

Diversity of supply for oil and oil products in OECD countries in 2022

Amelia Wyatt 07714 171 175 oil-gas.statistics@energysecurity.gov.uk

Key headlines

Security of supply in 2022 was affected by two key factors – the full impact of trade sanctions announced by some countries against Russia affecting trade patterns, as well as increases in demand because of fewer restrictions in place to curb the spread of COVID-19.

The UK remained self-sufficient for petrol. Demand was less than three quarters of indigenous production making the UK a net exporter in 2022, one of 15 OECD countries who were self-sufficient for petrol.

The UK continues to be reliant on imports of crude, producing 70 per cent of demand in 2022. Five of 38 countries in the OECD were self-sufficient for crude, far fewer than for oil products. Norway was the most self-sufficient, producing more than 11 times that consumed.

There was not a country in the OECD that was self-sufficient in all four oil types.

The UK continues to import crude and oil products from a diverse range of countries staying above OECD diversity averages for all fuel types.

Background

Countries meet their oil needs through a combination of indigenous production and trade. This article compares how OECD countries manage crude oil and transport fuel demand using data from the International Energy Agency (IEA). The aim is to determine how the UK compares with other OECD countries in how it secures oil supply.

A key change in 2022 was the implementation of sanctions against Russia following the illegal invasion of Ukraine (sanctions were announced by several countries including the UK and EU). In the UK there was a sharp decline and then a cessation of imports from Russia; the Government declared its intention to end imports of oil from Russia shortly after the invasion and worked with an industry task force to implement this. A statutory ban on the import of oils from Russia came into effect in December 2022:

<https://www.gov.uk/government/publications/uk-ban-on-russian-oil-and-oil-products/uk-ban-on-russian-oil-and-oil-products..>

The last cargo of primary oils to arrive in the UK from Russia was in October 2022 and the last cargo of finished products was in November 2022. Russian crude oil imports dropped from 7.4 per cent of the total in 2021 to 1.2 per cent in 2022, and Russian product imports dropped from 22 per cent to 6.9 per cent. More recent data on oil imports to the UK are published in [Energy Trends Table 3.14](#).

In addition to the impacts of the sanction on supply, 2022 saw further recovery in demand across OECD countries following the ending of Covid-19 restrictions on travel. In the UK transport demand bounced back in a period where the UK did not have travel restrictions, with road fuel demand up by 1.3 per cent and a near doubling of aviation demand. UK production of primary oils fell to a record low of 38.0 million tonnes amid reports of low investment in recent years. This article seeks to unpack these changes in relation to other OECD countries and trends.

Charting oil self-sufficiency and diversity of supply

- **Self-sufficiency** is the proportion of a country's demand that could be met through indigenous production (as shown on the vertical axis). A score of one indicates that a country produces as much oil as it uses, a score of 0 indicates that no demand was met with indigenous production.
- **A diversity score** is calculated using the number of sources in which a country imports oil, and their respective political stability – defined by the World Bank's governance indicators (See Appendix 3 for methodological note).
- **Consumption** is represented by the circle or bubble, the area of which indicates the level of consumption for 2022 for each OECD country.

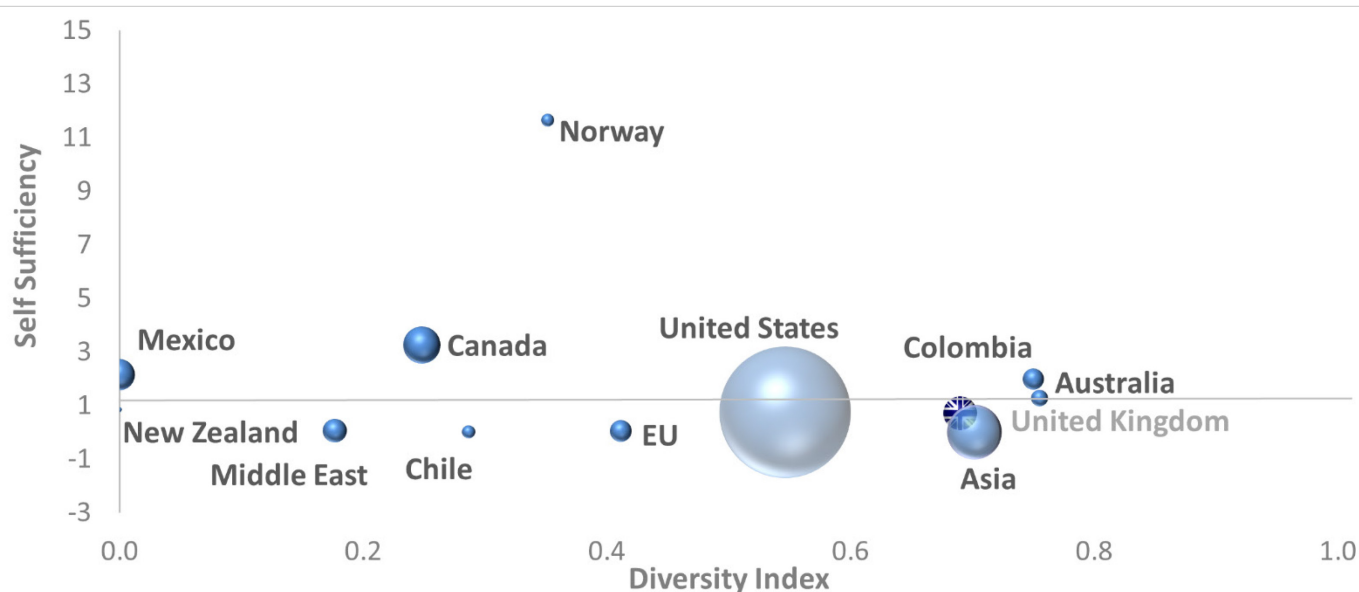
Bubble charts show the relationship between consumption (size of the bubble), indigenous production (self-sufficiency) and the diversity and political stability of import sources.

Bar charts provide a means of comparing OECD countries by self-sufficiency and diversity of imports. The sum of these two components is used as a simplified metric for security of supply, and thus does not represent a full description of security of supply beyond import diversity, stability and self-sufficiency. Appendix 2 shows the underlying data.

Choropleth maps show a visual representation of where OECD countries' oil imports come from. Variable quantities are shown according to colour; darker shades represent a higher proportion of imports originate from that country.

