

The energy dependency of the EU and Spain

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Rationale

In recent decades, the European Union and Spain have become increasingly dependent on energy imports from third countries. Given how important these products are in production chains, this dependency could represent a source of vulnerability for the European economies.

Takeaways

- The energy products imported from third countries that are most vulnerable to international trade disruptions notably include natural gas, uranium, anthracite, oil and coal, all of which are in short supply within the European Union (EU), hard to substitute and, in general, concentrated in a few suppliers.
- The main EU countries differ in terms of the extent of their external dependency, the energy suppliers they use and the vulnerability of their exposures. Spain is more reliant on third countries, although its imports are more diversified across different suppliers.
- The patterns of the EU's external energy dependency have been altered by Russia's invasion of Ukraine, owing to the substantial reduction in European imports of energy products from Russia, which is no longer the region's main energy supplier.

Keywords

Energy dependency, energy imports, vulnerability, inflation.

JEL classification

F1, F14, F5, F6, Q4.

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Introduction

The last two decades have seen a notable increase in the energy¹ imported from third countries by the EU. Thus, while in 1995 the EU imported energy products worth 1% of its GDP (\$82 billion) from outside the region, in 2019² this figure stood at 2.5% (\$395 billion). Spain's energy imports increased along similar lines, rising from 1.3% of its GDP in 1995 to 3% in 2019.³ This increase in energy imports has left the EU and Spain more dependent on external energy. The energy imported from outside the EU in 2019 accounted for 60% of the total energy consumed by the region as a whole, and 70% in the case of Spain,⁴ up eight and two percentage points (pp), respectively, on the figures for 1995. However, this aggregate external dependency conceals a certain heterogeneity across products. In particular, while the share is relatively small for the EU aggregate in the case of solid fossil fuels (around 43%), it is very large (over 90%) for both Spain and the EU as a whole in the case of oil, oil products and natural gas (Chart 1).

Given how important energy products are in production chains and household consumption, dependency on third country energy imports could, in principle, represent a significant source of vulnerability for the EU. This vulnerability on the part of the EU and Spain is described in the rest of this article, using indicators that reflect the concentration of imports from a few exporting countries, the scarcity of energy products at European level and the degree to which such products can be substituted. The article also looks at recent developments in energy dependency during the pandemic and following the Russian invasion of Ukraine.

Energy dependency and vulnerability in the EU and Spain

In the EU aggregate, the bulk of the third-country energy imports in 2019 were taken up by crude oil (58% of the value of non-EU energy imports), oil products (23%) and natural gas, whether in gaseous (9%) or liquefied (4%) form. By comparison, crude oil (68%) and liquefied natural gas (11%) accounted for a larger share of Spain's energy imports, whereas oil products represented 11% of the energy products imported from outside the EU (Chart 2).

1 The energy products considered in this article are anthracite, bituminous coal, peat, coke, crude oil, oil products, liquefied natural gas, gaseous natural gas, propane, butane, electricity, natural uranium, enriched uranium and fuelwood. The value of bilateral trade flows is taken from the BACI-CEPII database for the EU aggregate and from Comext-Eurostat for Member States, disaggregated at the HS 6-digit level.

2 2019 is taken as the reference period as this was the last year before the pandemic and the Russian invasion of Ukraine, events that may have altered the patterns of European energy imports, and whose impact is analysed later on in the article.

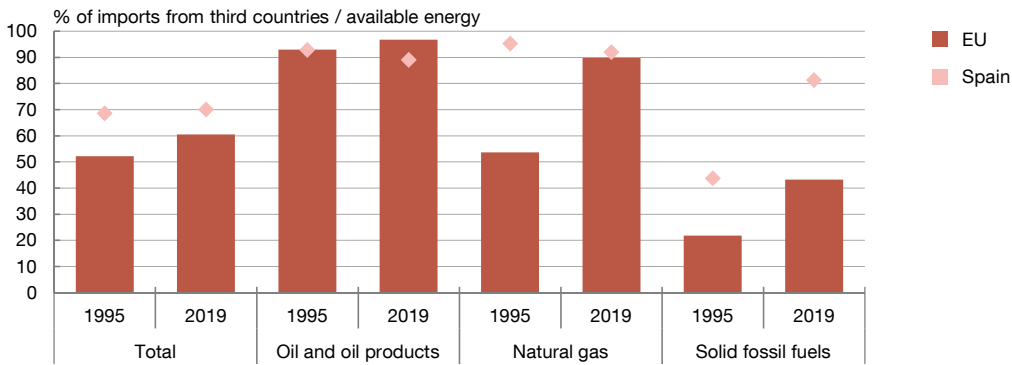
3 This article focuses on Spanish energy imports from non-EU third countries, which in 2019 represented 90% of the value of Spain's total imports of such products.

