How accessible is the Stockholm region by air?

The Stockholm region's accessibility 2023

Region Stockholm

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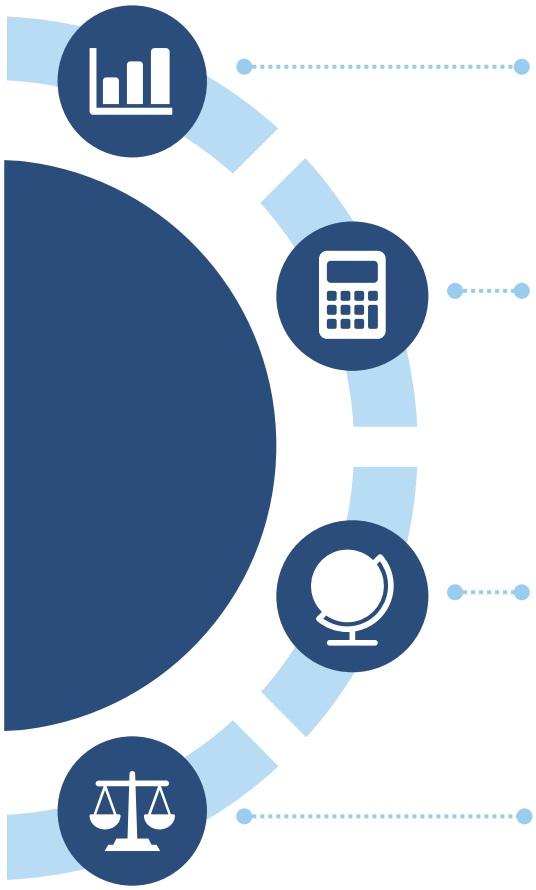
Assignment

To analyse the Stockholm region's accessibility in 2020 and 2023 for Arlanda (ARN), Bromma (BMA), Skavsta (NYO) and Västerås (VST) airports.

The report is a follow-up to the report Stockholms Internationella Tillgänglighet, which was published in 2012 and subsequently updated in 2018. The calculations have been based on the same methods and type of data. The Amsterdam, Barcelona, Berlin, Dublin, Hamburg, Helsinki, Copenhagen, London, Milan, Munich, Oslo, Paris and Vienna regions have been used to make comparisons with the Stockholm region's development.

The report has been produced by Copenhagen Economics in cooperation with SEO Economic Research on behalf of Region Stockholm, Visit Sweden and Swedavia.

Summary



The Stockholm region's total accessibility **decreased** by 25 percent between 2018 and 2023.	• There has been a general decline in accessibility for many European cities after the **Covid-19 pandemic**, with fewer passengers – but with a rapid recovery after the pandemic. • There has been a trend of not flying in Sweden, partly driven by so-called 'flygskammen' ('flight shame')[1]. • Helsinki's accessibility decreased more than Arlanda's.
Arlanda's accessibility decreased in both direct and indirect terms between 2018 and 2023.	• The reduction in accessibility has been driven by both direct and indirect accessibility reductions – see the next slide. **Direct** accessibility decreased by 21 percent between 2018 and 2023, and **indirect** accessibility decreased by 27 percent. • The absolute decrease was mainly driven by lower international and indirect accessibility. This can be increased by more and better connections to some of Europe's main hubs. Hubs can include London, Amsterdam, Frankfurt and Istanbul.
Arlanda has lower accessibility than the majority of the compared regions.	• Total accessibility **decreased** in all compared regions. • The biggest decrease in accessibility was to Asia and Europe, excluding the Nordic region. • Arlanda's reduced accessibility to Asia was mainly driven by a reduction in indirect accessibility rather than a reduction in direct accessibility.
The smaller airports in Stockholm experienced a greater reduction in accessibility than Arlanda between 2018 and 2023.	• Stockholm Bromma Airport's accessibility decreased by 57 percent. • Stockholm Skavsta Airport's accessibility decreased by 76 percent. • Stockholm Västerås Airport's accessibility decreased by 44 percent.

1 Arlanda's passenger numbers fell by more than 4 percent between 2018 and 2019, i.e. before Covid-19.
See Arlanda: www.arlandastockholmairport.com/statistics, Independent (2020): Flight shame:
What is the flight-shaming environmental movement that's sweeping Europe? and Harring, Niklas (2020):
Vad anser svenskarna om en klimatskatt på nötkött? ("What do Swedes think about a climate tax on beef?")

What do we mean by accessibility?

Total accessibility = direct accessibility + indirect accessibility

We measure accessibility using an accessibility index, a 'points system' for accessibility from one airport to another. It is calculated using models with data from flight schedules around the world. (See pages 38–39 in the appendix for a description of the methods used.) The value of the index in itself is hard to interpret, but the index is useful for comparing developments in accessibility over time and accessibility with other airports, and for investigating relative accessibility to different geographical regions. Total accessibility consists of direct accessibility and indirect accessibility.

Direct accessibility

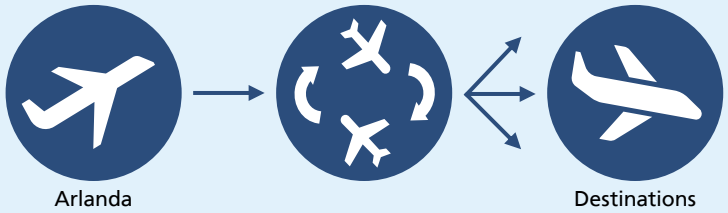
Direct accessibility is created when passengers can fly directly to a destination, such as direct flights to and from Stockholm Arlanda Airport. It increases as the number of weekly departures (frequencies) at the airport increases. One departure from one airport = 1 point, 10 departures = 10 points, etc.

Direct

Indirect accessibility

Indirect accessibility is created when passengers can fly to a destination with a stopover at another airport, for example from Stockholm Arlanda Airport via Frankfurt to Beijing. It increases when the number of weekly departures (frequencies) increases at airports with arriving flights from the Stockholm region, or when a new route is established to another hub. Indirect accessibility is delivered by other hubs, but it is also affected by how departures from the Stockholm region are optimised in relation to departures at other hubs. An indirect connection gives a score of between 0 and 1, depending on the quality of the connection. The quality of the indirect connection is measured in time relative to the direct flight time.

Indirect

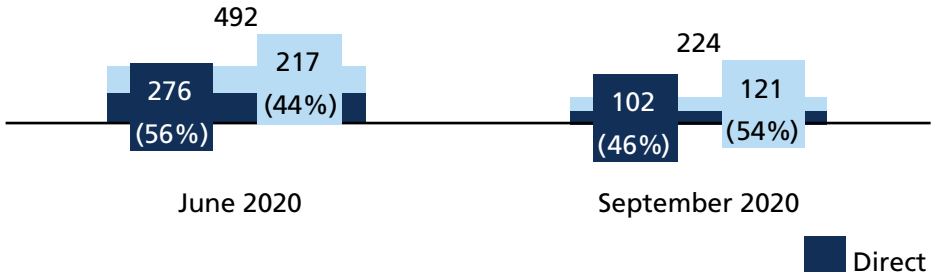


1. Covid-19 accessibility

Arlanda's direct and indirect accessibility was seriously affected by Covid-19 in 2020

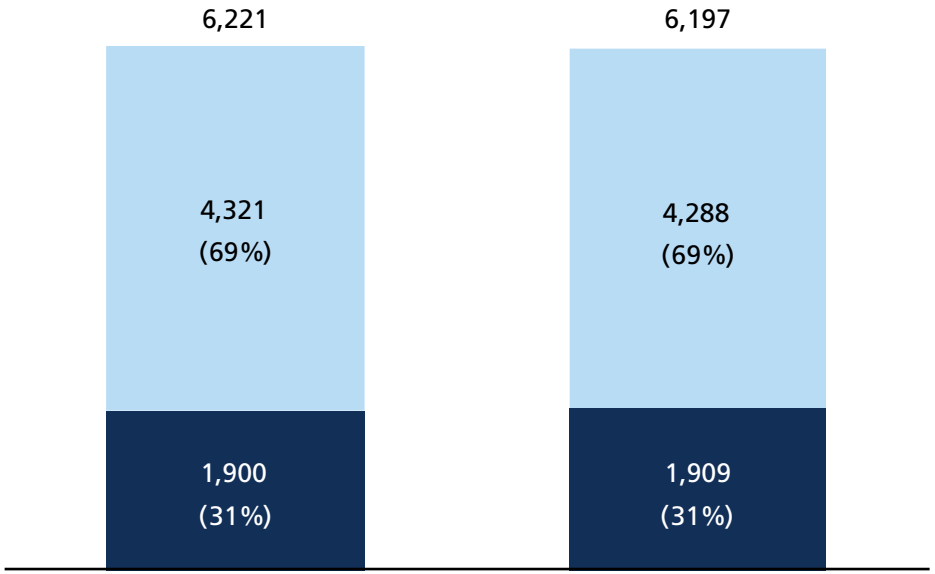
Arlanda's total accessibility, direct and indirect, June and September 2020

Accessibility index



Arlanda's total accessibility, direct and indirect, June and September 2023

Accessibility index

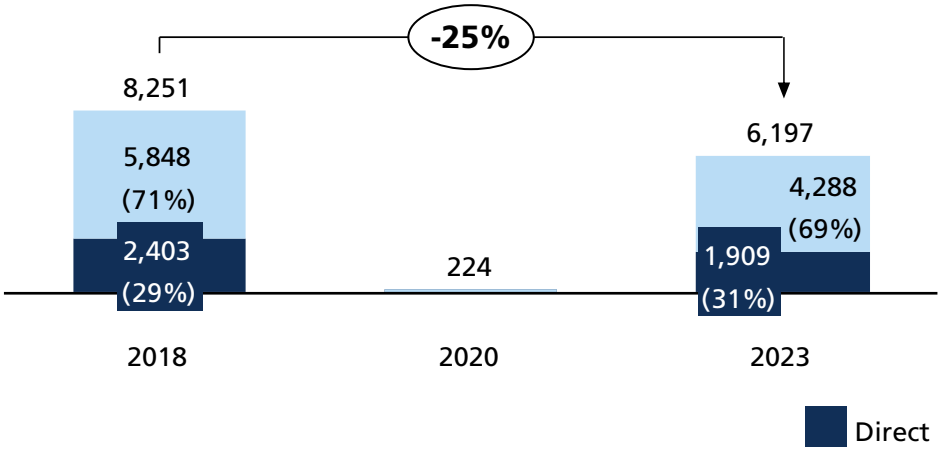


Note: The figures are stated in absolute terms.
Source: Copenhagen Economics based on SEO Economic Research (2023).