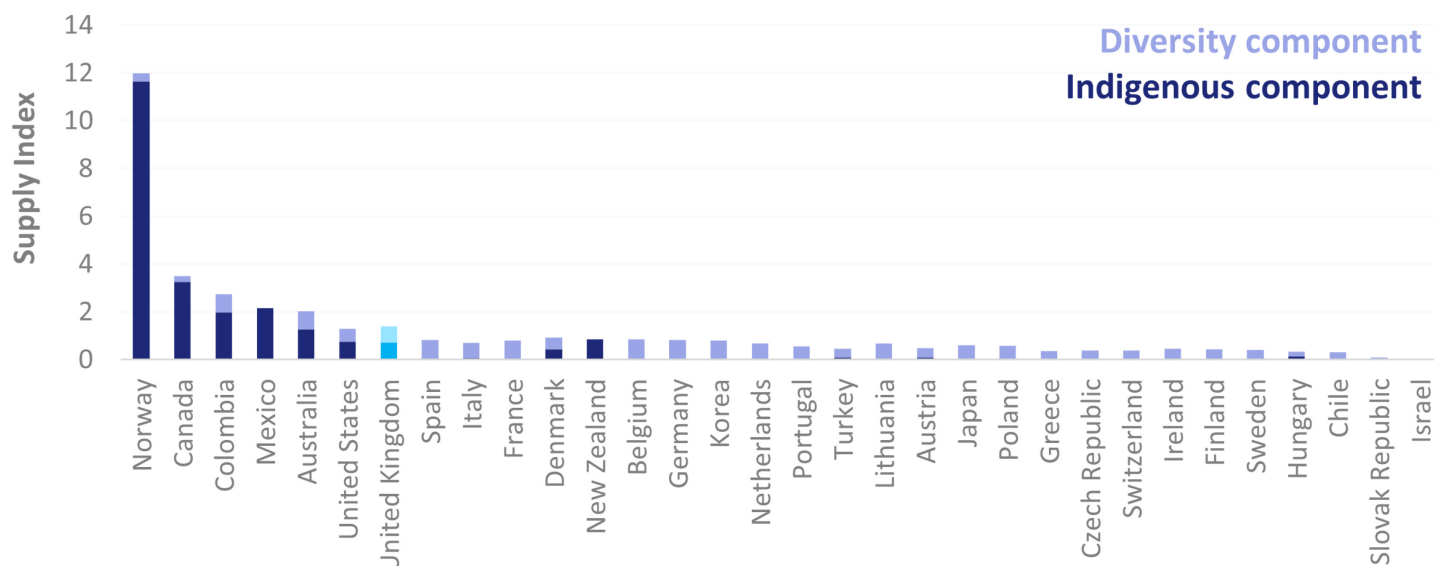
Crude Oil

Chart 1: Diversity and self-sufficiency of crude oil for OECD countries, 2022



With an average self-sufficiency score of 0.62, OECD countries were generally reliant upon imports of crude to meet refinery demand in 2022. Chart 1 shows that in 2022, five OECD countries were self-sufficient in terms of crude oil production. Norway remained a net exporter of crude oil and the most self-sufficient country producing more than eleven times its consumption. With a self-sufficiency score of 0.70, down 19 per cent on the previous year, the UK continued to be a net importer of crude in 2022. This was due to increased demand compared to 2021 alongside a continued decline in indigenous production as reports suggest decreased investment in recent years. Despite this, the UK ranked eight out of all OECD countries and was above the average of 0.62. The UK had a diversity score of 0.69 which is also above the OECD average of 0.40.

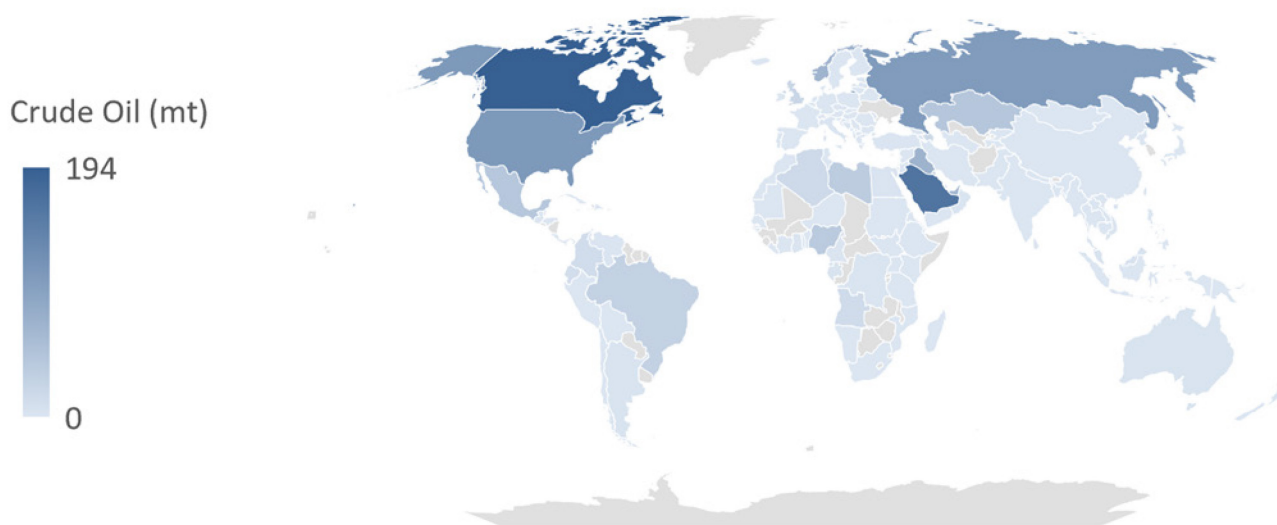
Chart 2: Security of supply of crude oil for OECD countries, 2022



Data not available for Costa Rica, Estonia, Iceland, Latvia, Luxembourg and Slovenia

The simplified security index of supply shows that most OECD countries fulfil supply of crude oil through trade, with a relatively small contribution from indigenous production; six of the 32 OECD countries for which data was available had no indigenous component to their crude supply (13 including countries with missing data). Chart 2 shows that the UK has substantial indigenous crude production. In 2022, just under half of the UK's gross supply was produced indigenously.

