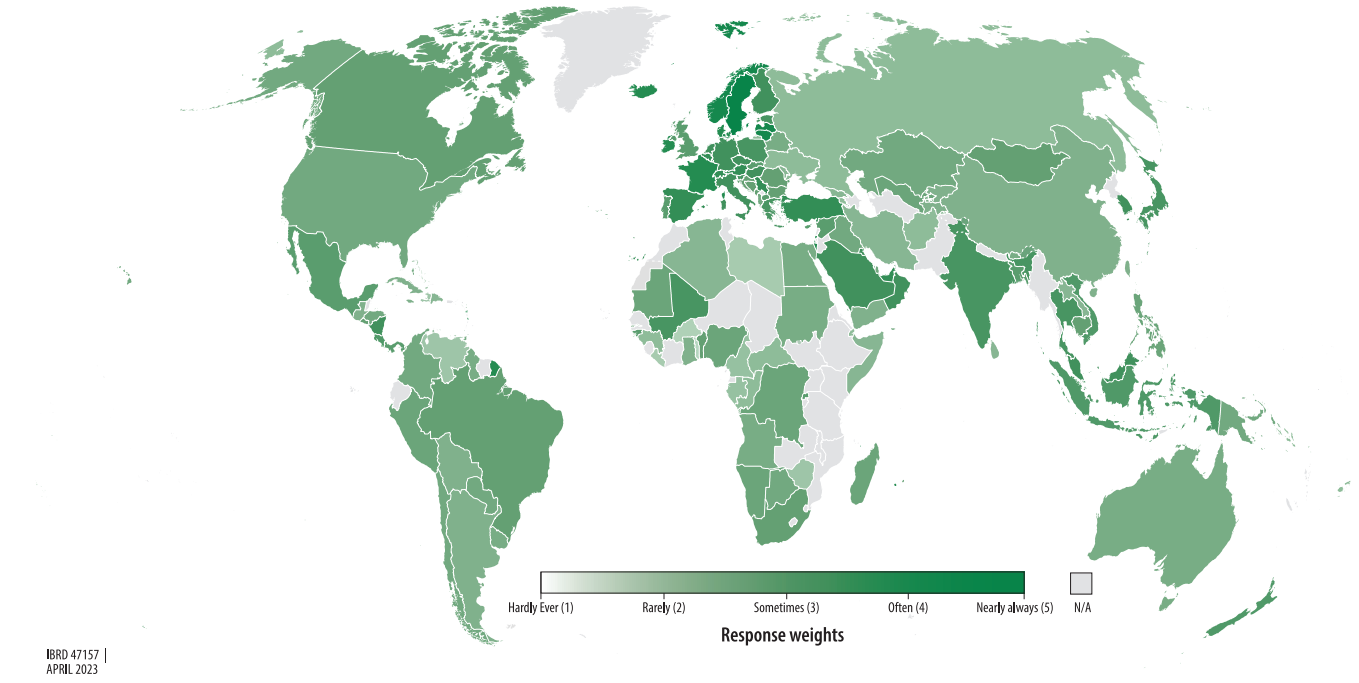
where LPI is a country's LPI score, N is the number of survey respondents for that country, s is the estimated standard error of each country's LPI score, and t is Student's t-distribution. As a result of this approach, confidence intervals and low-high ranges for scores are larger for small markets with few respondents, since these estimates are less certain. The average confidence interval on the 1–5 scale is 0.25, or about 8 percent of the average country's LPI score. Hence, caution must be taken when interpreting small differences in LPI scores.

LPI scores have two limitations. First, the experience of international freight forwarders might not represent the broader logistics environment in poor countries, which often relies on traditional operators. And international and traditional operators might differ in their interactions with government agencies—and in their service levels. Second, for landlocked countries and small island states, the LPI might reflect access problems outside the country assessed, such as transit difficulties. The low rating of a landlocked country might not adequately reflect its trade facilitation efforts, which depend on the workings of complex international transit systems. Landlocked countries cannot eliminate transit inefficiencies with domestic reforms.