The accessibility of Arlanda and other Western European airports has not recovered fully from Covid-19

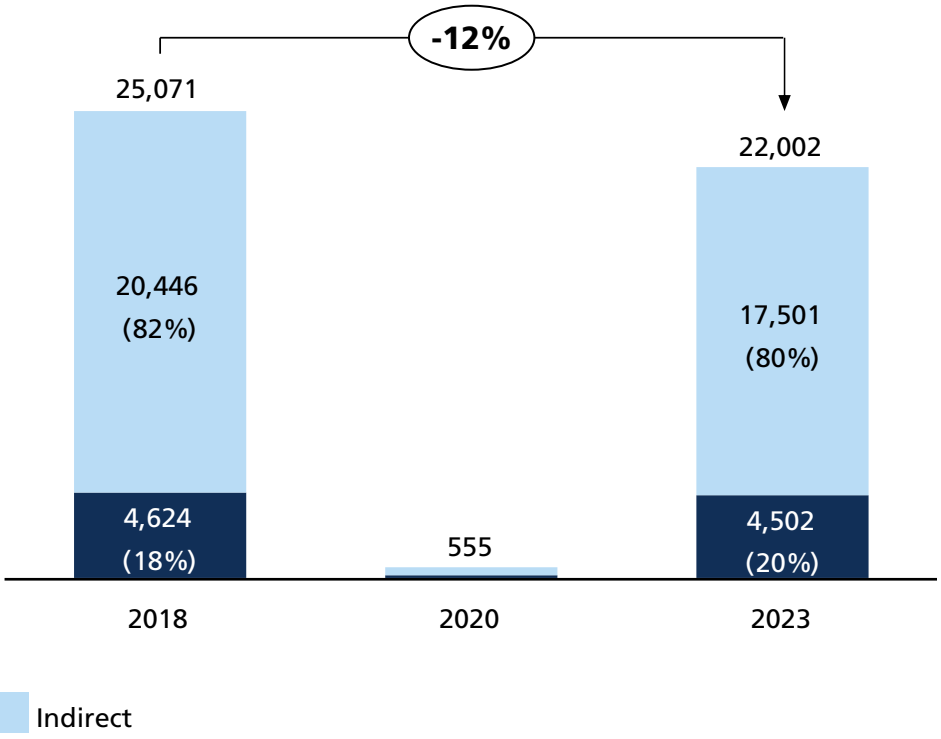
Stockholm Arlanda's development in total, direct and indirect accessibility between 2018 and 2023

Accessibility index



London Heathrow's development in total, direct and indirect accessibility between 2018 and 2023

Accessibility index



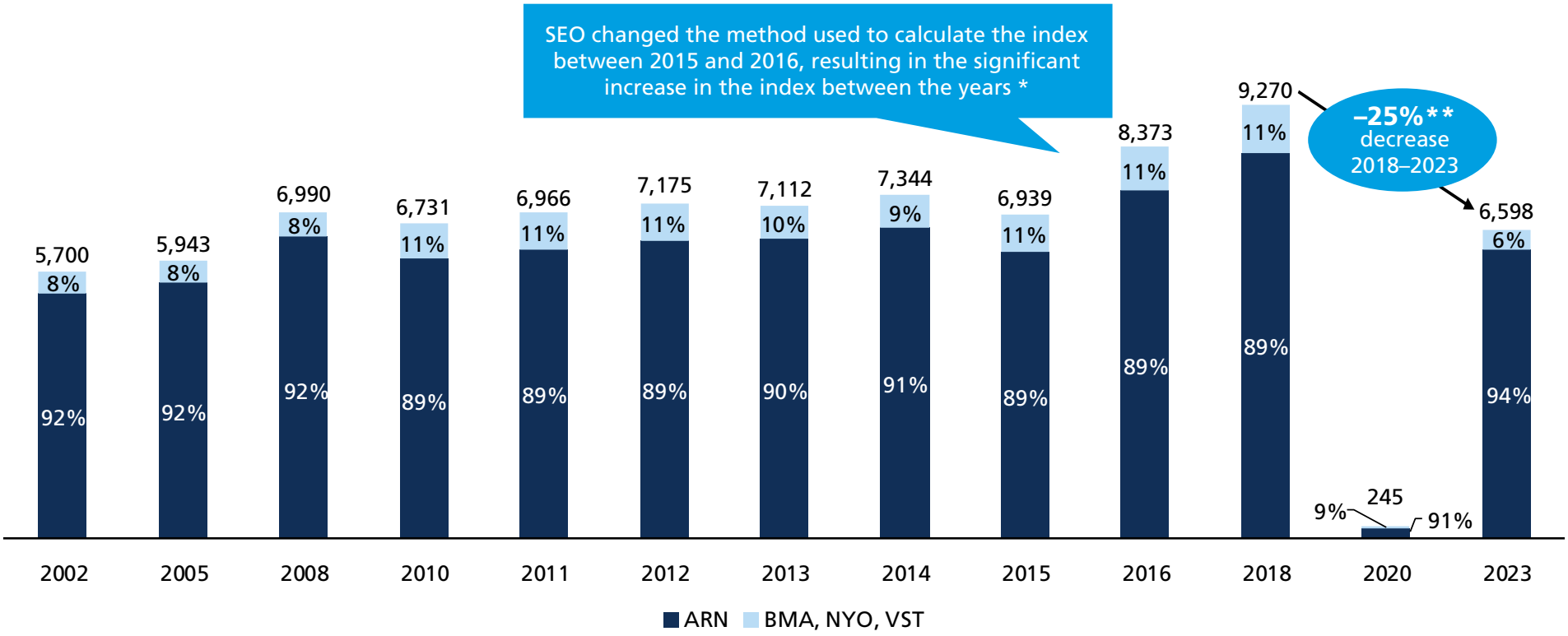
Note: The figures are from September 2018, September 2020 and September 2023.
Source: Copenhagen Economics based on SEO Economic Research (2023).

2. Total accessibility

Accessibility by air for the Stockholm region has decreased by 25 percent since 2018

Development of total accessibility at all airports in the Stockholm region, 2002–2023

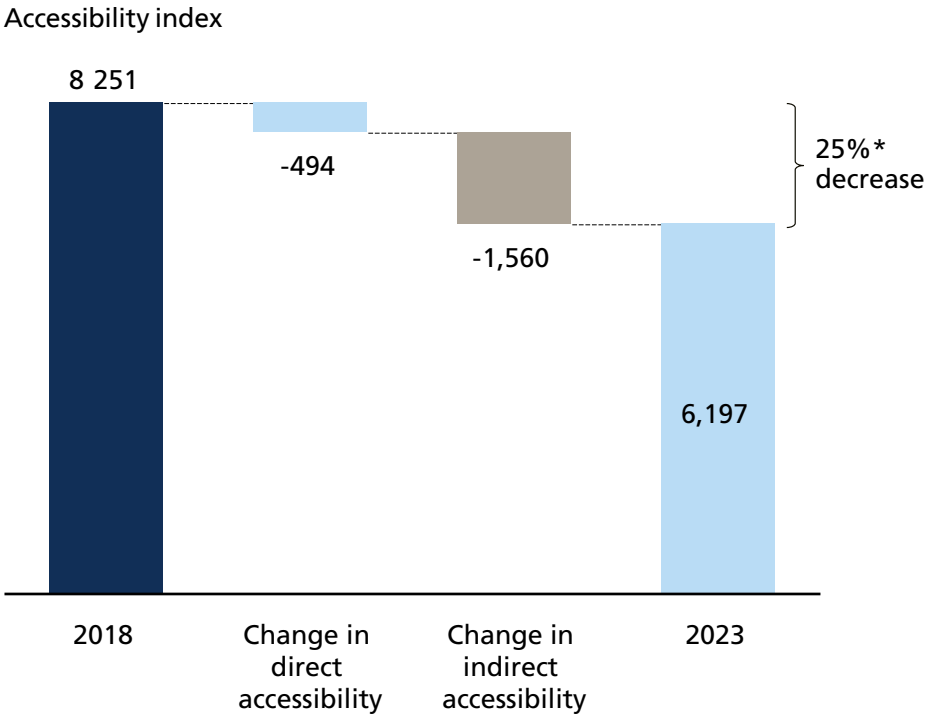
Accessibility index



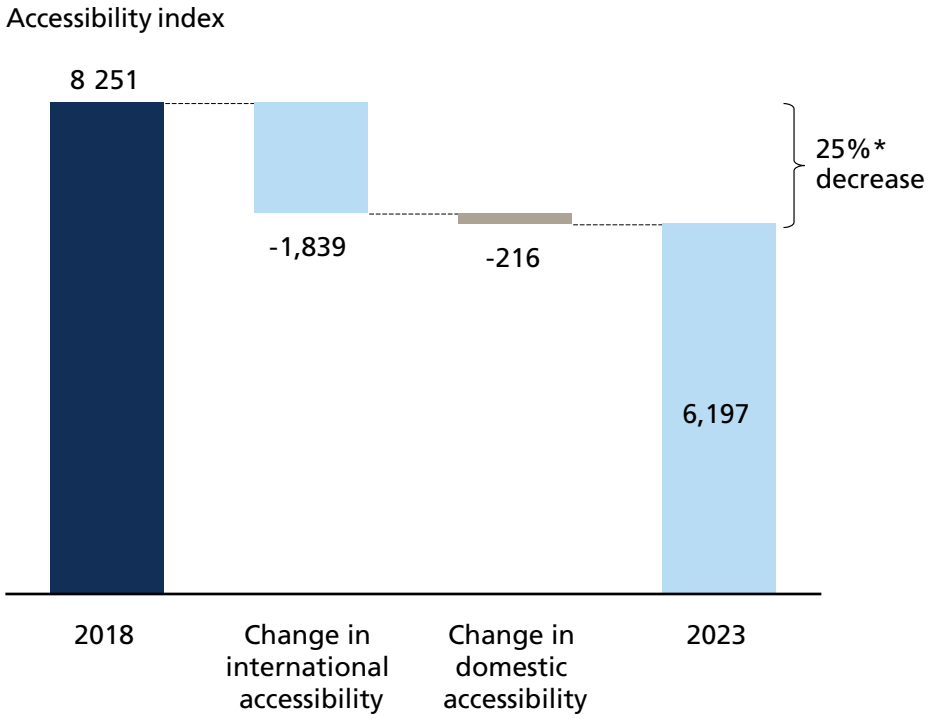
Note: Total accessibility is the sum of direct and indirect accessibility. In addition to Arlanda, Stockholm Bromma Airport (BMA), Stockholm Skavsta Airport (NYO) and Stockholm Västerås Airport (VST) are also included.
Source: Copenhagen Economics based on SEO Economic Research (2023
* SEO Economics changed its method for calculating indirect accessibility between 2015 and 2016. It now also includes codeshare agreements, which explains the significant change in the time series between these two years in the figure.
**The decrease in 2018–23 was -24.9%. The annual decrease in 2018–23 is 5.6%.)

Indirect and international accessibility made the largest contributions to Arlanda's decrease between 2018 and 2023

Change in accessibility for Arlanda between 2018 and 2023, divided up into direct and indirect accessibility



Change in accessibility for Arlanda between 2018 and 2023, divided up into international and domestic accessibility

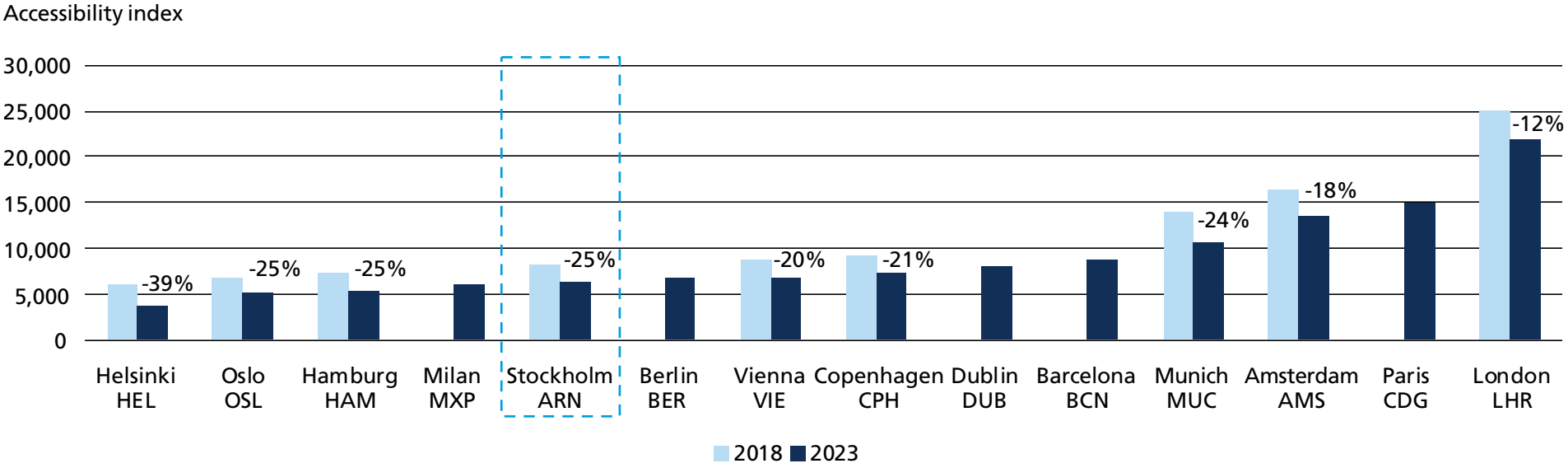


Note: The presented figures, besides the percentage decrease, are in absolute terms.
Total accessibility is the sum of direct and indirect accessibility.
Source: Copenhagen Economics based on SEO Economic Research (2023).