Map 1: Worldwide crude oil exports to OECD countries (million tonnes), 2022

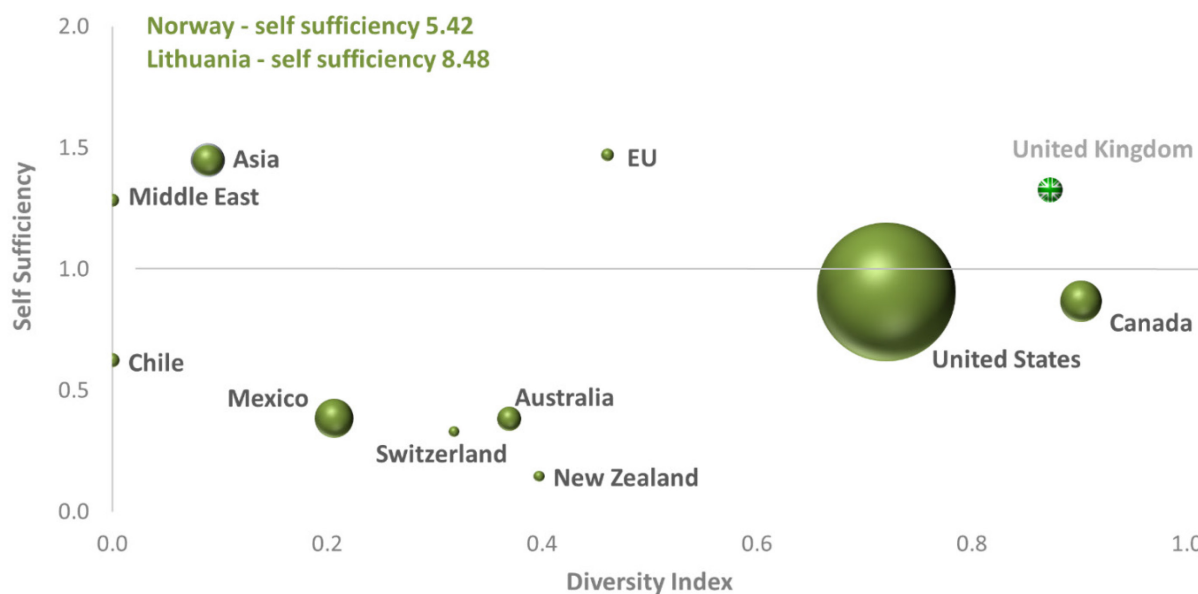


Map 1 illustrates where crude oil exports originated in 2022. Canada, Saudi Arabia, and the US were the largest exporters of crude to OECD countries; Canada exporting the most at 194 million tonnes. Of exporters to OECD countries, the UK ranked seventh, supplying 21 million tonnes.

In 2022, the UK imported crude oil from 23 countries (an increase from 14 in 2021). For the first time the US overtook Norway as the UK's largest import source, at 35 per cent and 32 per cent, respectively. Following Russia's illegal invasion of Ukraine, Russian crude oil imports were banned in the UK from the 5th of December 2022 and the UK has not imported Russian crude oil since April; in 2022, the UK imported just 1.2 per cent of its crude oil supply from Russia. [For more information on energy imports from Russia please see Energy Trends Table 3.14.](#)

Petrol

Chart 3: Diversity and self-sufficiency of petrol for OECD countries, 2022



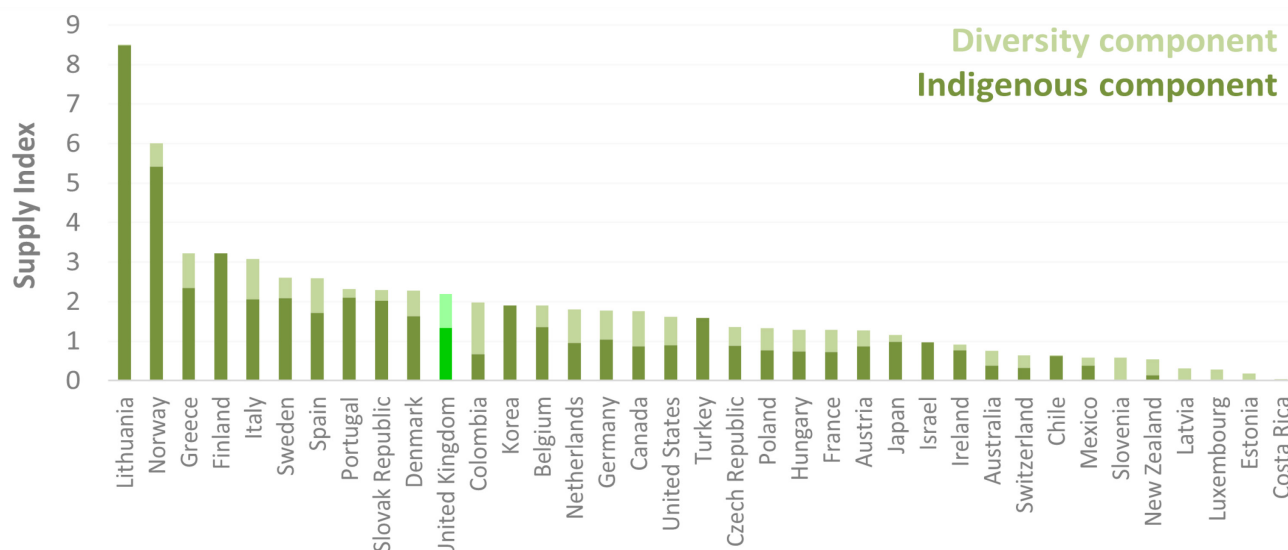
No Diversity Index data available for Middle Eastern countries, Israel, and Turkey.

OECD countries were generally self-sufficient in petrol, with an average score of 1.33, above the self-sufficiency threshold of one. Of all oil types, petrol imports were the most diverse with an average score of 0.43. Chart 3 shows that, unlike crude, 15 of the 38 OECD countries were self-sufficient in terms of petrol supply.

Lithuania had the highest self-sufficiency score of 8.48 showing that it produced more than eight times the amount of petrol it consumed. Lithuania's Mazeikiai refinery is the only one in the Baltic region and has capacity to produce oil products well in excess of domestic demand, making Lithuania a net exporter of refined products, principally to neighbours (e.g., Latvia, Ukraine, Poland, and Estonia) but also further afield (e.g., the Netherlands and the United States)¹.

The US constituted 63 per cent of total OECD petrol consumption and 60 per cent of total OECD petrol production, but despite this it wasn't self-sufficient in 2022 with a score of 0.90. The UK had a self-sufficiency score of 1.33, meaning that the UK more than met demand with indigenous production in 2022.