4 Nuclear energy and renewables are deemed domestic production.

Chart 1

The EU and Spain depend almost entirely on third countries for oil and natural gas

1.a Energy dependency of the EU and Spain



SOURCES: Eurostat and Banco de España, with Eurostat data.

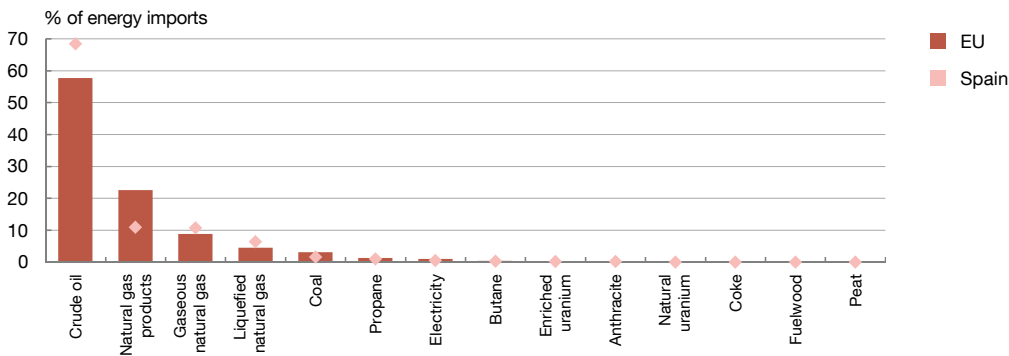
NOTE: The bars show net EU imports as a percentage of available energy. The diamonds show extra-EU imports to Spain as a percentage of total domestic production, total imports and stocks. Nuclear energy and renewables are deemed domestic production. The figure for 1995 for Spain is a Banco de España estimation based on Eurostat data.



Chart 2

The EU mainly imports crude oil, oil products and natural gas. Spain has a greater share of crude oil and liquefied natural gas in its extra-EU imports

2.a Energy product imports (2019)



FUENTES: BACI-CEPII database and Eurostat.

NOTE: Imports of each product as a percentage of total extra-EU imports.



Russia was the EU’s largest third-country energy supplier in 2019. As can be seen in Table 1, recent decades have seen an increase in European imports of Russian energy, rising from 20% of the region’s external energy purchases in 1995 to 33% in 2019, with Russia being the leading supplier of nine of the 14 most important energy products, including the three main ones (oil, oil products and gaseous natural gas).⁵ This increase came, at least in part, at the expense of a

5 Given the failure on the part of some countries to report gaseous natural gas imports, the shares of the different suppliers of this product are calculated using the Eurostat NRG database. See Bellora, Cotterlaz and Thie. (2022).

Table 1

Prior to the conflict with Ukraine, Russia was the leading supplier of energy products to the EU but only the seventh-largest supplier to Spain

	Exporters to the EU (%)		Exporters to Spain (%)	
	1995	2019	1995	2019
Russia	20.4	32.6	7.7	6.8
Norway	14.8	7.6	—	—
United Kingdom	11.0	6.6	—	—
Saudi Arabia	9.4	5.0	14.8	9.3
Libya	7.8	—	14.0	9.8
Algeria	7.5	—	11.3	9.4
Iran	6.2	—	8.8	—
United States	—	6.6	—	7.4
Kazakhstan	—	6.4	—	—
Nigeria	—	5.1	13.6	14.4
Mexico	—	—	6.1	8.1
Other	22.9	30.2	23.9	34.7

SOURCES: The BACI-CEPII database and Eurostat.

decline in the share of energy imports from Norway, which was the EU's second largest trading partner for this type of products in 2019, accounting for 8% of imports from outside the region. Meanwhile, recent years have seen a rise in energy purchases from the United States, the third largest exporter of energy products to the EU alongside the United Kingdom, each of which represented around 7% of Europe's total energy imports in 2019.