Since 2018, Arlanda's total accessibility has decreased the same or more than most other regions

- Arlanda decreased in line with Hamburg and Oslo in relative terms.
- The gap with Copenhagen is growing.
- London's total accessibility is more than twice as high as Arlanda's.
- Helsinki decreased the most in relative terms, and is almost half as accessible as Arlanda.

Total accessibility in 2018 and 2023, plus percentage change

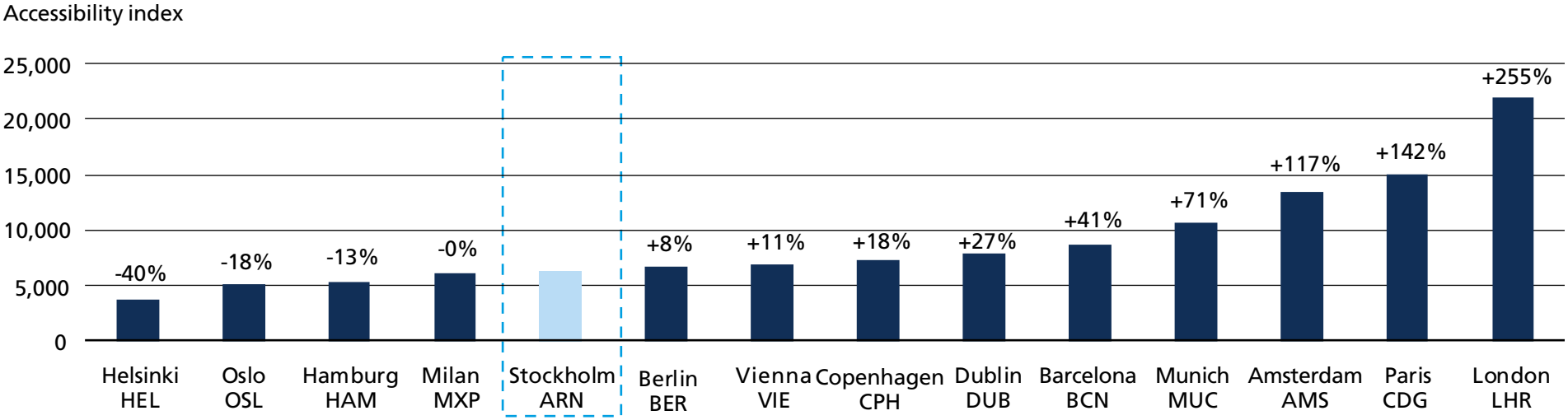


Note: Total accessibility is the sum of direct and indirect accessibility.
Only data from 2020 and 2023 is available for MXP, BER, DUB, BCN and CDG.
Source: Copenhagen Economics based on SEO Economic Research (2023).

Arlanda is the airport with the second greatest accessibility in the Nordic region, after Copenhagen

- Arlanda has higher accessibility than Helsinki, Oslo and Hamburg.
- Arlanda is almost twice as accessible as Helsinki.
- Copenhagen and Berlin have slightly higher accessibility than Arlanda.
- London and Paris have almost 2.5 and 1.5 times the accessibility of Arlanda, respectively.

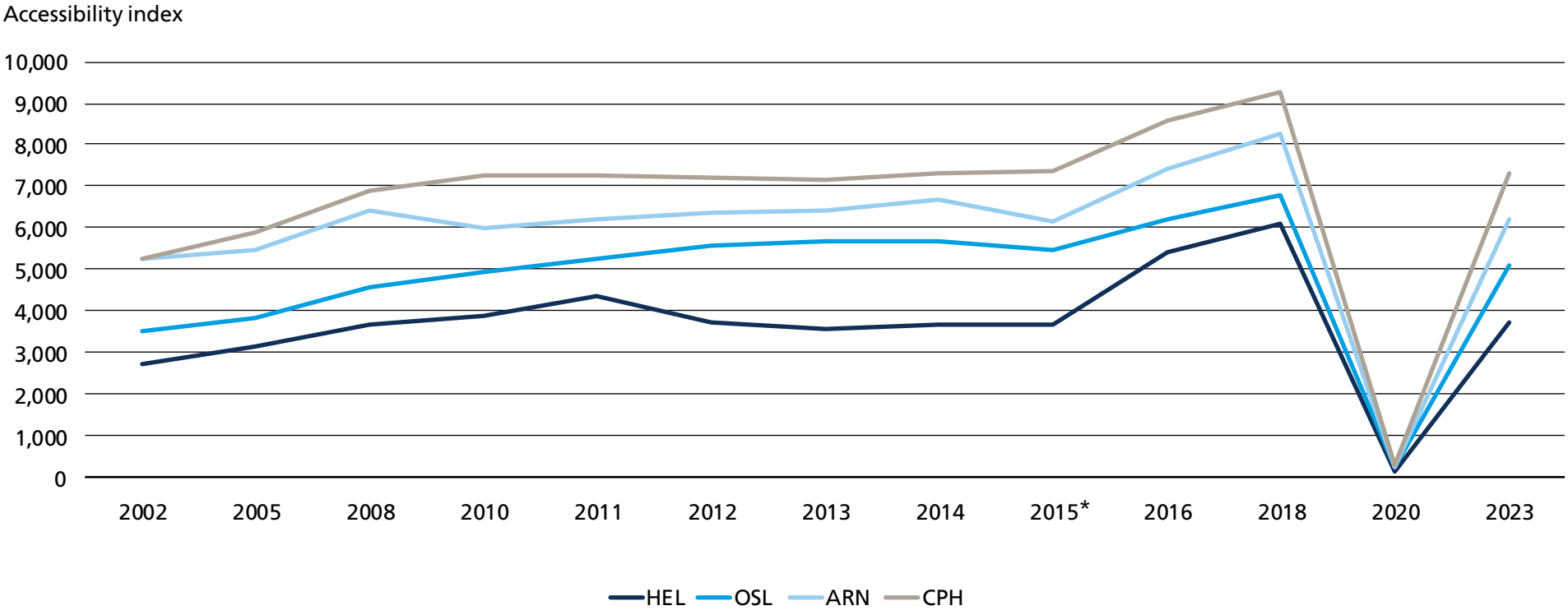
Total accessibility in 2023, plus percentage comparison with Arlanda



Note: Total accessibility is the sum of direct and indirect accessibility.
The percentage figures show the difference compared to Stockholm ARN.
Source: Copenhagen Economics based on SEO Economic Research (2023).

Copenhagen has the highest accessibility of the major Nordic airports

Total accessibility for the major Nordic airports, 2002–2023

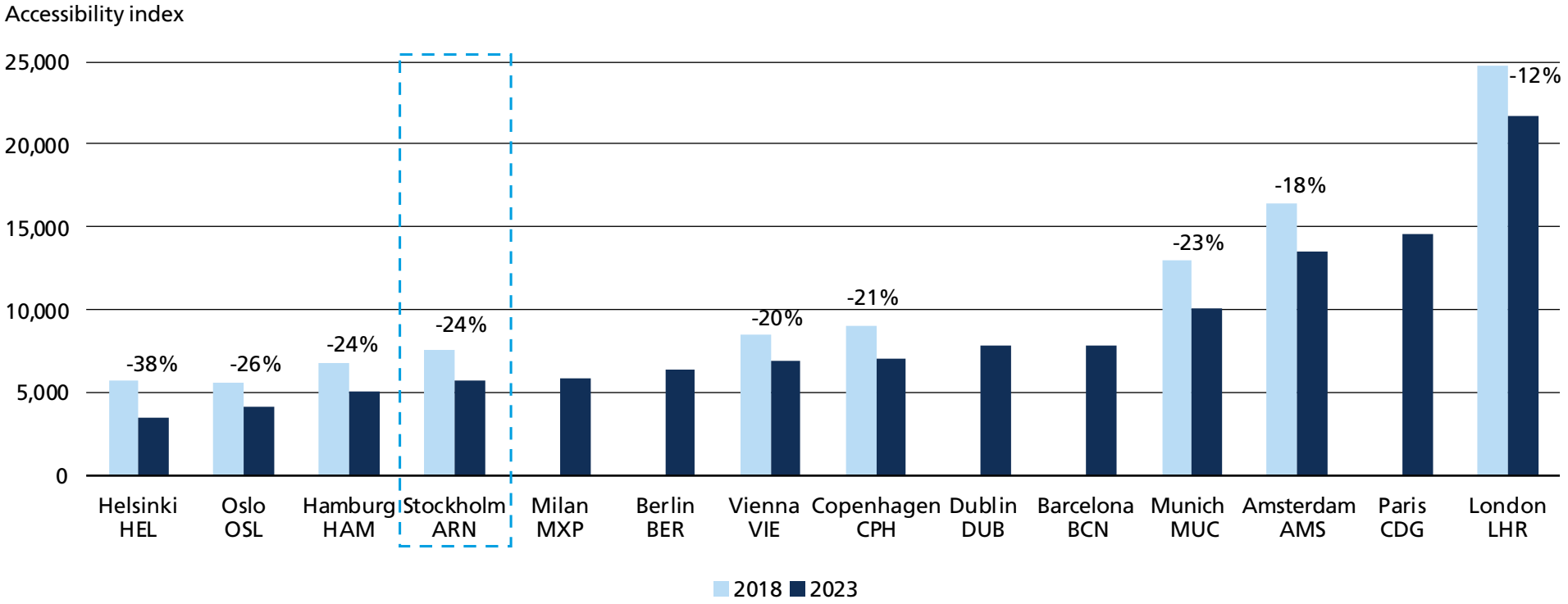


Source: Copenhagen Economics based on SEO Economic Research (2023).
* SEO Economics changed its model for calculating indirect accessibility between 2015 and 2016.
It now also includes codeshare agreements, thereby increasing the number of indirect connections.