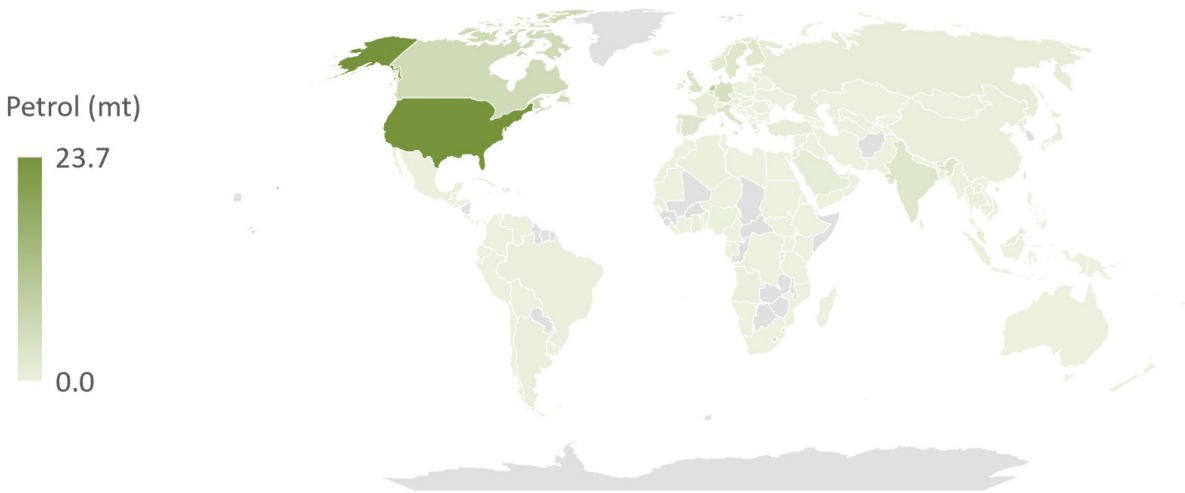
Chart 4: Security of supply of petrol for OECD countries, 2022



¹ <https://www.iea.org/articles/lithuania-oil-security-policy>

Chart 4 shows that most OECD countries produce a large proportion of the petrol they consume, unlike the pattern for crude. The UK ranks eleventh for security of petrol supply in this simplified index.

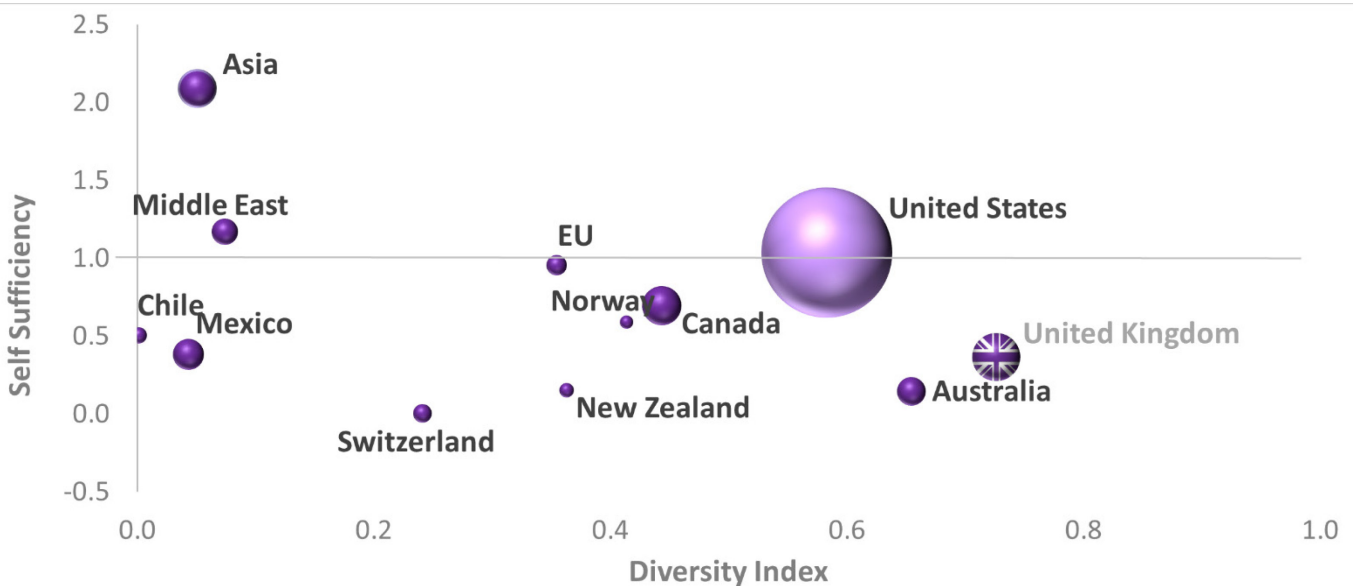
Map 2: Worldwide petrol exports to OECD countries (million tonnes), 2022



The largest exporter of petrol to OECD countries globally was the US, exporting 23.7 million tonnes of petrol in 2022; the US made up almost 30 per cent of OECD petrol imports and 17 per cent of global petrol imports. EU countries also play a significant role exporting petrol; in 2022 EU countries exported 36.9 million tonnes, almost half of the OECD total petrol exports of 78.4 million tonnes. The Netherlands is one of the largest global oil trading hubs, exporting 10 million tonnes of petrol in 2022. The UK is the seventh largest exporter of petrol in the OECD, exporting 3.6 million tonnes to other OECD countries. Globally, the UK exports 9 million tonnes of petrol.

