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The 2022 gas price shock: did it trigger or bring to light the restructuring of European industry?

The disruption of Russian gas supplies in 2021-23 caused a major energy crisis in Europe, which initially impacted the most exposed countries, foremost among them Germany, as well as energy intensive industries, particularly the chemicals and metal and metal products industries. Beyond this episode, since the early 2000s European industry has been undergoing a restructuring in favour of less energy-intensive sectors such as pharmaceuticals and electronics. These sectors are driven to a greater extent by final demand than energy intensive industries, signaling a structural shift within the manufacturing industry.

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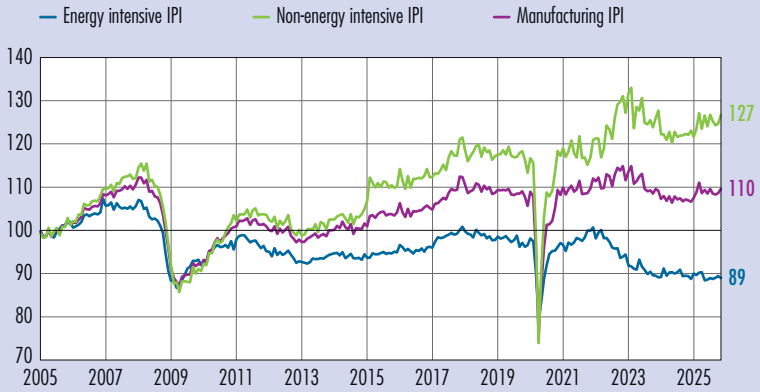
JEL codes
Q41, Q43,
E23, L60

–11.0%
decline in production in energy intensive sectors in the euro area (March 2022–May 2025)

7.4%
share of value added provided by these sectors just before the energy crisis (2021)

40%
Russia's share of European gas consumption prior to the invasion of Ukraine (2022)

Industrial production in the euro area since 2005
(index, 100=2005)



Source: European Commission (Eurostat); authors' calculations.
Notes: Seasonally adjusted data. Last point: November 2025.
IPI: industrial production index. Energy intensity: a sector is "intensive" if its intermediate consumption of gas and electricity in 2018 represented at least 5% of the value added it produced.

BANQUE DE FRANCE
EUROSYSTÈME

1 Russian gas, a long-standing source of support for Europe's energy-intensive industry

A defining energy compromise, particularly in certain European countries

With an industrial sector built on coal, Europe gradually turned to primary energy sources that were scarce on its soil—first oil, then natural gas—while developing electricity production.[1] These energy sources, which are easier to transport and store, better suited to the automation and modernisation of industrial processes, and generally more energy efficient, have gradually replaced coal in most sectors. From the 1970s onwards, several Central and Eastern European countries, such as Austria and Germany, turned to Soviet (and later Russian) gas. Long-term contracts, dedicated infrastructure (notably the Yamal and Nord Stream gas pipelines) and moderate prices secured a long-term energy supply for their industries.

This model enabled European industry to benefit from competitive gas prices, which were higher than in the United States, a hydrocarbon producer, but slightly lower than in Asia. Indeed, during the 2010s, low and stable natural gas prices provided lasting support for industrial production. This advantage came at the cost of heavy dependence on Russia, which in 2021 supplied nearly 155 billion cubic metres of gas to the European Union, or about 40% of its annual consumption (International Energy Agency – IEA, 2022).

An energy intensive and geographically concentrated industrial base

This favourable energy framework supported the development of particularly energy intensive industries, especially those that consume natural gas. These include metal and metal products, chemicals, glass, paper, refining and coking, wood processing, and agri-food. For these activities, intermediate consumption of gas and electricity accounted for at least 5% of the value added produced in 2018. This percentage is the threshold used in this article to define sectors as energy intensive, in line with similar studies (Simon, 2022).[2] In these sectors, gas plays a dual role: it is both a source of energy and a production input, particularly in the chemical and petrochemical industries. This duality makes any substitution complex and often costly.

Prior to the war in Ukraine, the industrial geography of Europe largely coincided with that of Russian gas imports. Germany and Italy were doubly exposed: these countries imported 48% and 44% of their gas from Russia, respectively (IEA data 2021, to be interpreted with caution given indirect flows) and had the highest shares of value added (VA) from energy intensive sectors (8.1% for Germany and 8.4% for Italy, compared to 7.4% on average in the euro area). Conversely, France and Spain were less dependent on Russian flows (20% and 8%) and had slightly less exposed industrial specialisations (5.7% and 7.2% of total VA; see Chart 1 below).