Compared with the EU aggregate, Spain's energy imports were more concentrated in African suppliers and less dependent on Russia (Table 1). Specifically, Nigeria, Libya and Algeria were the top three energy exporters to Spain, together accounting for 34% of Spain's overall energy purchases in 2019. Conversely, Russia was Spain's seventh largest energy supplier in 2019, its share falling just short of 7%, as compared with 33% in the case of the EU. In line with the EU-wide trend, Spain has significantly increased its energy purchases from the US in recent decades.

Dependency on third-country energy imports could, in principle, constitute a source of vulnerability for the EU and Spain. This vulnerability can be quantified using the three dependency indicators proposed by the European Commission (2021) and Ioannou and Pérez (2023). For each energy product, these indicators can be used to measure how concentrated their imports are (calculated, based on the Herfindahl-Hirschman index, as the sum of the squared market shares of all suppliers), their scarcity within the EU (proxied using the ratio of imports from outside the EU to total imports, both internal and external), and the extent to which they can be substituted (in other words, the ability to substitute external imports with European exports).⁶ Once calculated, the

⁶ The substitutability indicator is calculated as the ratio of non-EU imports to the region's total (internal and external) exports. For further details on how the indicators are calculated, see European Commission (2021) and Ioannou and Pérez (2023). The indicators are calculated using the trade flows included in the Eurostat NRG database for the products available and, for all other products, drawing on BACI-CEPII data in the case of the EU and Comext-Eurostat data in the case of Spain.

Table 2

The EU's vulnerability to international trade disruptions is concentrated in gaseous natural gas, uranium, anthracite and coal

	Concentration	Scarcity	Substitutability	Total vulnerability	Concentration+ geopolitical vulnerability	% of energy imports
Crude oil	Green	Red	Red	Yellow	Green	57.70
Oil products	Green	Yellow	Yellow	Green	Yellow	22.58
Gaseous natural gas	Red	Yellow	Yellow	Red	Red	8.81
Liquefied natural gas	Green	Red	Red	Yellow	Yellow	4.49
Coal	Yellow	Red	Red	Yellow	Yellow	3.11
Liquefied petroleum gases	Green	Yellow	Yellow	Yellow	Green	1.63
Electricity	Green	Green	Green	Green	Green	0.97
Enriched uranium	Red	Yellow	Green	Yellow	Red	0.24
Anthracite	Red	Yellow	Yellow	Red	Red	0.17
Natural uranium	Yellow	Yellow	Yellow	Red	Green	0.14
Coke	Yellow	Green	Green	Green	Yellow	0.12
Fuelwood	Yellow	Green	Green	Green	Green	0.02
Peat	Yellow	Green	Green	Green	Yellow	0.01

FUENTES: Banco de España, drawing on the BACI-CEPII and Eurostat databases and Bailey, Strezhnev and Voeten (2017).

NOTE: The indicators of import concentration, scarcity and substitutability for each product are standardised by the mean and the standard deviation for the whole sample (z-score). The energy products are classified and colour-coded according to the quintile to which their z-scores belong; colours closer to red signal higher vulnerability. The indicators of concentration, scarcity and substitutability are aggregated to obtain a "total vulnerability" indicator, which is shown in the fourth column. The last column shows the import concentration index in which each country's import shares are weighted with an indicator of "political proximity" to the EU, based on voting patterns at the United Nations General Assembly sessions on human rights and calculated following Bailey, Strezhnev and Voeten

three indicators can be used to build heatmaps reflecting the EU and Spain's external dependencies in terms of energy imports (Table 2). Specifically, these heatmaps are constructed by standardising the dependency indicators for the different energy products, using the mean and the standard deviation for the whole sample of energy goods, to obtain a z-score. The products are classified and colour-coded according to the quintile to which their z-scores belong, with colours closer to red signalling the products whose dependencies are characterised by a higher relative vulnerability.⁷ The dependency indicators can be aggregated to obtain an indicator of total dependency for each product, whose vulnerability is reflected in the fourth column of Table 2.⁸ Moreover, to analyse the extent to which the vulnerability of trade exposures might be affected by the possible emergence of geopolitical tensions, the import concentration indicator can be weighted using an indicator that reflects the "political proximity" of each supplier country with respect to the EU.⁹

This analysis reveals that the EU imports characterised by relatively high vulnerability in 2019 were those of gaseous natural gas, uranium, anthracite and coal, all goods whose imports are strongly

7 For a more detailed description of this methodology, see Aikman, Kiley, Lee, Palumbo and Warusawitharana (2017).

8 Specifically, as in Ioannou and Pérez (2023), total dependency is calculated by applying weights of 0.5, 0.25 and 0.25 for concentration, scarcity and substitutability, respectively.