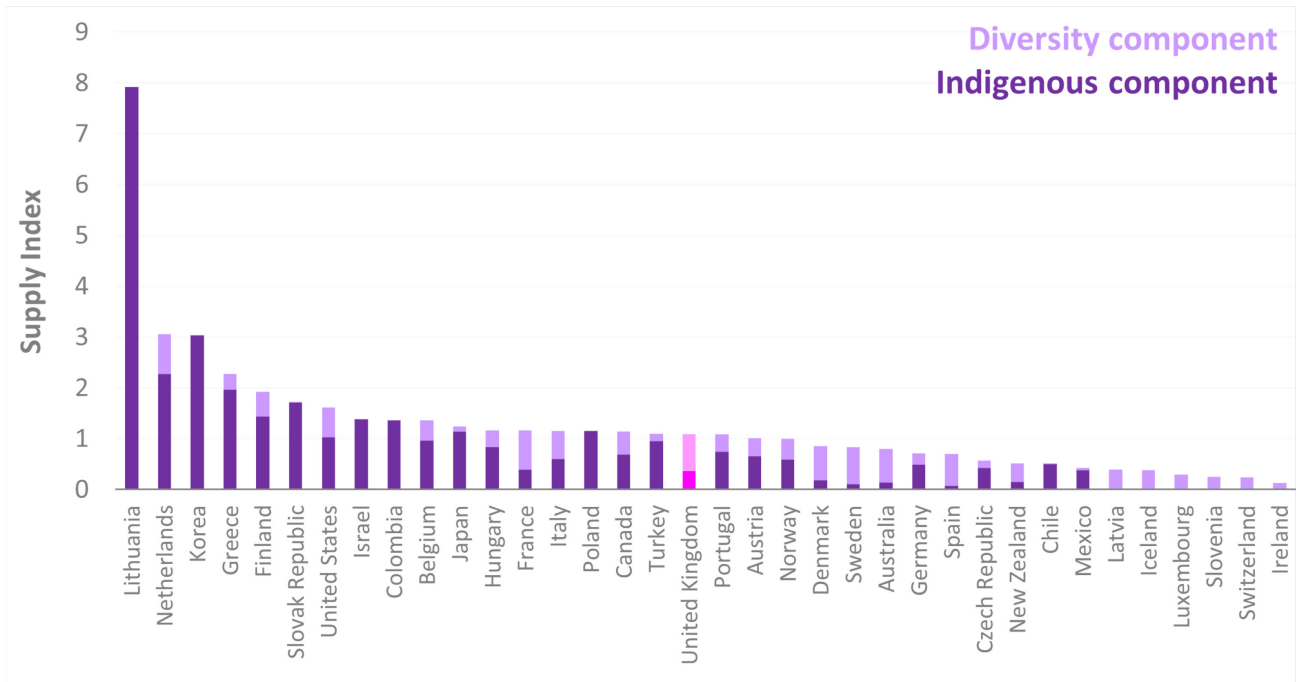
Jet Fuel

Chart 5: Diversity and self-sufficiency of jet fuel for OECD countries, 2022



Jet fuel imports were the least diverse of the four oil types because fewer countries produce and export jet fuel in large quantities. Demand for jet fuel increased in 2022 following fewer restrictions due to COVID-19, meaning that the average self-sufficiency score continued to drop, falling to 0.89 compared to 0.99 in 2021. Lithuania was again the most self-sufficient with a score of 7.92 meaning it produced almost eight times its own consumption, followed by Korea and the Netherlands. After increasing by 27 per cent between 2020 and 2021, US demand for jet fuel in 2022 decreased slightly, still making up more than half of total OECD demand.

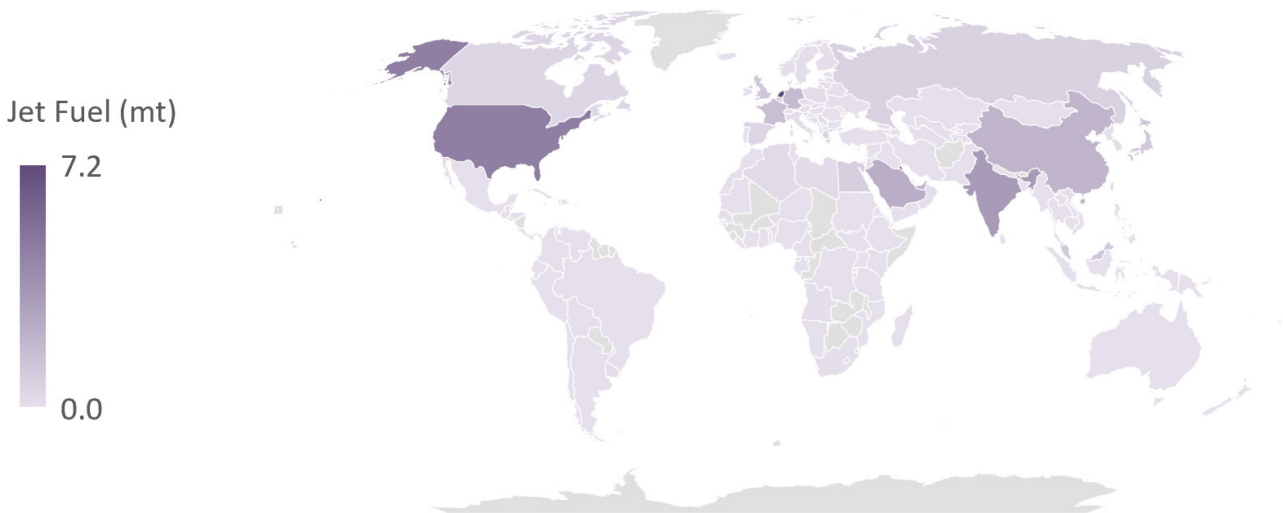
Chart 6: Security of supply of jet fuel for OECD countries, 2022



Data not available for Costa Rica and Estonia

Heathrow is one of the busiest airports in Europe, contributing to the UK’s high demand for jet fuel. The UK had the second highest demand in 2022, behind only the US. The UK’s small indigenous production results in a relatively small self-sufficiency score of 0.36, down from 0.39 in 2021, but this is secured with imports from a diverse range of stable countries, evidenced in the UK diversity score of 0.73 compared to the average of 0.31.