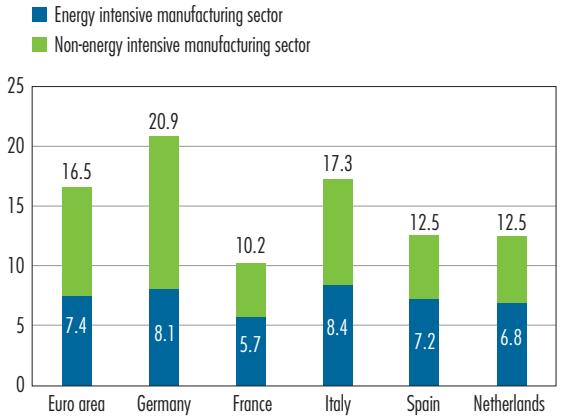
1 In 2023, 67.4% of the European Union's gross available energy consisted of oil (37.6%), gas (20.4%), and coal (9.4%). Nuclear heat and renewable energies accounted for 11.8% and 19.5% of the total, respectively. Since the 1970s, the share of coal in gross available energy has declined, falling from around 30% to less than 9% in 2023, while the share of renewable energy has risen from around 5% in 1990 to almost 20% in 2023.

2 Choosing value added as reference parameter, rather than intermediate consumption or gross production, makes it possible to combine the measurement of energy inputs and the value created by each sector. It also allows for a balanced distribution between energy intensive and non-energy intensive sectors across the entire manufacturing sector.

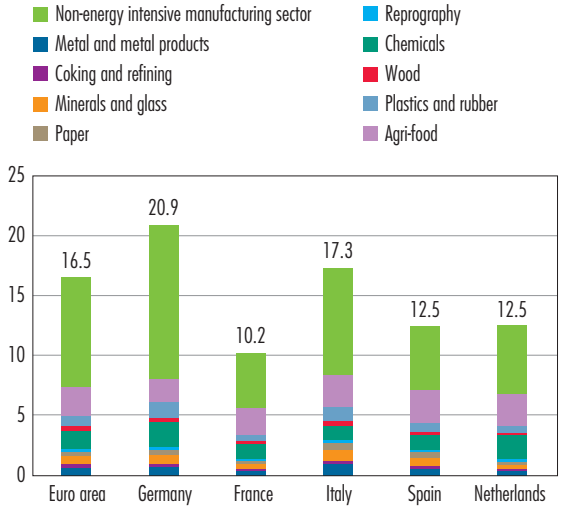
C1 Share of manufacturing value added in total value added produced in 2021 in the euro area

(%)

a) By energy intensity



b) By sector of activity for so-called "intensive" industries



Source: European Commission (Eurostat); authors' calculations.
Note: Intensive sectors are ranked in descending order of intensity – from most to least intensive (metal and metal products and agri-food, respectively) – based on euro area data.

In Germany, the vulnerability of the industrial sector was exacerbated by the internal structure of certain industries: the German chemical industry relied more heavily than elsewhere on natural gas as an intermediate input, particularly due to its specialisation in petrochemicals. Because of this combination of factors—the importance of the manufacturing sector, energy intensity, and specific dependence on Russian gas—certain countries were particularly exposed.

Weaknesses that emerged prior to the energy crisis

European industrial momentum began to slow in 2018, well before the war in Ukraine. The slowdown in global trade, against a backdrop of trade tensions between the United States and China, reduced foreign demand for European goods, particularly capital and intermediate goods. The European Central Bank (Camba-Mendez and Forsells, 2018) had already pointed out that the slowdown in activity was primarily due to a decline in net exports, with domestic demand remaining broadly stable.

At the same time, competition from Asia intensified: China's move upmarket in traditionally European technological and industrial segments heightened the pressure. In Germany, export market shares have been declining since 2017 and growth in foreign markets has halved since 2018 (Deutsche Bundesbank, 2025).

This weakness was then amplified by the Covid-19 crisis, which caused a temporary collapse in demand and disrupted supply chains. On the eve of the energy shock, the European manufacturing sector was already weakened by several years of external slowdown and competitive pressure, which increased its vulnerability to soaring energy prices.