9 The political proximity indicators are based on Bailey, Strezhnev and Voeten (2017) and reflect differences in voting patterns at the United Nations General Assembly sessions on human rights between the EU (proxied by Germany, France, Italy, Spain, the Netherlands and Belgium) and each supplier country, between 2010 and 2019. According to the literature, this indicator proxies countries' geopolitical alignment.

Table 3

Spain is vulnerable in the same categories of energy products as the EU aggregate

	Concentration	Scarcity	Substitutability	Total vulnerability	Concentration+ geopolitical vulnerability	% of energy imports
Crude oil	Green	Red	Yellow	Yellow	Green	68.43
Liquefied natural gas	Green	Red	Yellow	Yellow	Green	10.90
Oil products	Green	Yellow	Green	Green	Green	10.66
Gaseous natural gas	Red	Yellow	Yellow	Red	Red	6.38
Liquefied natural gas	Yellow	Yellow	Yellow	Yellow	Green	1.75
Coal	Green	Yellow	Yellow	Yellow	Yellow	1.02
Enriched uranium	Yellow	Red	Red	Red	Green	0.43
Anthracite	Red	Red	Yellow	Red	Red	0.26
Coke	Yellow	Green	Yellow	Green	Yellow	0.16
Fuelwood	Yellow	Green	Green	Green	Green	0.00
Peat	Green	Green	Green	Green	Green	0.00

SOURCES: Banco de España, drawing on the BACI-CEPII and Eurostat databases and Bailey, Strezhnev and Voeten (2017).

NOTE: The indicators of import concentration, scarcity and substitutability for each product are standardised by the mean and the standard deviation for the whole sample (z-score). The sample includes the indicators of vulnerability for the four main EU countries (Germany, Spain, France and Italy) and the EU as a whole. The energy products are classified and colour-coded according to the quintile to which their z-scores belong; colours closer to red signal higher vulnerability. The indicators of concentration, scarcity and substitutability are aggregated to obtain a "total vulnerability" indicator, which is shown in the fourth column. The last column shows the import concentration index in which each country's import shares are weighted with an indicator of "political proximity" to the EU, based on voting patterns at the United Nations General Assembly sessions on human rights and calculated following Bailey, Strezhnev and Voeten (2017).

concentrated in a handful of exporting countries, that are scarce in the EU and that are hard to substitute. Also notable among the main most vulnerable energy products are crude oil and liquefied natural gas, both of which are scarce within the EU and not easy to substitute, albeit with relatively diversified imports across supplier countries. Indeed, imports of liquefied natural gas (and, to a lesser extent, of crude oil) have become increasingly less concentrated in recent decades. Conversely, imports of oil products and, above all, anthracite, have become more concentrated.

Moreover, the emergence of geopolitical tensions could affect how vulnerable external dependencies are for some products, as can be seen by comparing the first and last columns of the heatmap (Table 2). Examples include oil products (with one third of imports coming from Russia), liquefied natural gas (whose main suppliers are Qatar and Russia, with shares of 25% and 17%, respectively) and coal (with 45% of imports coming from Russia), all products with relatively diversified imports, but whose main suppliers are countries less aligned with the EU's international positions. By contrast, certain products relatively concentrated in a handful of exporters, such as natural uranium, could prove less vulnerable to global trade disruptions, since more than half of their imports come from Canada.

Broadly speaking, Spain has vulnerabilities in the same energy product categories as the EU as a whole (Table 3).¹⁰ That said, there is some disparity between Spain's external dependencies

¹⁰ The Table 3 heat map is constructed using the same methodology as that described for Table 2. The sample includes the dependency indicators for the four main EU countries (Germany, Spain, France and Italy) and for the EU as a whole.

and those of the other three main EU member countries in terms of size, main suppliers and vulnerability of trade exposures. Thus, Spain is among those most reliant on energy imports from outside the EU (Chart 3.a).¹¹ Nonetheless, Spain is also characterised by a greater diversification of such imports (Chart 3.b). Moreover, highly concentrated products or products vulnerable to geopolitical factors account for a relatively small share of Spain's imports (Chart 3.c), largely thanks to its lower dependence on gaseous natural gas from Russia.