APPENDIX 6

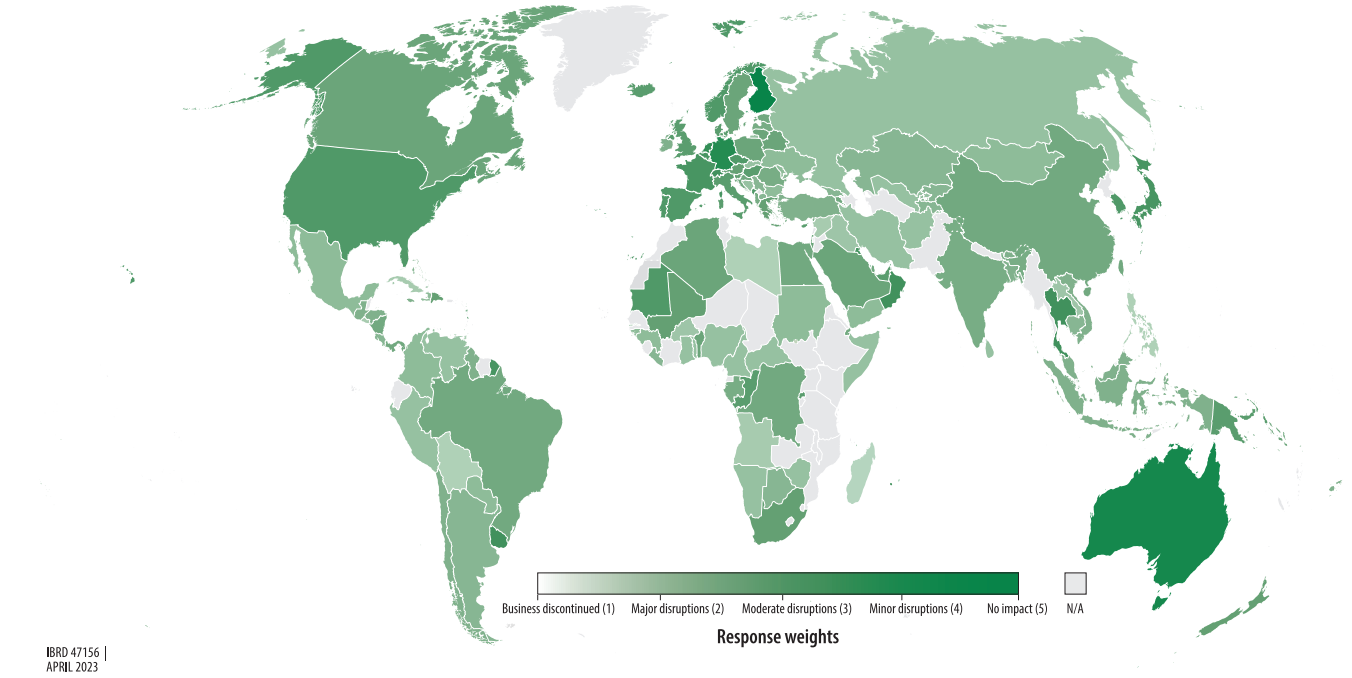
Results from the LPI survey question on demand for environmentally sustainable shipping options and on changes in global supply chains since 2019

Map **A6.1** **How often do shippers ask for environmentally friendly options (e.g., in view of emission levels, choice of routes, vehicles, schedules, etc.) when shipping to…?**



Source: 2023 LPI team.

Map A6.2 **Based on your experience, how have supply chains been affected since the year 2019 when shipping to...?**



Source: 2023 LPI team.