3. International and domestic accessibility

Arlanda's international accessibility decreased less than Helsinki's and Oslo's in relative terms

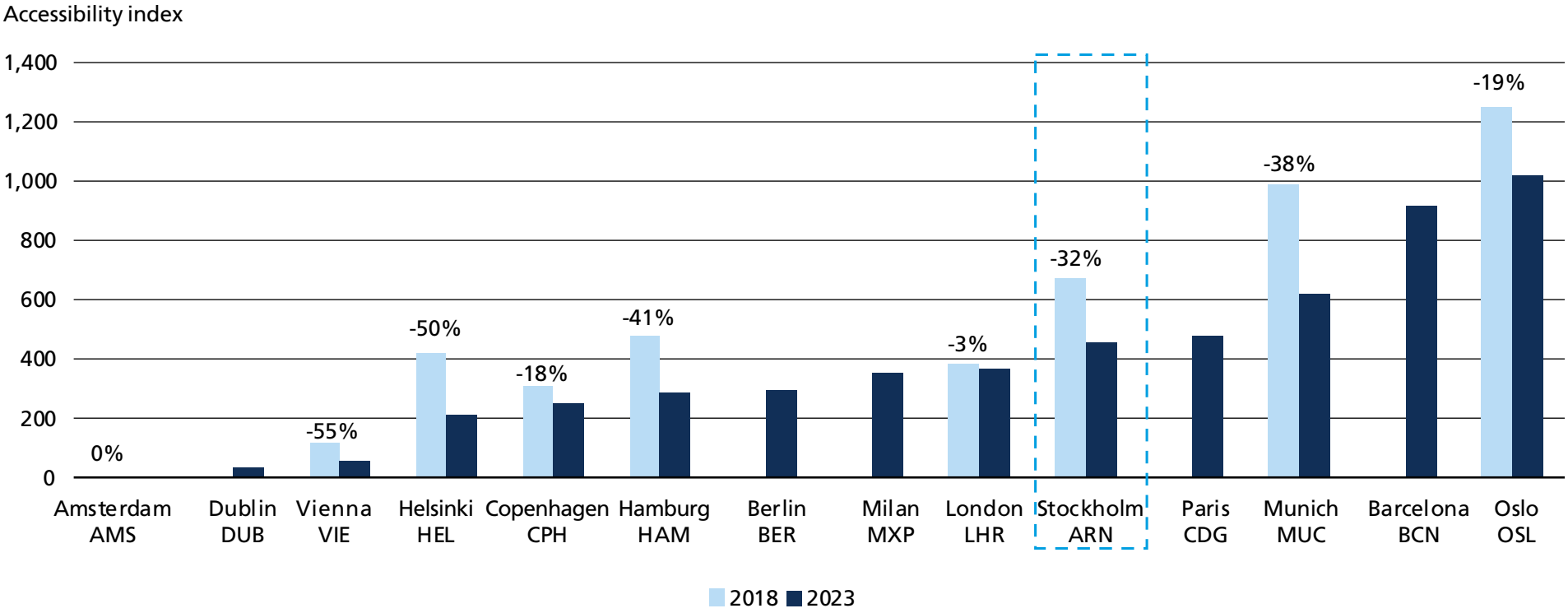
Total international accessibility in 2018 and 2023, plus percentage change



Note: Total accessibility is the sum of direct and indirect accessibility. Only 2023 data is available for MXP, BER, DUB and BCN airports, and no percentage changes are therefore presented for them.
Source: Copenhagen Economics based on SEO Economic Research (2023).

Domestic accessibility has decreased the most in Helsinki and Vienna since 2018, with the lowest decrease in London

Total domestic accessibility in 2018 and 2023, plus percentage change



Note: Total accessibility is the sum of direct and indirect accessibility. For domestic accessibility, direct accessibility is the most important factor as indirect routes are awarded low values in the model due to short flight distances and flight times. See the appendix for a more detailed explanation. Only 2023 data is available for MXP, BER, DUB and BCN airports, and no percentage changes are therefore presented for them. Amsterdam had domestic accessibility of 1 in 2018 and 0 in 2023.
Source: Copenhagen Economics based on SEO Economic Research (2023).

4. Direct accessibility

Summary of developments in direct accessibility

- Between 2018 and 2023, Arlanda's direct accessibility **decreased** by 21 percent. Direct accessibility decreased at all major airports.

- **Reduced** direct accessibility to **domestic destinations** was the biggest factor behind the decrease for Arlanda, with a -32 percent decrease since 2018.

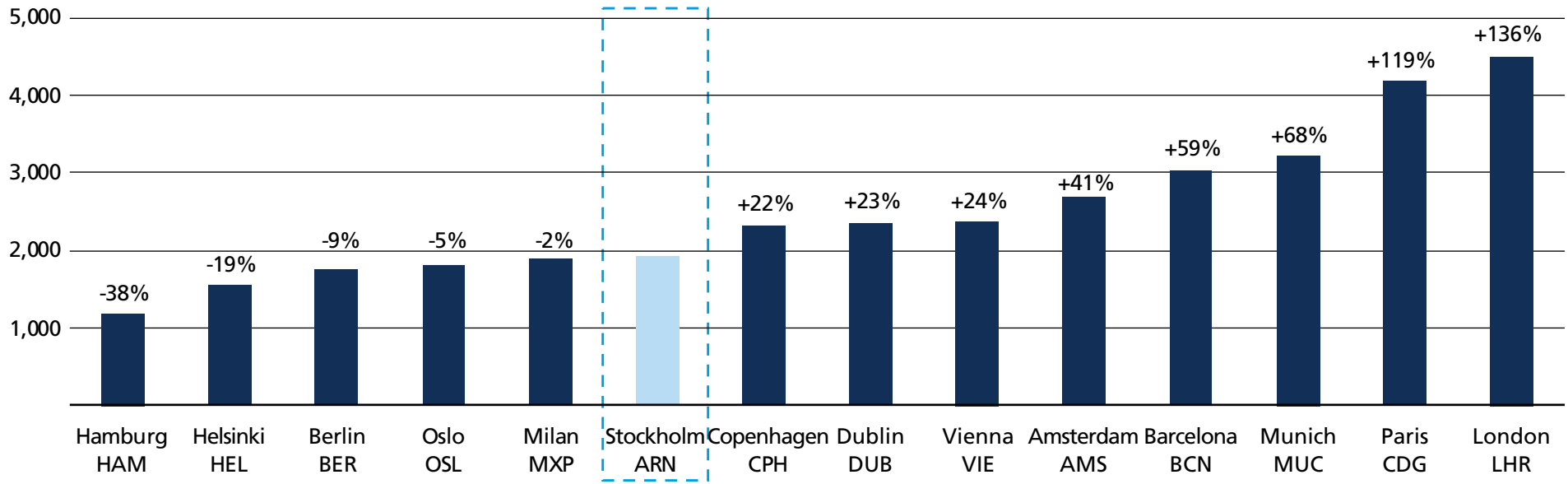
- Arlanda's direct accessibility to the Nordic region and Europe also decreased.
- Arlanda's direct accessibility to the rest of the world remains relatively stable.

- Similar reductions in direct accessibility can be seen at other European airports, which have also not recovered fully from Covid-19.
- Amsterdam's direct accessibility has decreased by 45 percent since 2018, while Vienna only had an 8 percent decrease.

Copenhagen has greater direct accessibility than Arlanda, but Helsinki and Oslo have lower direct accessibility

- London, Paris, Munich, Barcelona, Amsterdam, Vienna, Dublin och Copenhagen have greater direct accessibility than Arlanda

Direct accessibility in 2023, plus percentage comparison with Arlanda

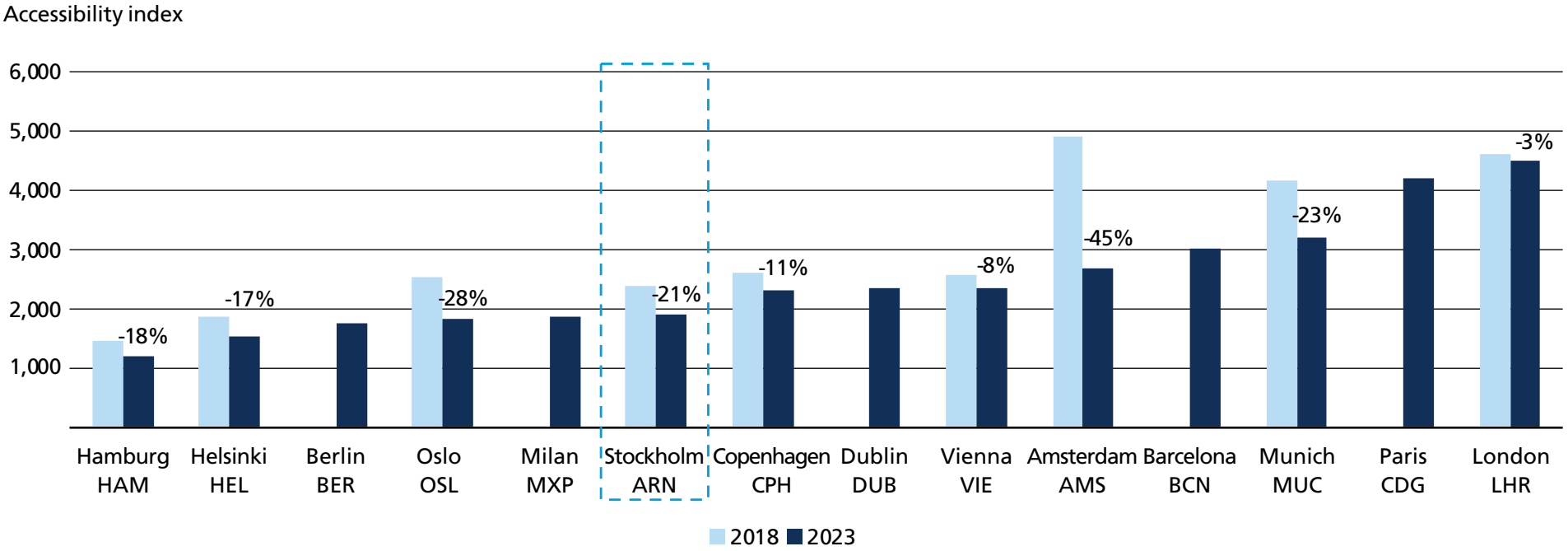


Note: The percentage figures show the difference compared to Stockholm ARN.
Source: Copenhagen Economics based on SEO Economic Research (2023).

The development of direct accessibility varies among the comparison regions

- Amsterdam, Oslo and Munich followed by Arlanda, are decreasing faster than the comparison regions.
- The largest relative and absolute decrease was in Amsterdam.
- London had the lowest relative and absolute decrease in direct accessibility compared to the comparison regions.

Direct accessibility in 2018 and 2023, plus percentage change

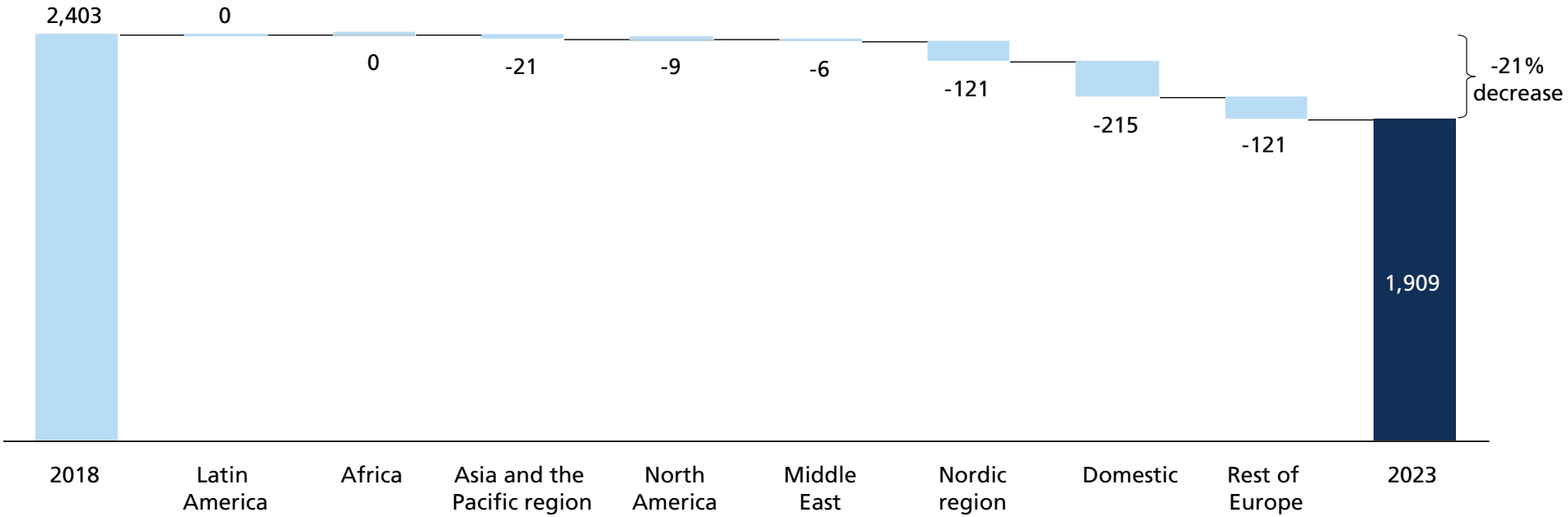


Note: Only 2023 data is available for MXP, BER, DUB and BCN airports, and no percentage changes are therefore presented for them.
Source: Copenhagen Economics based on SEO Economic Research (2023).