The impact of the Russian invasion of Ukraine

As Russia's invasion of Ukraine shows, economies can face significant risks when their energy imports are highly concentrated.¹² Indeed, as illustrated by Chart 4, the European countries whose energy imports were more concentrated in a few supplier countries in 2021 saw a bigger rise in inflation over 2022, when energy markets came under significant strain in the wake of Russia's invasion of Ukraine.¹³

The invasion of Ukraine also affected the pattern of energy imports for the EU as a whole. While the health crisis brought about by COVID-19 reduced the EU's external dependency on third countries owing to the fall in the demand for energy, without entailing significant changes in terms of the main supplier countries,¹⁴ Russia's invasion of Ukraine led to a substantial reduction in energy imports from that country. The sanctions imposed by the EU on Russian sales of solid fossil fuels, in force since September,¹⁵ halted European imports of coal and coke (Chart 5.a), as well as of anthracite. Meanwhile, interruptions to Russian supplies of gaseous natural gas since summer 2022 saw the country's share of European imports of this product fall from 50% in 2021 to 13% in 2022 Q4. This was reflected in Russia's share of the total value of EU energy imports, which fell from 29% to 15% over the same period. Thus, the country has gone from being the EU's leading supplier of nine energy products in 2019 to only two (crude oil and related products) at end-2022. However, as can be seen in Table 4, even for these products Russia's share of the supply appears to have declined, making way for other suppliers.¹⁶ In the last quarter of 2022

11 The bilateral trade data identify the country of origin of a particular product as the exporting country. However, these flows do not account for the fact that part of the value added contained in the goods is originated in other economies, located upstream in the production chain. For example, it is important to note that a greater use of imports from EU countries does not necessarily mean a lower dependency on third countries, given that the oil products refined in hub countries such as Belgium and the Netherlands use crude oil from outside the EU (mainly from Russia and Saudi Arabia).

12 See Quintana (2022) for an analysis of the economic impact in Spain and the EU of a hypothetical suspension of energy commodity imports from Russia.

13 The limited integration at European level of the market for some energy products, such as natural gas, also played a part. Banco de España (2023).

14 In 2020 the value of EU energy imports from third countries was down 37% on the previous year. The imports that saw the biggest declines were those of coke (-59%), coal (-47%) and anthracite (-45%). In turn, the lower volume of imports reduced the EU's external dependency on third countries (from 60% in 2019 to 56% in 2021). Nonetheless, the pandemic did not bring about any major changes in terms of the EU's main energy suppliers, the biggest variation being an increase in the US share to 10% of total imports.

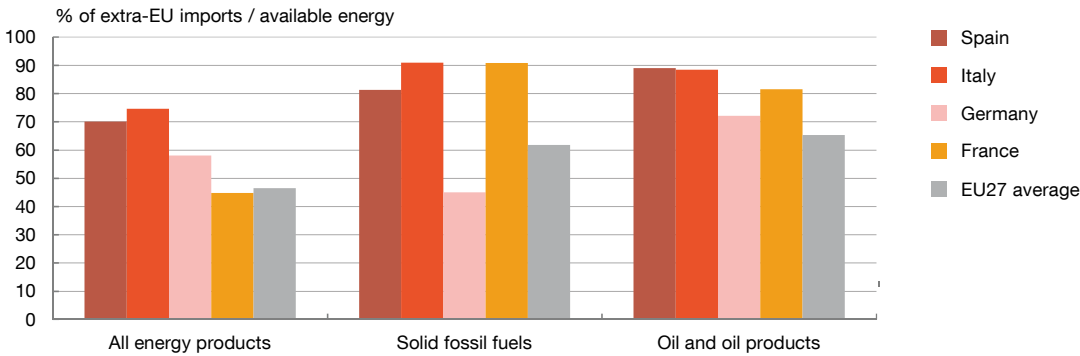
15 The European sanctions on Russian oil entered into force in December 2022, followed by those on oil products in February 2023. European Commission (2022).

16 In 2022 Q4, the value of crude oil imports from the US and Norway overtook that of Russian imports. However, in real terms, Russia remained the EU's main supplier of this product.