APPENDIX 7

Respondent demographics

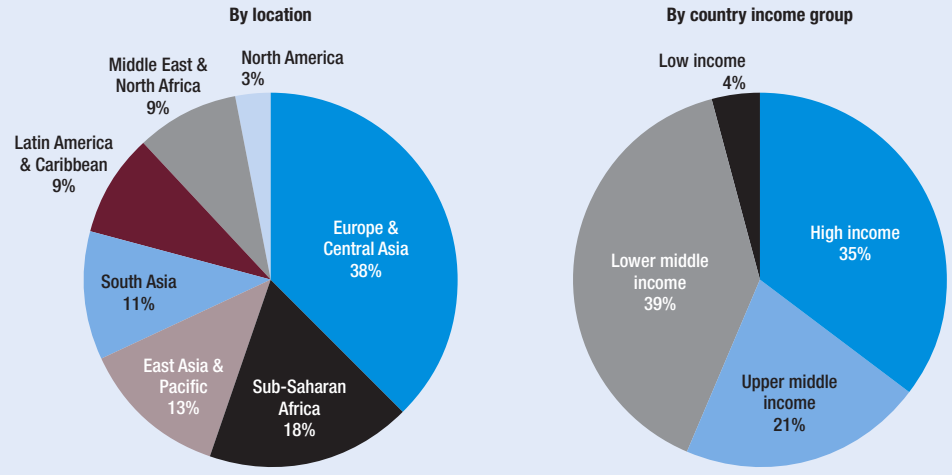
Operators on the ground are best placed to assess the vital aspects of logistics performance. The Logistics Performance Index (LPI) thus uses a structured online survey of logistics professionals, multinational freight forwarders, and the main global express operators (for example, DHL, FedEx, and UPS). The 2023 LPI data are based on a survey conducted from September 6 to November 5, 2022, answered by 652 respondents.

Among the respondents, 4 percent were in low-income countries, 39 percent were in lower-middle-income countries, 21 percent were in upper-middle-income countries, and 35 percent were in high-income countries (figure A7.1). These values are similar to those in previous LPI editions, except there are more respondents from lower-middle-income countries.

About 38 percent of respondents identified their country of operations as Europe or Central Asia, while others were dispersed among East Asia and Pacific (13 percent), South Asia (11 percent), and Sub-Saharan Africa (18 percent). The least represented regions are Latin America (9 percent of respondents), the Middle East and North Africa (9 percent), and North America (3 percent).

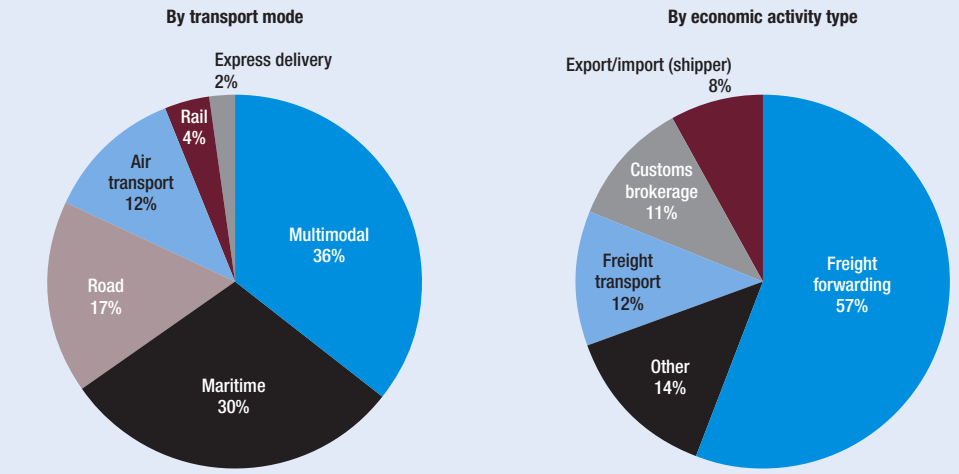
Among the respondents, 36 percent dealt with multimodal transport, 30 percent dealt with maritime transport, 17 percent dealt with road transport, and 12 percent dealt with air transport (figure A7.2). While these numbers are similar to those in 2018, the share of respondents dealing with road transport is higher than in previous years. In 2022, 57 percent of respondents were in freight forwarding, 12 percent worked with freight transport, 11 percent worked with customs brokerage, and 8 percent dealt with exports or imports.

Figure A7.1 Number of respondents by location and country income group



Source: 2023 LPI team.

Figure **A7.2** **Respondents by transport mode and economic activity type**



Source: 2023 LPI team.