Decreased direct domestic accessibility is the biggest individual factor behind the decrease in total direct accessibility

Change in direct accessibility from Arlanda between 2018 and 2023, by region

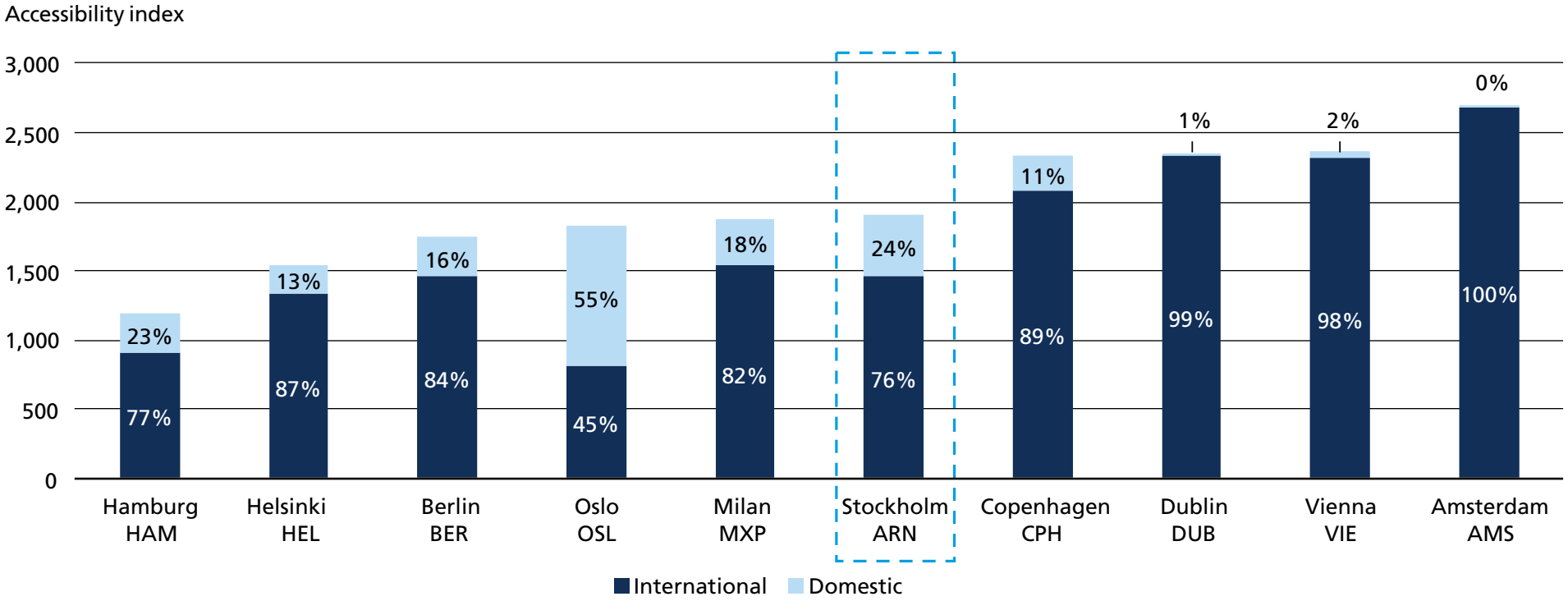
Accessibility index



Note: The presented figures, besides the percentage decrease, are in absolute terms.
The Nordic region includes Denmark, Finland, the Faroe Islands, Greenland, Iceland and Norway.
Source: Copenhagen Economics based on SEO Economic Research (2023).

The proportion of direct accessibility attributable to domestic flights is high in Oslo, Arlanda and Hamburg

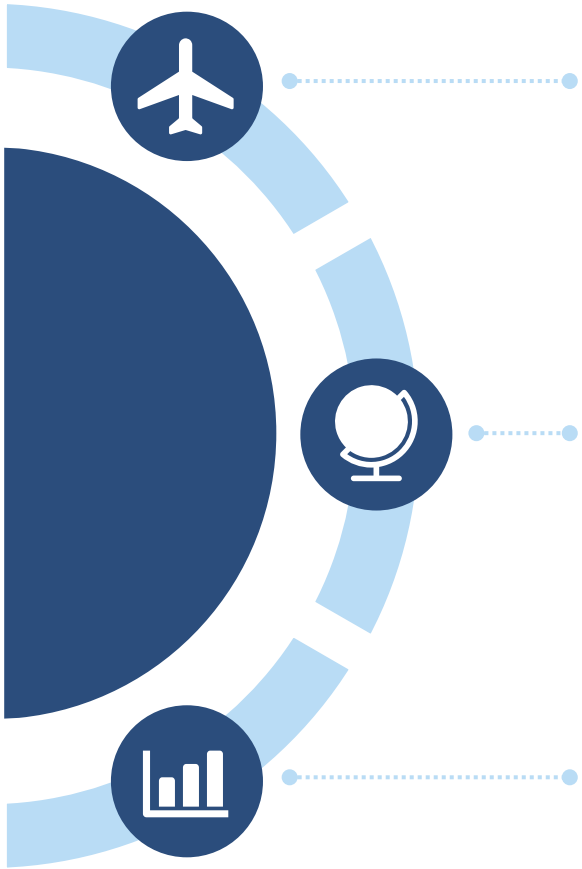
Direct accessibility in 2023, broken down by domestic and international accessibility



Source: Copenhagen Economics based on SEO Economic Research (2023).

5. Indirect accessibility

Summary of developments in indirect accessibility



- Arlanda's indirect accessibility **decreased** by **27 percent** in 2018–2023, which is less than for other Nordic regions, excluding Copenhagen.
- Arlanda is on the **same level as Hamburg, and just behind Vienna and Copenhagen**.

- This decrease is mainly attributable to **reduced** indirect accessibility to **Asia** and **Europe**[2].
- Arlanda's indirect accessibility to all other regions also **decreased**.
- This decrease is partly due to a decrease in direct accessibility but is mostly due to poorer connections at destination airports.

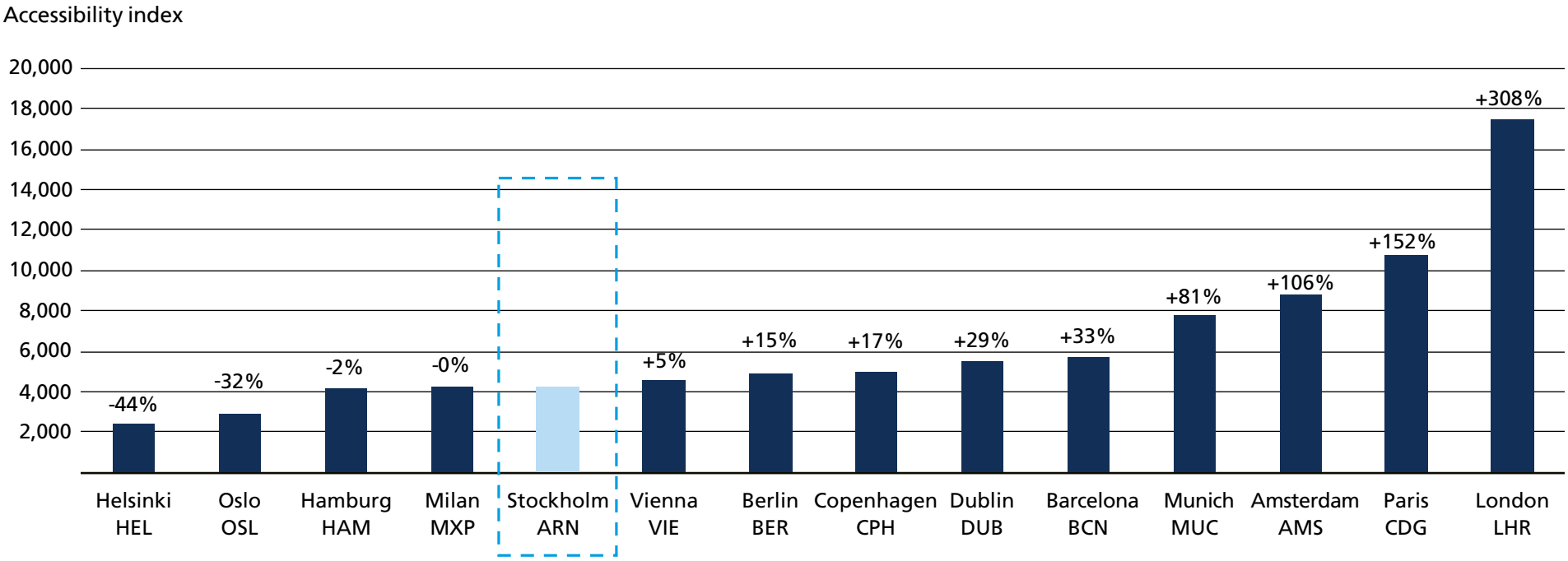
- Copenhagen, Vienna and Hamburg have seen reductions in indirect accessibility of around 25 percent.
- Helsinki's indirect accessibility has decreased by 43 percent since 2018.

2 Excluding Scandinavia.

Arlanda is ahead of Helsinki, Oslo and Hamburg in terms of indirect accessibility

- Arlanda and Milan have roughly the same levels of indirect accessibility. Helsinki and Oslo have almost 30–45 percent lower indirect accessibility than Arlanda.
- Arlanda is immediately behind Vienna in terms of indirect accessibility, but is somewhat lower than Berlin and Copenhagen.
- Amsterdam, Paris and London have more than 100 percent greater indirect accessibility than Arlanda.

Indirect accessibility in 2023, plus percentage comparison with Arlanda

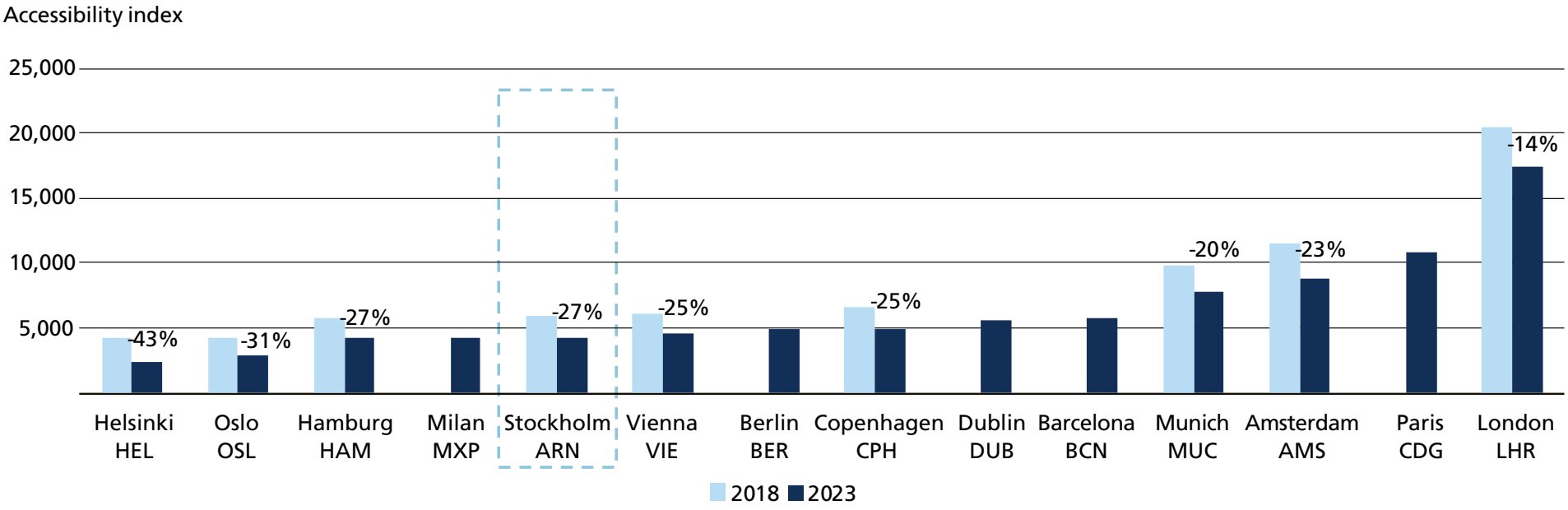


Note: The percentage figures show the difference compared to Stockholm ARN.
Source: Copenhagen Economics based on SEO Economic Research (2023).