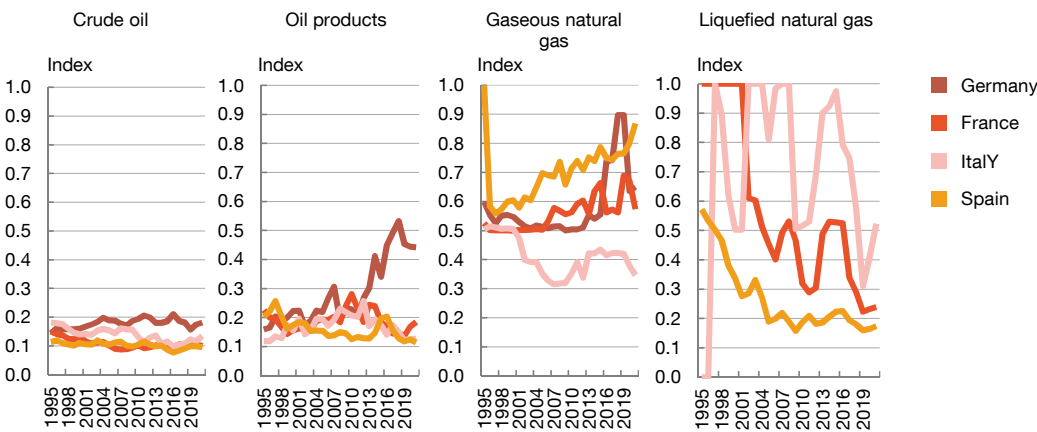
Chart 3

In comparison with the largest EU economies, Spain is more dependent on third countries and its imports are less concentrated

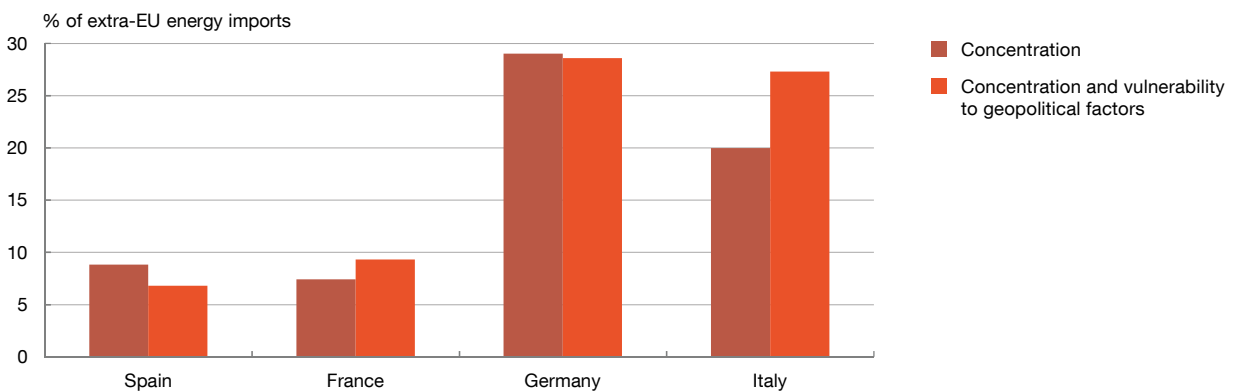
3.a Energy dependency on third countries (2019) (a)



3.b Concentration of imports (b)



3.c Products that are highly concentrated or vulnerable to geopolitical factors as a share of total imports from outside the EU (c)



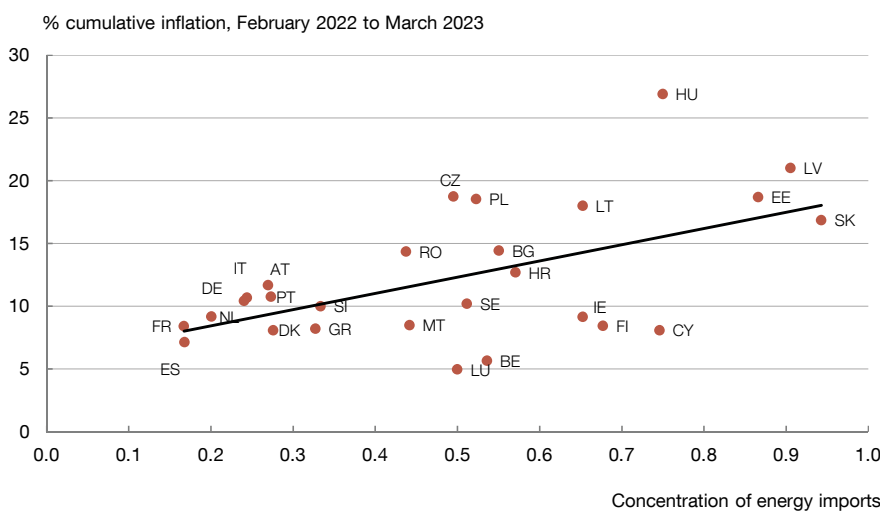
SOURCES: Eurostat and Banco de España, drawing on the Comext-Eurostat database and Bailey, Strezhnev and Voeten (2017).