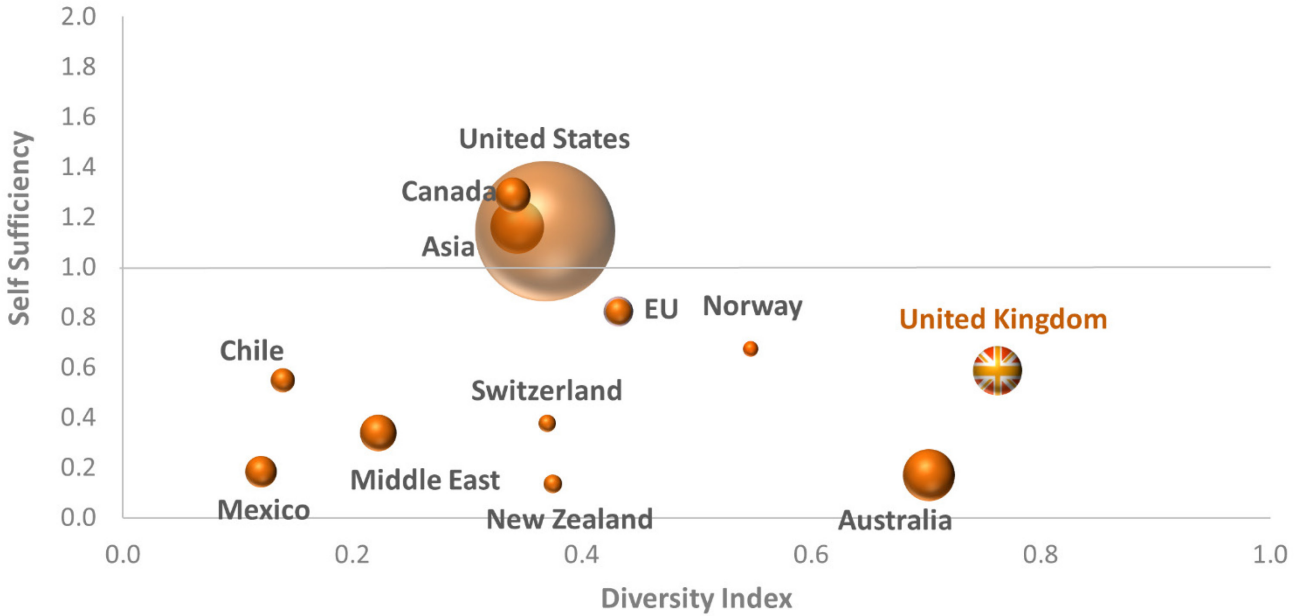
Map 3: Worldwide jet fuel exports (million tonnes), 2022



Unlike crude and petrol, very few countries export jet fuel in large quantities. The largest exporters to OECD countries were the Netherlands, Korea, and the US. The Netherlands exported 7.2 million tonnes in 2022, followed by Korea who exported 6.3 million tonnes. The UK exported 1.1 million tonnes of jet fuel to other OECD countries and was the twelfth largest exporter.

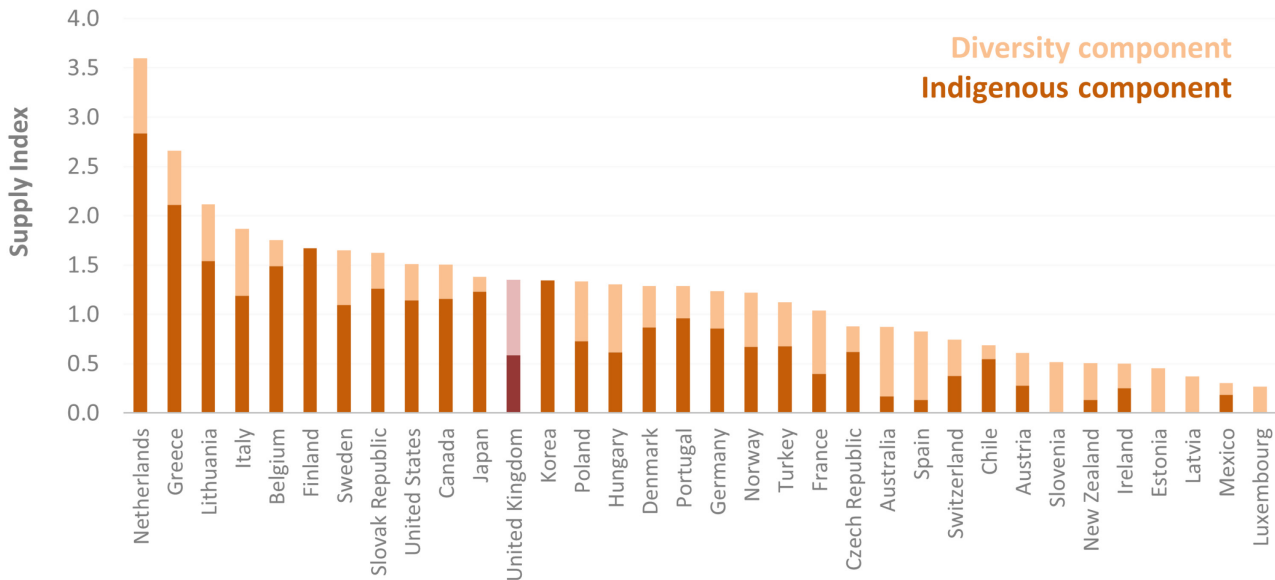
Road Diesel

Chart 7: Diversity and self-sufficiency of diesel for OECD countries, 2022



OECD countries remain reliant on imports to meet demand for diesel, with the average self-sufficiency score of 0.71 falling by seven percentage points compared to 2021. The average diversity score for the OECD was 0.38, a slight increase from 0.37 in 2021. In 2022, 12 countries were self-sufficient in terms of diesel supply, and eight countries did not produce any diesel at all. Chart 7 shows that the UK’s self-sufficiency score of 0.59 remained below the OECD average, EU average and below the self-sufficiency threshold of 1. Despite this, the UK had a diversity index of 0.76, the highest in the OECD in 2022.

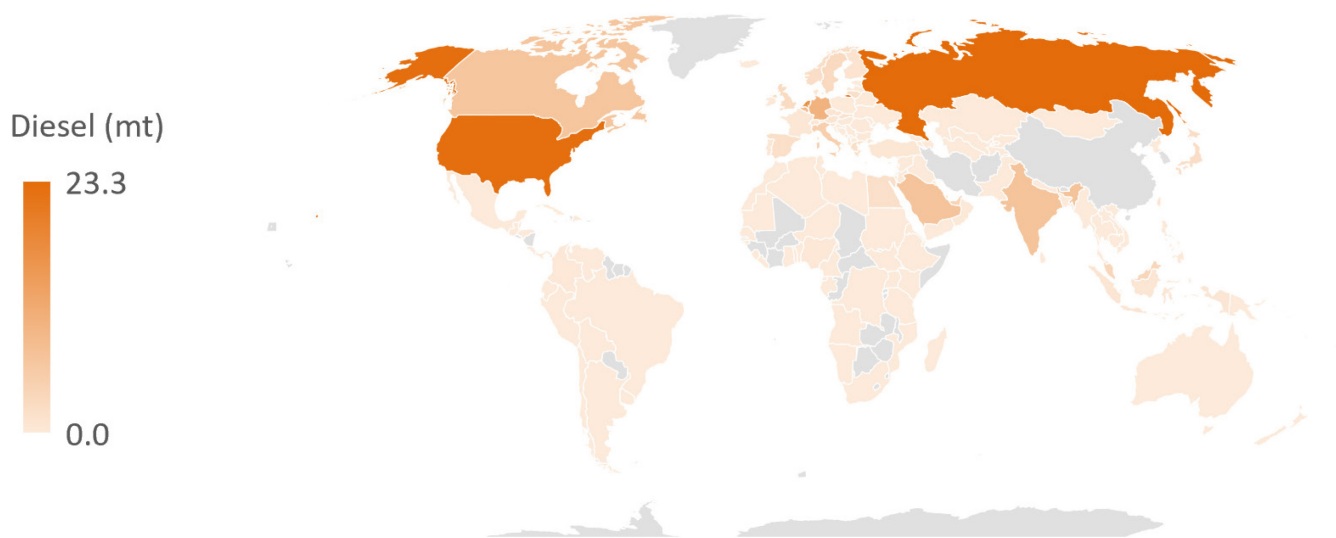
Chart 8: Security of supply of diesel for OECD countries, 2022