Arlanda's indirect accessibility decreased less than Helsinki's and Oslo's in relative terms

- In absolute terms, Oslo saw a smaller decrease in indirect accessibility than Arlanda.
- Hamburg and Arlanda are declining at about the same relative and absolute rates.
- Helsinki has had the largest relative reduction, while London has had the largest absolute reduction.
- All airports experienced reductions in indirect accessibility in 2018–2023.

Indirect accessibility in 2018 and 2023, plus percentage change

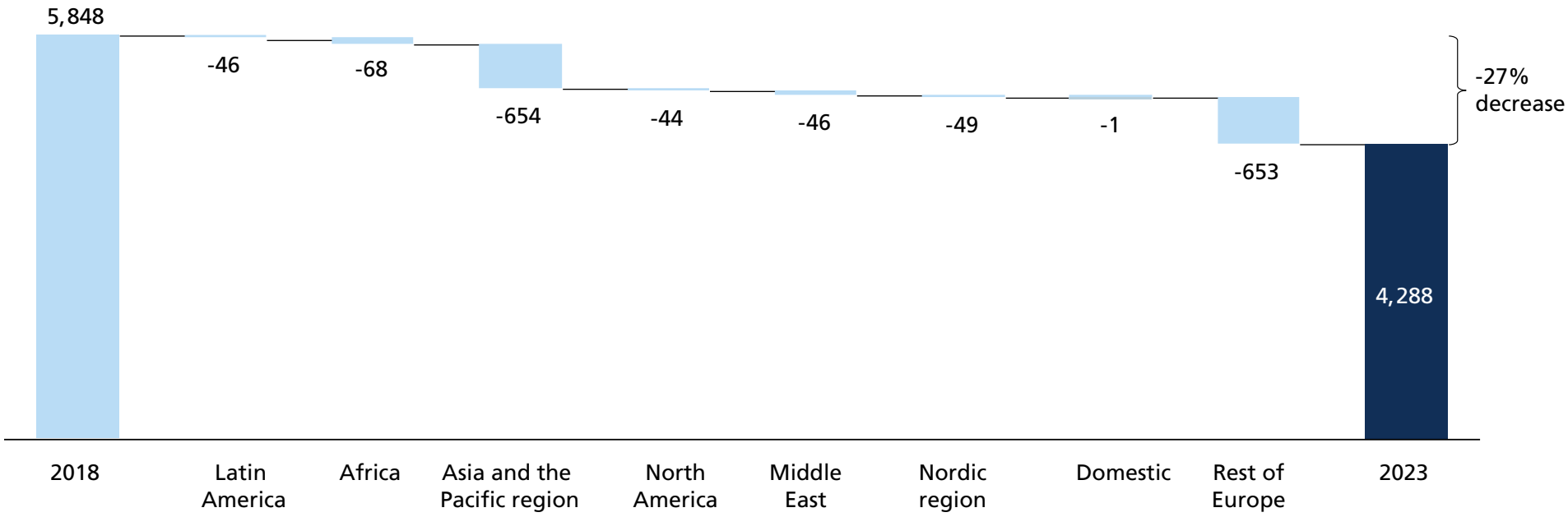


Note: Few of the airports have indirect domestic accessibility. Indirect flights across short distances are not attractive to passengers, as the total travel time including transfers is relatively high. This means that these routes have a very low accessibility value, often zero. Source: Copenhagen Economics based on SEO Economic Research (2023).

Decreased indirect accessibility, mainly to Asia and Europe

Change in indirect accessibility from Arlanda between 2018 and 2023, by region

Accessibility index



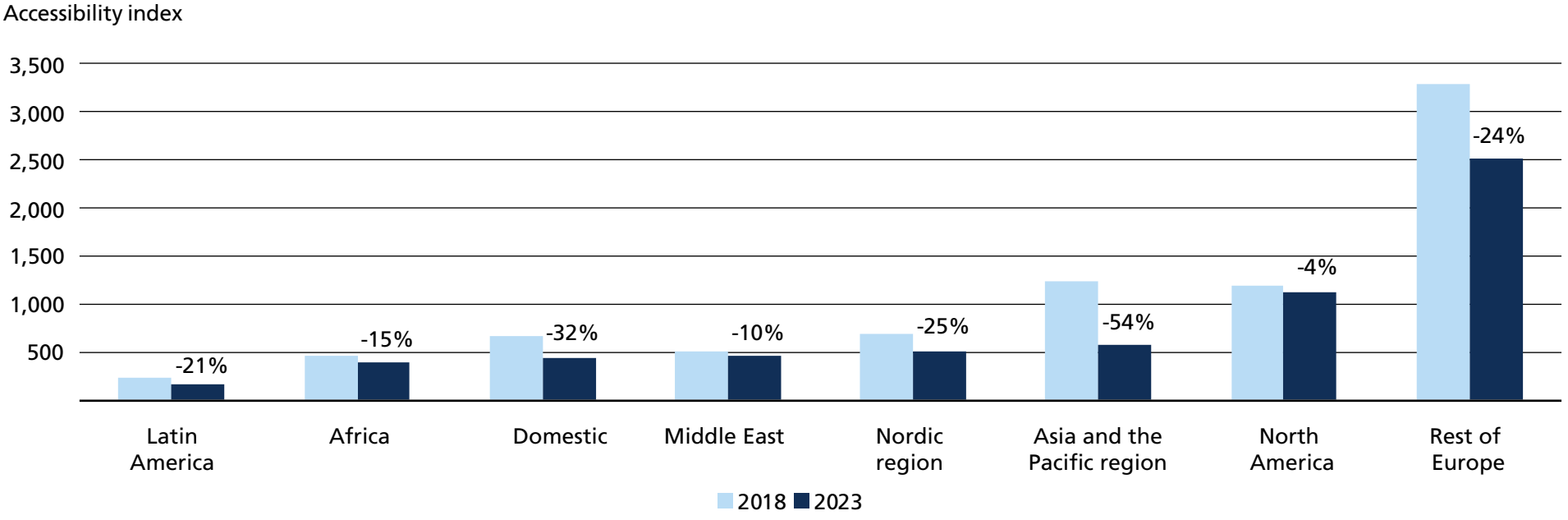
Note: The presented figures, besides the percentage decrease, are in absolute terms.
The Nordic region includes Denmark, Finland, the Faroe Islands, Greenland, Iceland and Norway.
Source: Copenhagen Economics based on SEO Economic Research (2023).

6. Accessibility by region

Total accessibility from Arlanda decreased the most to Asia, domestic destinations and Europe

- The largest relative decrease was to Asia, while – in absolute terms – Europe (excluding Scandinavia) saw the largest decrease in accessibility.
- The smallest relative decrease in accessibility was to North America, and in absolute terms accessibility decreased least to Latin America.
- Total accessibility decreased to all regions.

Total accessibility from Arlanda in 2018 and 2023, by region, plus percentage change

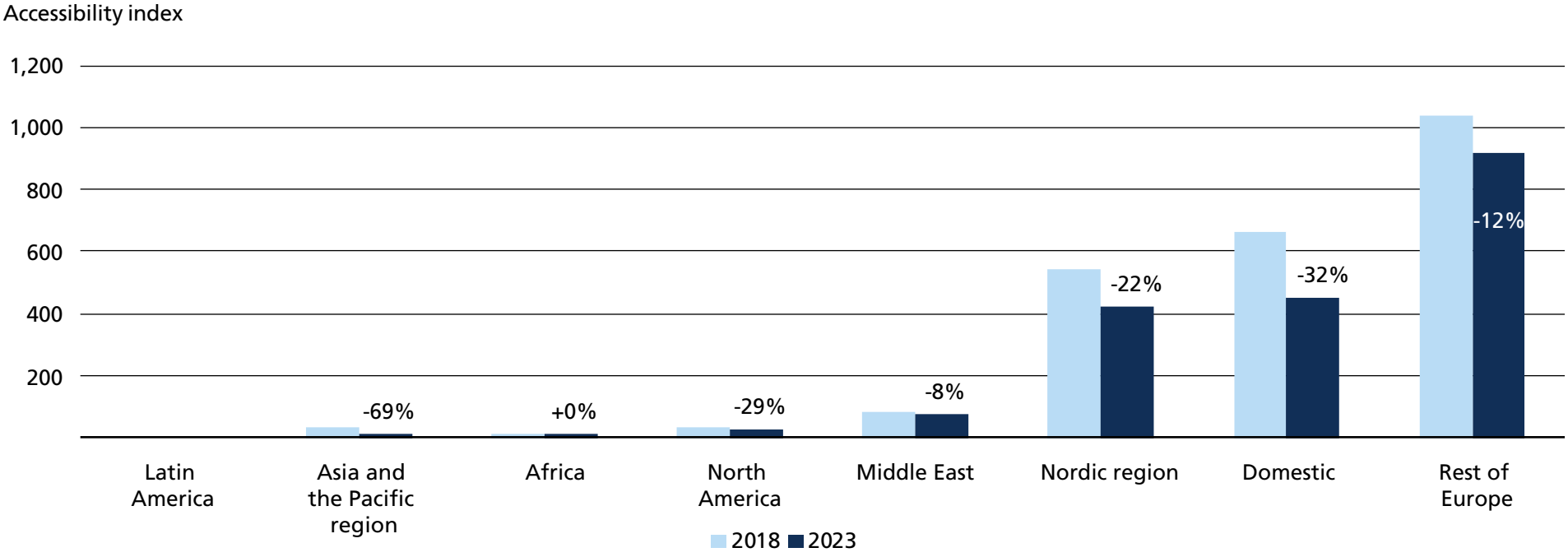


Note: Total accessibility is the sum of direct and indirect accessibility.
The Nordic region includes Denmark, Finland, the Faroe Islands, Greenland, Iceland and Norway.
Source: Copenhagen Economics based on SEO Economic Research (2023).

Direct accessibility from Arlanda also decreased, primarily to Asia and domestic destinations

- Direct accessibility decreased by a total of 21 percent for Arlanda.
- Largest relative decrease to Asia, largest absolute decrease to domestic destinations.
- No difference in direct accessibility to Africa – the absolute direct accessibility remained 0 in 2023.