APPENDIX 8

LPI results in research and policymaking literature

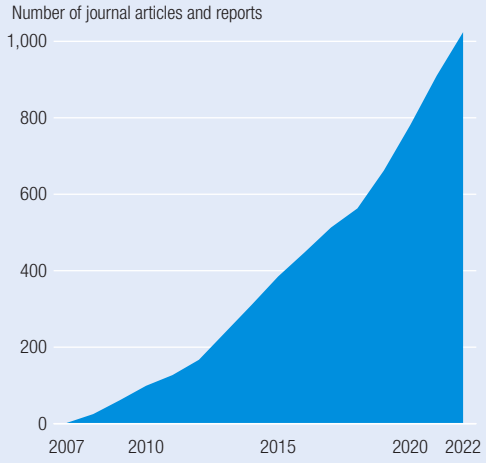
Since its launch in 2007, the Logistics Performance Index (LPI) has established itself as a global trade and transport facilitation indicator for policymakers, academics, logistics practitioners, consultants, and traders. It is also used by several advocacy groups, such as logistics sector industry associations. More than 1,000 research publications have used LPI data since 2007 (figure A8.1). In addition, hundreds of policymaking reports have relied on LPI data. This excludes numerous textbooks, consultancy reports, and teaching materials and theses at various levels.

The LPI has also been used as a component in various transport and trade indicators, such as the World Economic Forum's Enabling Trade Index, first published in 2008, and the EU Transport Scoreboard, launched in 2014. Practically all multilateral agencies, including the African Development, the Asian Development Bank, and the Inter-American Development Bank, as well as the United Nations Conference on Trade and Development, the United Nations Economic Commission for Europe, and the United Nations Economic and Social Commission for Asia and the Pacific, have adopted the LPI as a standard element in their trade- and transport-related publications.

LPI indicators are typically cited in research or policy literature that falls roughly evenly into two categories: trade economics or trade and transport facilitation and supply chain management, transport, and logistics competitiveness issues.

The division between the two categories is not clear cut. However, they indicate that the LPI is widely used for both trade facilitation and policymaking, typically at the macro level (the first category), and for more business-oriented purposes, often at the micro or supply chain level (the second category).

Figure A8.1 Use of LPI data in research literature, 2007–22



Source: Google Scholar.

In about 20 percent of citations, LPI data are the main empirical evidence, and in about 30 percent, LPI data are used as a major reference. In the remaining 50 percent, LPI data are used as a minor reference. A nonexhaustive list of literature using the LPI since 2018, based on a literature search in ResearchGate in November 2022, is below.

Selected research articles using the LPI since 2018

The following is a nonexhaustive list of literature using the LPI since 2018, based on a literature search in ResearchGate in November 2022.

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What is the Logistics Performance Index?

The LPI is an interactive benchmarking tool created to help countries identify the challenges and opportunities they face in their performance on trade logistics and what they can do to improve their performance. The LPI is based on two components: First, a worldwide survey of international logistics operators on the ground (global freight forwarders and express carriers), providing feedback on the logistics "friendliness" of the countries with which they trade. The International LPI 2023 allows for comparisons across 139 countries.

Second, this edition introduces indicators derived from global tracking datasets. They measure speed and delays for container, postal and air freight activities. They complement the main indicator but do not enter its score. Hence logistics performance is measured from two different perspectives: one based on the perceptions of international logistics professionals assessing their partner countries, the other one measuring the actual speed of global trade by using supply chain tracking information.

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This is the seventh edition of Connecting to Compete, a report summarizing the findings from the new dataset for the Logistics Performance Index (LPI) and its component indicators. The 2023 LPI encapsulates the firsthand knowledge of movers of international trade and evidence from supply chain tracking data. This information is relevant for policymakers and the private sector seeking to identify reform priorities for trade and logistics infrastructure. Findings include:

- Notwithstanding the pandemic-induced disruptions to shipping and the global supply chain crisis, average overall scores in the LPI 2023 were roughly the same as in the last survey in 2018.
- The new indicators point to widespread differences in delays and supply chain reliability across the World. Several countries experience much larger delays than advanced and emerging economies. Binding constraints for low performances may be traced to infrastructure, productivity, or clearance procedures.
- The survey confirms growing demand for green logistics options, which lessen the carbon footprint of supply chains and keep trade moving.