- a The bars show the share of imports from outside the UE as a percentage of domestic production, total imports and stocks. Nuclear energy and renewables are deemed domestic production.
- b The concentration of energy imports is measured using the Herfindahl-Hirschman index, which is obtained as the sum total of the shares of each exporting country in EU imports, squared. The index runs from zero to one.
- c The bars show the share of products for which indicators of concentration, as well as those of concentration and geopolitical vulnerability, are in the fourth and fifth quintiles, respectively, in the distribution of total extra-EU imports. See also the footnote to Table 3.



Chart 4

EU countries with higher energy import concentrations have seen higher inflation since the start of the war in Ukraine



SOURCE: Banco de España, based on data from Eurostat and the BACI-CEPII database.

NOTE: Cumulative inflation is the change in the HICP from February 2022 to March 2023. The concentration of energy imports is measured using the Herfindahl-Hirschman index calculated for 2021. For each country, the index is aggregated at product level using weighting based on the value of imports of the 14 energy products included in Chart 2.



Russia also lost its spot as the number one supplier of natural gas, having been overtaken by Norway and the US.¹⁷

As far as Spanish energy imports are concerned, alongside a reduction in demand and external dependency,¹⁸ the years of the pandemic also saw a slight increase in the value of imports from the US and Russia, which accounted for as much as 13% of total imports in 2021 – owing, in part, to the higher price of the liquefied natural gas exported by such countries – and from Algeria (rising to 11%). Meanwhile, Russia’s invasion of Ukraine has brought about significant changes in Spain in the procurement from non-EU sources of coke and coal, 86% and 31% of which, respectively, was imported from Russia before the conflict (Chart 5.b).¹⁹ Moreover, although Spanish purchases of Russian oil have been suspended since May 2022, the impact on imports of this product has been limited, since only 6% of the oil supplied to Spain from outside the EU came from Russia in 2021. 2022 also saw an increase in the liquefied natural gas purchased from Russia. As a result of the war, Spain’s imports from Russia at end-2022 were restricted to oil products and liquefied natural gas, with Russia’s share of the total value of Spain’s energy purchases falling to 8%. Elsewhere, the changes in Spanish natural gas imports over the course

17 In order to cope with the fall in energy imports from Russia, as well as increasing their energy purchases from other international suppliers, the European economies cut their gas consumption over the course of 2022 by 13% with respect to recent years. Banco de España (2023).

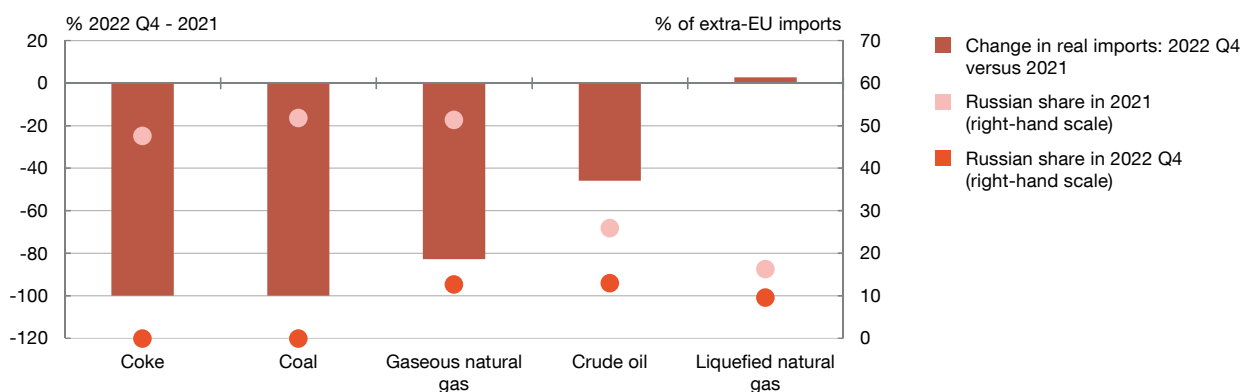
18 As was the case in the EU overall, thanks to the lower demand for energy, Spain’s energy dependency on third countries declined to 66% in 2020 and 2021.