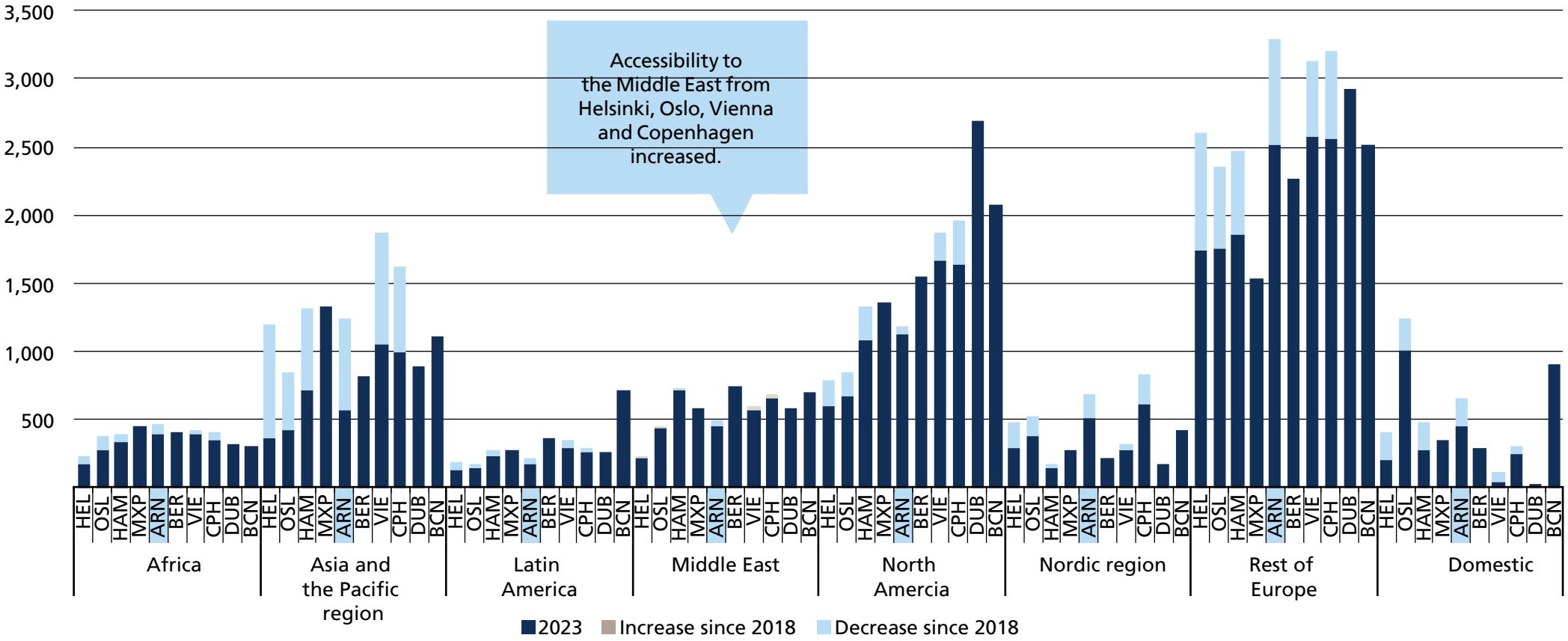
Direct accessibility from Arlanda in 2018 and 2023, by region, plus percentage change



Note: Total accessibility is the sum of direct and indirect accessibility.
The Nordic region includes Denmark, Finland, the Faroe Islands, Greenland, Iceland and Norway.
Source: Copenhagen Economics based on SEO Economic Research (2023).

Accessibility decreased to almost all regions

Total accessibility to each region, 2018–2023



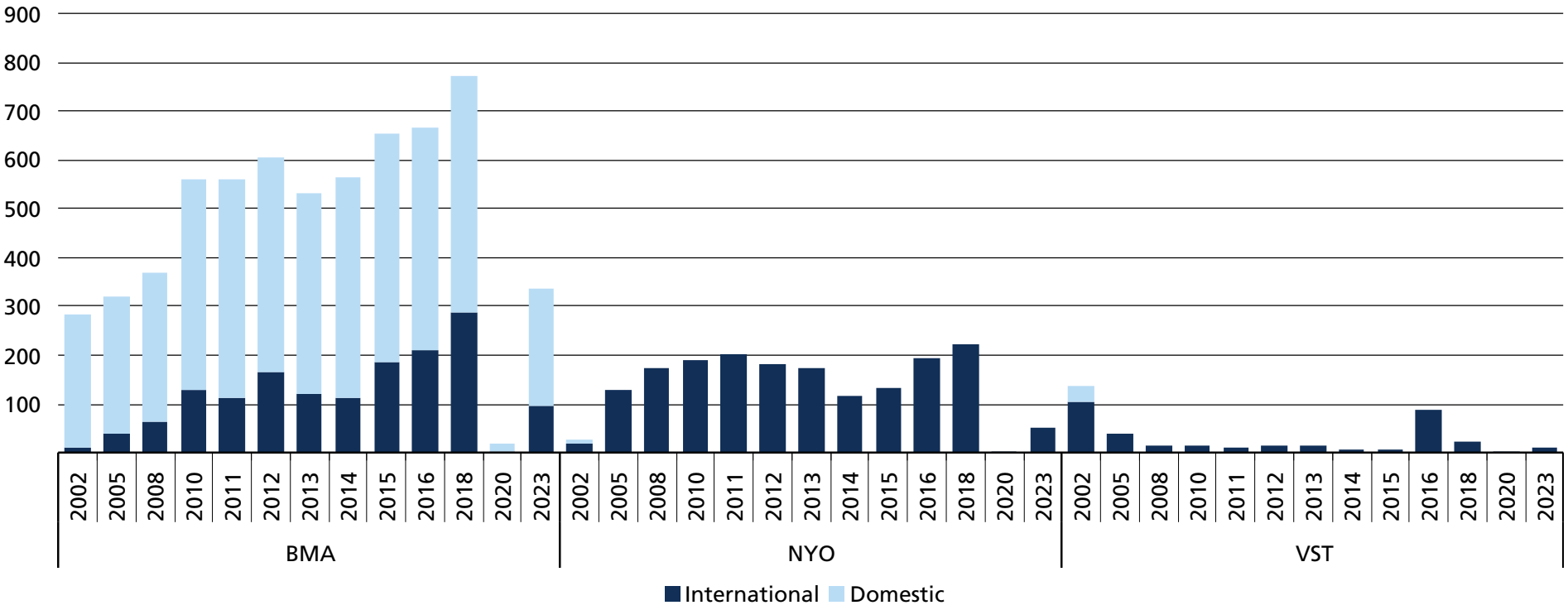
Note: Total accessibility is the sum of direct and indirect accessibility. Domestic and Scandinavian accessibility is excluded in groups at a more aggregated level. Only 2023 data is available for MXP, BER, DUB and BCN airports, and no percentage changes are therefore presented for them. The Nordic region includes Denmark, Finland, the Faroe Islands, Greenland, Iceland and Norway.
Source: Copenhagen Economics based on SEO Economic Research (2023).

7. Accessibility to other Stockholm airports

Accessibility to all other Stockholm airports has decreased

Development of direct accessibility, other Stockholm airports, 2002–2023

Accessibility index

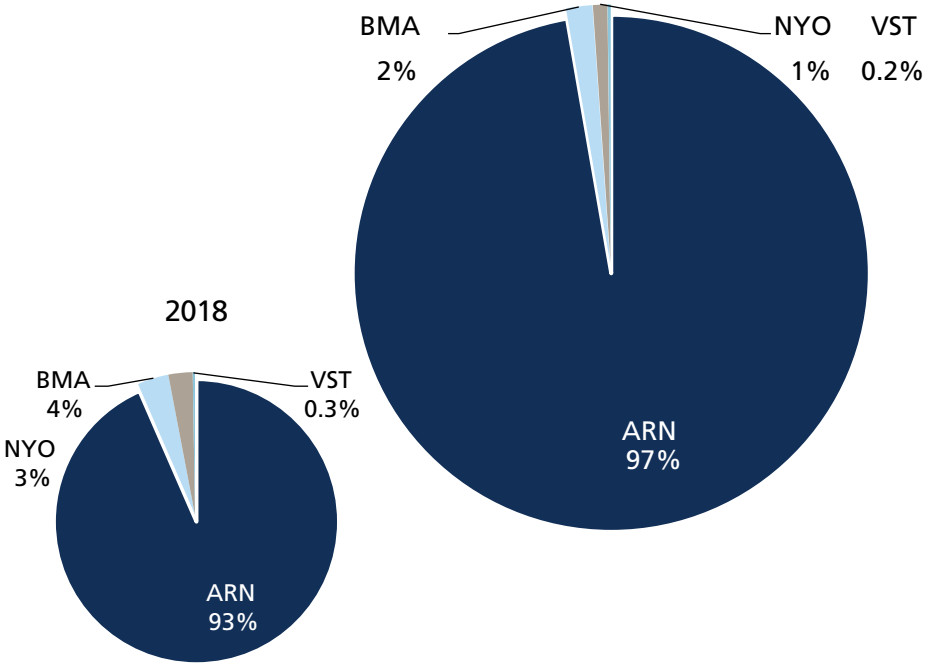


Note: Total accessibility is the sum of direct and indirect accessibility.
Other Stockholm airports are Bromma (BMA), Skavsta (NYO) and Västerås (VST).
Source: Copenhagen Economics based on SEO Economic Research (2023).
SEO Economics changed its model for calculating indirect accessibility between 2015 and 2016.
It now also includes codeshare agreements, thereby increasing the number of indirect connections.

Bromma accounts for 35% of domestic accessibility in the Stockholm region

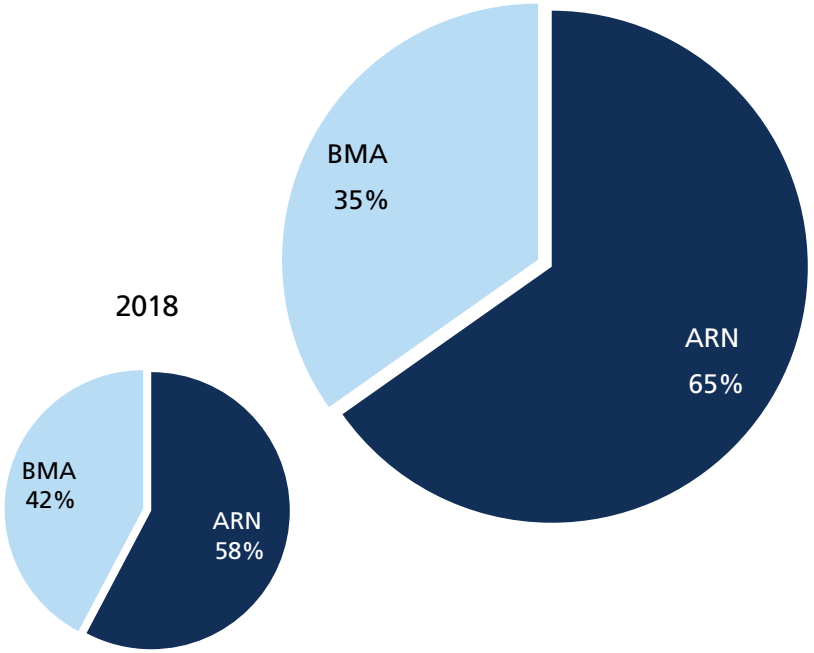
Total international accessibility for Stockholm's airports, 2023

Percent



Total domestic accessibility for Stockholm's airports, 2023

Percent



Arlanda accounts for **94 percent** of total accessibility in the Stockholm region in 2023, i.e. 5 percentage points more than in 2018.

Note: No domestic accessibility for NYO or VST.
Source: Copenhagen Economics based on SEO Economic Research (2023).

Appendix

Calculating of the accessibility index and additional figures

Calculating the accessibility index (1/2)

The accessibility index is based on the number of connections from an airport during a week in September each year ('weekly frequencies') to a certain destination. We have used Beijing as an example destination below and on the next slide.