Data not available for Colombia, Costa Rica, Iceland and Israel

Chart 8 shows that a large proportion of diesel demand was met through indigenous production, but many countries relied upon a combination of both indigenous and diversity components. Finland and Korea did not import any diesel. The UK ranked twelfth out of all OECD countries for security of diesel supply with a score of 1.4, above the OECD average of 1.2.

Map 4: Worldwide diesel exports to OECD countries (million tonnes), 2022



Historically Russia has been a key supplier of diesel to the UK, EU, and OECD. In 2022 Russia remained the largest exporter of diesel to the OECD, exporting 23.3 million tonnes followed by the US (22.7 million tonnes) and the Netherlands (16.3 million tonnes).

However, although Russia was still the largest import source for the OECD, imports had dropped by just over four million tonnes in 2022 compared to 2021. Several countries implemented sanctions against Russian oil imports in 2022: the UK banned Russian oil imports on the 5th December 2021; Canada, Australia, and other members of the G7 banned Russian oil imports in March 2022 and imposed a price cap in December 2022²; and the EU imposed a ban and price cap on Russian crude oil in December 2022, and on products in February 2023³

To compensate, imports of diesel were up from the US by 4.4 million tonnes as the OECD sought alternative supply.

Summary

The OECD has a higher security of supply for oil products compared to crude oil. This is because of higher levels of refinery production compared to crude extraction. Nevertheless, the scores for transport fuels are dependent on refining crude oil and therefore should only be considered independently with caution. The average self-sufficiency score for crude oil was 0.62 which, despite increasing since 2021, shows OECD countries are still dependent on imports of crude oil to meet refinery demand. The diversity score for crude oil of 0.40 was much more comparable to transport fuels showing that the OECD has a consistent, wide range of sources of imports.

As demand continued to increase in 2022 compared to 2021, average self-sufficiency scores for transport fuels decreased. Out of the three transport fuels, petrol supply was the most secure with both the highest average self-sufficiency and diversity scores. Fifteen of the 38 members were self-sufficient and the average score of 1.33 suggests that OECD countries are well-placed to meet demand for petrol. The supply of diesel was the least secure transport fuel in 2022. Twelve OECD countries were self-sufficient, but the average self-sufficiency score was 0.71, which is below the sufficiency threshold of 1.

With the second highest average self-sufficiency score (0.89) of the oil types OECD countries were on average almost self-sufficient in jet fuel supply. However, jet fuel had the lowest diversity score of all fuel types

² <https://www.canada.ca/en/department-finance/news/2022/12/g7-and-australia-move-forward-with-price-cap-on-russian-oil.html>

³ <https://www.consilium.europa.eu/en/policies/sanctions/restrictive-measures-against-russia-over-ukraine/sanctions-against-russia-explained/#sanctions>

largely due to fewer countries exporting jet fuel at high quantities. Jet fuel demand continued to rise across the OECD in 2022 as there were fewer travel restrictions in place to curb the spread of COVID-19, increasing by 31 per cent on average compared to 2021. Demand for jet in the UK nearly doubled, but with a diversity score of 0.73 the UK remains in a relatively secure position compared to the OECD average.

The UK consistently has diversity scores higher than the OECD average for all oil types considered here. The UK is self-sufficient in petrol (and a net exporter). The UK is not self-sufficient for crude oil, diesel or jet fuel, but meets its needs through a diverse range of import sources as well as indigenous production.

Appendix 1 – List of OECD countries in category averages

Asia

Japan
Korea

EU (excluding UK)

Austria
Belgium
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Latvia
Lithuania
Luxembourg
Netherlands
Poland
Portugal
Slovak Republic
Slovenia
Spain
Sweden