19 Imports of other solid fossil fuels, such as anthracite and peat, as well as of wood, were also interrupted in 2022.

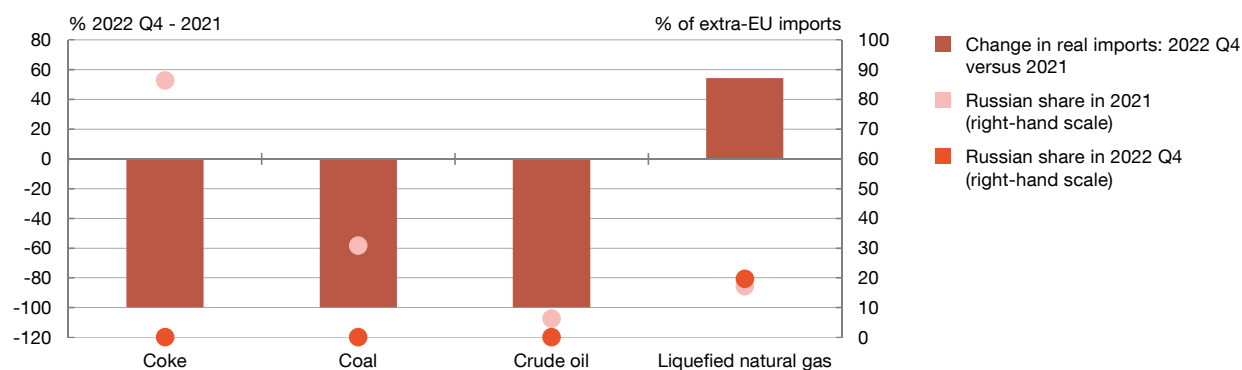
Chart 5

As a consequence of the Russian invasion of Ukraine, 2022 saw a marked reduction in European energy imports from Russia

5.a EU: change in imports from Russia and Russian share of imports



5.b Spain: change in imports from Russia and Russian share of imports



SOURCE: Eurostat and European Commission.



of 2022 – the result of a 21 pp decline in Algeria’s share – were related to the bilateral tensions between these two economies (Table 4).²⁰

All told, from an energy dependency standpoint, the invasion of Ukraine has led to a reduction in the concentration of the EU’s energy imports in the short term. In the case of Spain, the war has entailed a slight reduction in the import concentration of certain specific products, such as coke, in which Russia had a significant share before 2022. Nonetheless, thanks to its lower dependency on Russia, the war has had a more modest impact on the pattern of Spain’s imports when compared with the EU as a whole. Overall, a reorientation of import flows towards suppliers more closely aligned with the European countries from a geopolitical standpoint, together with greater

²⁰ According to domestic sources (Enagás, 2021 and 2022), Algeria’s share of Spain’s total (intra and extra-EU) natural gas imports fell from 43% in 2021 to 24% in 2022.

Table 4

Leading exporters of energy products to the EU and Spain

	Leading exporters of energy products to the EU (%)				Leading exporters of energy products to Spain (%)			
	Oil		Natural gas		Oil		Natural gas	
	2021	2022 Q4	2021	2022 Q4	2021	2022 Q4	2021	2022 Q4
Russia	25.8	13.0	43.9	12.5	—	—	11.5	15.9
Norway	9.0	10.7	18.6	26.0	—	—	—	—
United States	8.4	10.8	5.8	15.3	7.6	9.0	16.6	22.5
Libya	8.0	7.4	—	—	11.3	7.8	—	—
Kazakhstan	7.9	7.4	—	—	—	—	—	—
Nigeria	7.0	—	—	—	18.4	9.9	12.5	15.4
Saudi Arabia	—	8.3	—	—	7.1	—	—	—
Algeria	—	—	12.4	12.4	—	—	42.4	21.1
United Kingdom	—	—	5.7	9.4	—	—	—	—
Qatar	—	—	4.6	7.5	—	—	6.9	5.7
Mexico	—	—	—	—	13.9	—	—	—
Iraq	—	—	—	—	6.8	8.3	—	—
Brazil	—	—	—	—	—	6.9	—	—
Azerbaijan	—	—	—	4.3	—	—	—	—
Angola	—	—	—	2.6	—	—	—	—
Egypt	—	—	—	2.0	—	—	—	—
Trinidad and Tobago	—	—	—	—	—	—	3.7	4.7
Other	33.9	42.4	9.0	7.9	34.9	44.6	6.4	14.7

SOURCES: Eurostat and European Commission.

diversification, could mean that, at least in the short term, the war has made the EU's energy imports somewhat less vulnerable.

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