Direct accessibility corresponds to the number of weekly departures from an airport to Beijing. For example, if Beijing is served by 14 departures per week, direct accessibility from the airport to Beijing is 14.

Indirect accessibility corresponds to the number of travel opportunities to Beijing via a stopover at another airport (a hub). In practice, this number can be very large, as it is possible to fly via many different hubs to Beijing, and with several stopovers.

Because a journey with stopovers takes longer due to transfer time, and because stopovers involve a geographical detour, these connections are of lower quality than a direct connection. The number of departures to Beijing via a hub is therefore weighted by a quality indicator, quality of service (QoS), to give a measure of indirect accessibility.

Quality of service is measured as transfer time plus the detour time, relative to the direct flight time. QoS thus expresses the actual travel time relative to the direct flight time, and varies between 0 and 1. A direct connection has a quality of 1.

However, QoS does not take into account other aspects of quality, such as the cost of the journey, access to services at the airport or the risk of missing the flight in the case of indirect connections.

Indirect accessibility takes into account transfers within the same airline, transfers between airlines within the same airline alliance, and transfers between airlines that have entered into codeshare agreements. The opportunities for passengers to buy transfer tickets separately from different airlines are thus not taken into account in the model.

The table on the next page shows an example calculation of accessibility between Amsterdam and Beijing.

Calculating the accessibility index (2/2)

Accessibility index

Departure	Hub	Destination	Transfer time	Routing factor	Departures per week		QoS		Accessibility index
AMS	—	PEK	—	100 %	14	*	1	=	14.0
AMS	CDG	PEK	162	112 %	42	*	0.41	=	17.4
AMS	FRA	PEK	201	106 %	41	*	0.35	=	14.2
AMS	ICN	PEK	92	123 %	16	*	0.54	=	8.7
AMS	MUC	PEK	174	112 %	23	*	0.38	=	8.6
AMS	LHR	PEK	190	111 %	14	*	0.33	=	4.7
AMS	VIE	PEK	187	117 %	14	*	0.3	=	4.2
AMS	CPH	PEK	123	103 %	7	*	0.6	=	4.2
AMS	HEL	PEK	165	103 %	7	*	0.47	=	3.3
AMS	IST	PEK	100	130 %	7	*	0.46	=	3.2
AMS	PVG	PEK	186	133 %	14	*	0.18	=	2.5
AMS	SVO	PEK	240	108 %	7	*	0.21	=	1.5
AMS	CAN	PEK	160	136 %	6	*	0.23	=	1.4
Total									**Accessibility AMS–PEK**

Note: Data is collected using a model developed by SEO Economic Research (the SEO NetScan Connectivity Model), which scans digital flight schedules. To calculate total accessibility for the Stockholm region, the calculations in the table are carried out for departures from Stockholm to all destinations worldwide. The results are added together to create an accessibility index.
Source: Veldhuis (1997); IATA (2000); Burghouwt & Veldhuis (2006); Burghouwt et al. (2009); Burghouwt & Redondi (2009); Lieshout et al. (2009).

Table of airport codes

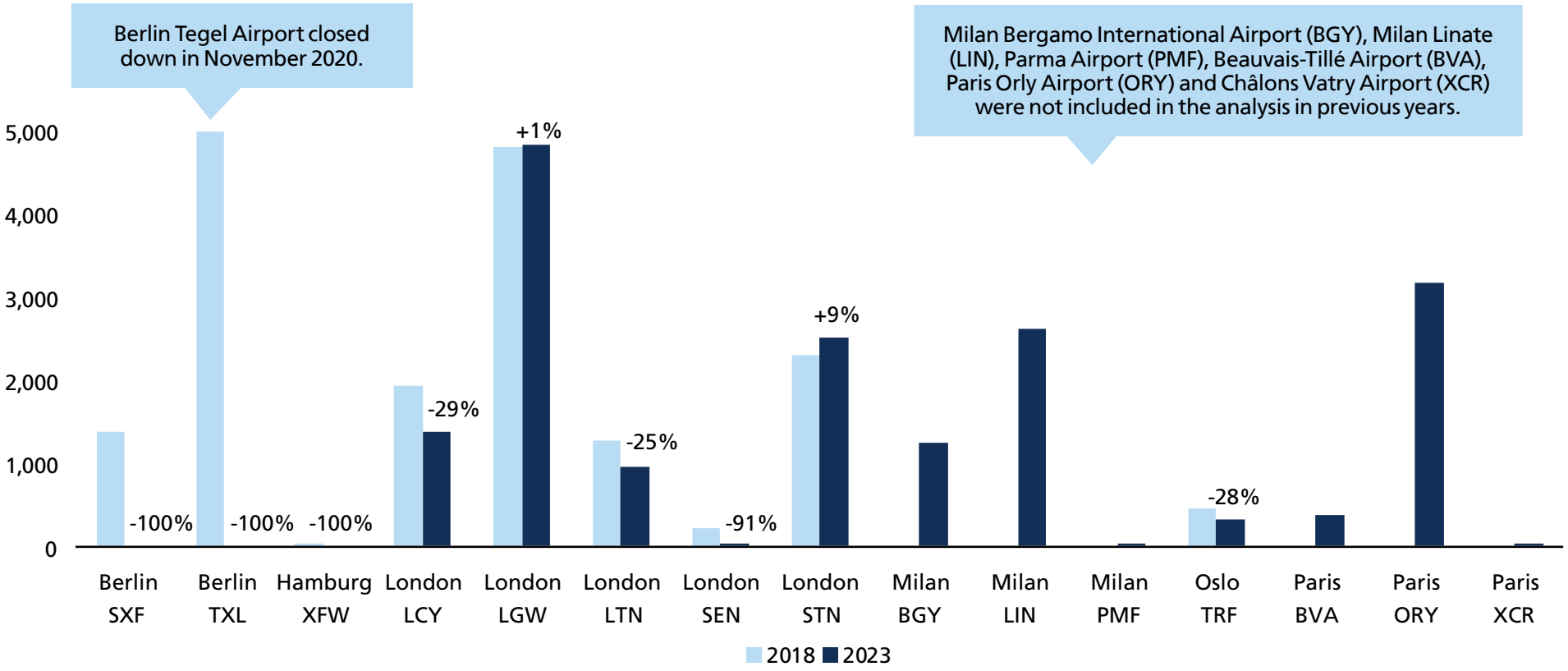
Airport code	City (local area)	Airport name
AMS	Amsterdam	Schiphol
ARN	Stockholm	Arlanda
BCN	Barcelona	Josep Tarradellas
BER	Berlin	Brandenburg
BGY	Milan	Orio al Serio
BMA	Stockholm	Bromma
BVA	Paris	Beauvais-Tillé
CDG	Paris	Charles de Gaulle
CPH	Copenhagen	Kastrup
DUB	Dublin	Dublin
HAM	Hamburg	Hamburg
HEL	Helsinki	Helsinki
LCY	London	London City
LGW	London	Gatwick
LHR	London	Heathrow
LIN	Milan	Linate

Airport code	City (local area)	Airport name
LTN	London	Luton
MUC	Munich	Franz Josef Strauss
MXP	Milan	Malpensa
NYO	Stockholm	Skavsta
ORY	Paris	Orly
OSL	Oslo	Gardermoen
PMF	Parma	Giuseppe Verdi
SEN	London	Southend
STN	London	Stansted
SXF	Berlin	Schönefeld (closed)
TRF	Oslo	TORP Sandefjord
TXL	Berlin	Tegel (closed)
VIE	Vienna	Vienna
VST	Stockholm	Västerås
XCR	Paris	Châlons Vatry
XFW	Hamburg	Finkenwerder

More diverse growth among ‘smaller’ airports

Total accessibility in 2018 and 2023, plus percentage change

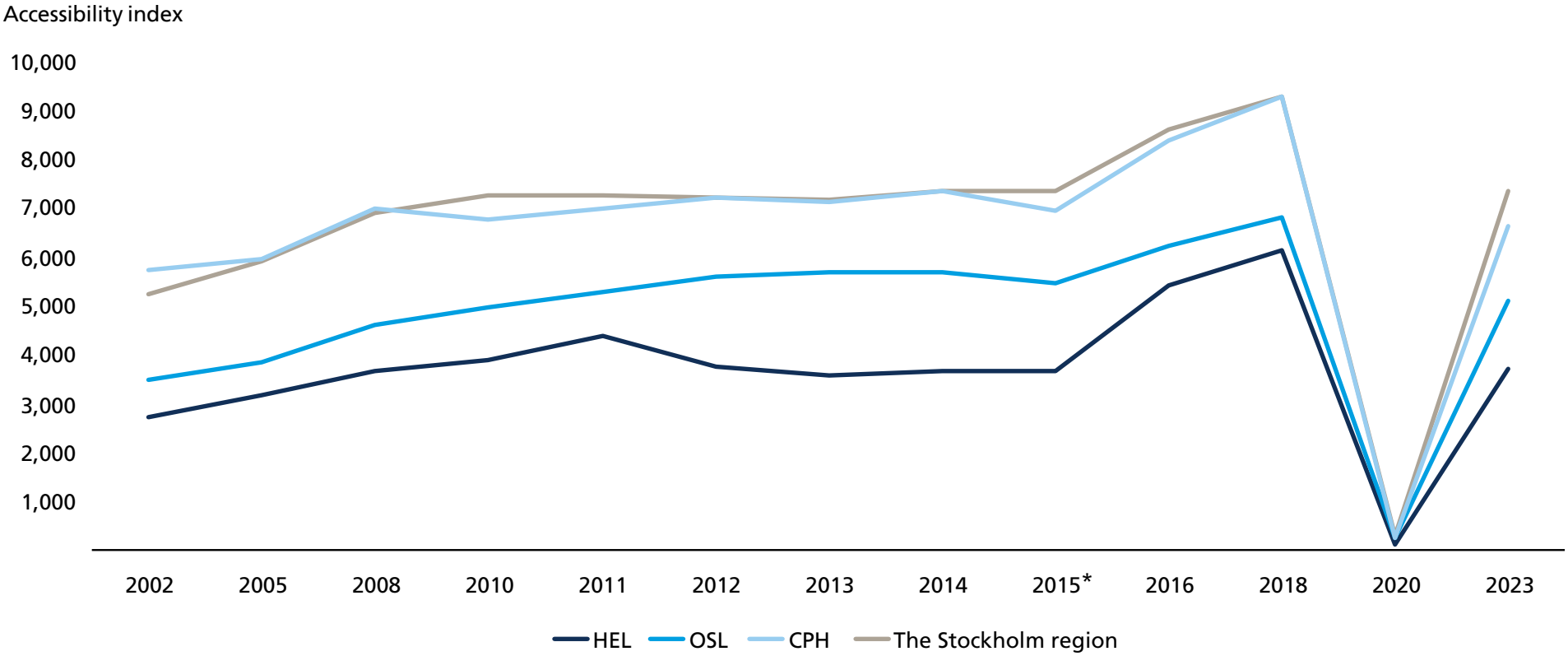
Accessibility index



Note: Total accessibility is the sum of direct and indirect accessibility. Berlin Schönefeld Airport (SXF) was transformed into Berlin Brandenburg Airport in October 2020. Only 2023 data is available for BGY, LIN, PMF, BVA, ORY and XCR airports, and no percentage changes are therefore presented for them.
Source: Copenhagen Economics based on SEO Economic Research (2023).

Accessibility in the Stockholm region is still lower than in Copenhagen

Total accessibility in 2002–2023, all airports in the Stockholm region plus Helsinki, Oslo and Copenhagen



Source: Copenhagen Economics based on SEO Economic Research (2023).
* SEO Economics changed its model for calculating indirect accessibility between 2015 and 2016.
It now also includes codeshare agreements, thereby increasing the number of indirect connections.

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