Middle East

Israel
Turkey

Appendix 2 – Provisional data for 2022

	CRUDE			PETROL			JET FUEL			DIESEL		
	DI	S-S	Demand	DI	S-S	Demand	DI	S-S	Demand	DI	S-S	Demand
Australia	0.76	1.26	11,770	0.37	0.38	11,189	0.65	0.15	3,395	0.70	0.17	25,688
Austria	0.39	0.09	5,617	0.40	0.87	1,500	0.35	0.66	610	0.33	0.28	6,116
Belgium	0.84	0.00	27,763	0.55	1.35	2,241	0.40	0.97	1,695	0.26	1.49	5,832
Canada	0.25	3.25	60,557	0.90	0.87	33,273	0.44	0.70	6,306	0.34	1.16	26,211
Chile	0.29	0.01	7,318	0.00	0.62	3,779	0.00	0.51	1,035	0.14	0.55	4,734
Colombia	0.75	1.99	19,564	1.30	0.68	6,193	0.00	1.37	847	0.00	0.00	0
Costa Rica	0.00	0.00	0	0.04	0.00	926	0.00	0.00	176	0.00	0.00	995
Czech Republic	0.37	0.01	7,457	0.48	0.88	1,589	0.14	0.43	274	0.26	0.62	5,093
Denmark	0.48	0.44	7,212	0.65	1.63	1,273	0.67	0.19	765	0.42	0.87	2,454
Estonia	0.00	0.00	0	0.19	0.00	208	0.00	0.00	54	0.45	0.00	780
Finland	0.43	0.00	9,273	0.00	3.22	1,283	0.49	1.44	593	0.00	1.67	2,329
France	0.79	0.01	41,244	0.56	0.73	10,045	0.76	0.40	6,320	0.64	0.40	35,736
Germany	0.81	0.02	89,850	0.73	1.04	19,566	0.22	0.50	8,952	0.37	0.86	34,761
Greece	0.36	0.00	21,997	0.87	2.35	2,175	0.30	1.97	1,468	0.55	2.11	2,883
Hungary	0.19	0.14	6,416	0.54	0.75	1,533	0.32	0.84	261	0.69	0.62	3,852
Iceland	0.00	0.00	0	0.00	0.00	139	0.39	0.00	280	0.00	0.00	484
Ireland	0.45	0.00	2,983	0.13	0.77	690	0.13	0.00	966	0.25	0.26	2,980
Israel	0.00	0.01	13,700	0.00	0.98	3,195	0.00	1.38	901	0.00	0.00	0
Italy	0.62	0.07	65,581	1.00	2.07	7,929	0.55	0.60	3,820	0.68	1.19	23,543
Japan	0.61	0.00	133,219	0.18	0.99	34,580	0.10	1.14	7,523	0.15	1.23	20,555
Korea	0.79	0.00	139,229	0.00	1.91	10,376	0.00	3.04	5,101	0.00	1.34	20,168
Latvia	0.00	0.00	0	0.31	0.00	157	0.39	0.00	141	0.37	0.00	788
Lithuania	0.66	0.00	8,241	0.01	8.48	282	0.00	7.92	108	0.58	1.54	1,685
Luxembourg	0.00	0.00	0	0.28	0.00	345	0.30	0.00	554	0.27	0.00	1,209
Mexico	0.00	2.15	42,443	0.21	0.38	28,954	0.04	0.38	3,954	0.12	0.18	13,538
Netherlands	0.66	0.01	49,823	0.85	0.95	3,928	0.78	2.27	3,108	0.76	2.84	5,505
New Zealand	0.00	0.84	899	0.40	0.15	2,156	0.36	0.15	837	0.37	0.13	3,216
Norway	0.35	11.64	7,211	0.58	5.43	657	0.41	0.59	711	0.55	0.67	2,440
Poland	0.54	0.03	26,645	0.55	0.78	5,202	0.00	1.15	978	0.60	0.73	17,931
Portugal	0.56	0.00	10,142	0.22	2.11	1,054	0.34	0.75	1,513	0.33	0.96	4,408
Slovak Republic	0.08	0.00	5,394	0.26	2.03	628	0.01	1.71	43	0.36	1.26	2,121
Slovenia	0.00	0.00	0	0.59	0.00	423	0.25	0.00	21	0.52	0.00	1,656
Spain	0.81	0.00	63,394	0.88	1.72	5,751	0.63	0.07	5,872	0.69	0.13	22,156
Sweden	0.41	0.00	18,375	0.53	2.09	2,154	0.73	0.11	712	0.55	1.10	4,657
Switzerland	0.38	0.00	3,025	0.32	0.33	2,080	0.24	0.00	1,383	0.37	0.38	2,709
Turkey	0.35	0.10	36,670	0.00	1.59	3,250	0.15	0.96	4,935	0.44	0.68	24,555
United Kingdom	0.69	0.70	50,118	0.87	1.33	11,889	0.73	0.36	9,585	0.76	0.59	23,158
US	0.55	0.75	785,674	0.72	0.90	376,668	0.58	1.04	71,704	0.37	1.14	193,288
OECD Asia average	0.70	0.00	136,224	0.09	1.45	22,478	0.05	2.09	6,312	0.08	1.29	20,361
OECD EU average	0.41	0.04	20,322	0.46	1.47	3,047	0.35	0.96	1,700	0.43	0.82	8,216
OECD Middle East average	0.18	0.05	25,185	0.00	1.28	3,223	0.07	1.17	2,918	0.22	0.34	12,277
OECD average	0.40	0.62	46,811	0.43	1.33	15,770	0.31	0.89	4,145	0.38	0.71	14,479

Items in bold highlight those countries where indigenous production exceeded domestic consumption.

DI = Diversity Index

S-S = Self-sufficiency

Demand is in thousand tonnes (kt)

Source IEA (<http://data.iea.org/>)

Appendix 3 – Methodology

Data for crude oil and transport fuel self-sufficiency

Data for crude oil, petrol and jet fuel were extracted from the IEA database. For diesel, data were provided on request from the IEA. Self-sufficiency was determined from data on indigenous production and consumption (production (kt) ÷ consumption (kt)).

Crude oil and transport fuel diversity indices

The diversity index used here is a product of a standard diversity index and an index for political stability. As a basic index for measuring diversity, we used the Shannon-Wiener diversity index. The Shannon-Wiener index is of the form:

$$\sum_{i=1}^n -x_i \ln(x_i)$$

Where x is the proportion of total fuel supply represented by the i th source country and n represents the final source country. A value below 1 signifies a country that is dependent on a small range of import sources, a value above 2 represents a country with a wide range of import sources. The minimum value of zero denotes a country that has one imported fuel source or relies entirely on indigenous production.

A previous comparative study on import diversities in Energy Trends March 2011 used the Herfindahl Index as the basic diversity index. Although both indices have their advantages, the Shannon-Wiener was chosen here as this represents the data with less skew, as well as placing more weight on the diversity of contributions from smaller countries and lessening the impact of larger nations.

Political stability was determined using data from the World Bank worldwide governance indicators. Specifically, the index reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism. These data were standardised between 0 and 1.

Source: World Bank (<http://info.worldbank.org/governance/wgi/index.aspx#home>)

Once Shannon-Wiener and political stability indices were determined, these were multiplied and summed:

$$\sum_{i=1}^n -x_i \ln(x_i) b_i$$

Where b is an index of political stability of the country exporting. This is called the SWNI (Shannon-Weiner-Neumann index), in line with previous work.

Each SWNI index was normalised for each petroleum product between 0 and 1, to have a standardised index. This was done by working out a maximum diversity score, by assuming maximum diversity was equivalent to importing products in line with proportional contributions of exporting countries (e.g. if a single country were responsible for exporting 50 per cent of all product, and five other countries were responsible for 10 per cent each, we assumed maximum import diversity at a ratio of 5:1:1:1:1:1). This maximum diversity score then acted as our upper score of 1, with all other scores divided by this maximum to standardise the data.



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