2 An unprecedented energy crisis causes European industrial production to plummet

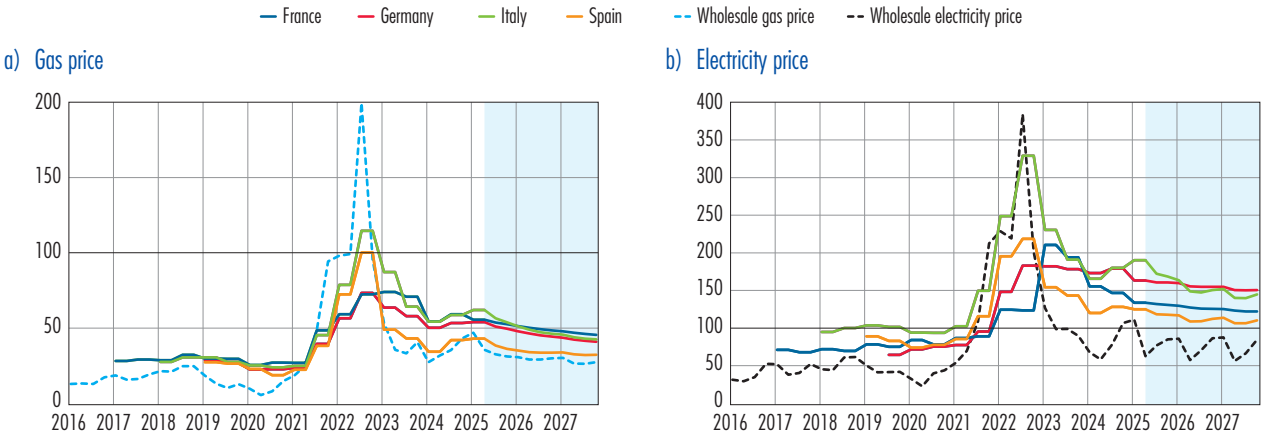
A sudden, multifactorial exogenous shock

The energy crisis of 2022 resulted from an unprecedented combination of supply and demand shocks, which pushed wholesale gas prices up to unprecedented levels, driving up electricity prices. During the 1973 and 1979 oil shocks, oil prices in dollars nearly tripled (up by 200%). In 2022, however, gas prices rose even further, nearly eightfold (a 700% increase), and electricity prices increased more than 5.5-fold (a 450% increase).[3]

- On the demand side, the rapid post-Covid global recovery boosted energy consumption, while strong Asian demand for liquefied natural gas (LNG) attracted a growing share of available cargoes to Asia. In Europe, the harsh winter of 2020-21 increased heating needs, and starting in the summer of 2022, the rush to replenish gas stocks led to significant purchases on the futures markets.
- On the supply side, several constraints overlapped: a gradual reduction in European production, particularly in the Netherlands (planned shutdown of the Groningen field); scheduled maintenance on gas infrastructure; a decrease in Russian deliveries starting in 2021, followed by a near-complete halt in 2022; and, in France, a simultaneous decline in hydroelectric production (due to the 2021 drought) and nuclear production (due to stress corrosion). These tensions were compounded by the rise in carbon prices in the Emissions Trading System (ETS), which increased the cost of thermal production.

The summer of 2022 marked the height of the shock. The scarcity of supply, combined with massive purchases to secure stocks, triggered a spectacular surge in wholesale prices. Through the merit order mechanism—according to which the market price of electricity is set by the marginal cost of the last power plant called upon—the rise in gas prices was immediately passed on to the wholesale electricity market (Baget et al., 2024). Between the pre-Covid period and 2022, the price of gas increased sixfold, leading to a similar rise in wholesale electricity prices.

C2 Wholesale gas and electricity prices in Europe and average retail prices excluding taxes paid by businesses
(prices paid in €/MWh)



Sources: European Commission (Eurostat), European Central Bank, and Refinitiv; authors' calculations.
Notes: Retail prices per country correspond to the weighted average of pre-tax prices actually paid by businesses based on their gas consumption. The wholesale gas price corresponds to the price on the TTF (Title Transfer Facility), while the wholesale electricity price is a weighted average of spot prices in the five main economies of the euro area.
The blue shaded area corresponds to the forecast period.

3 However, the inflationary impact of these shocks has been much more limited in recent years, as the price/wage spiral has not been observed, unlike in the 1970s and 1980s. See Battistini et al. (2022).

The surge in wholesale prices was gradually passed on to the retail prices actually paid by businesses (see Chart 2 above). However, the pace and extent of this transmission varied across countries, depending on the structure of energy contracts, the existence of hedging mechanisms, and the degree of public support. Despite these buffers, price increases were marked in most countries from the second half of 2022 onwards, with a slight lag in France.

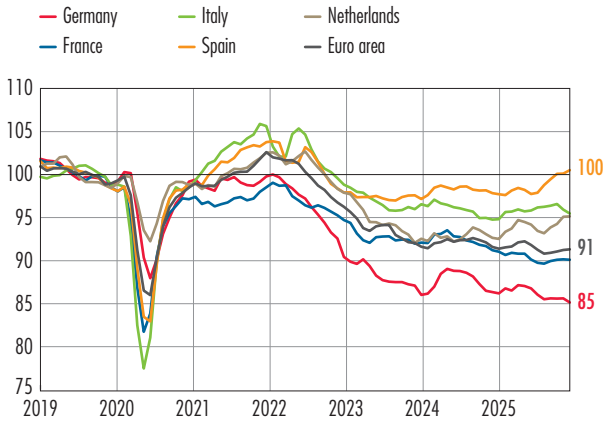
The industrial contraction was concentrated in energy intensive sectors

Faced with this rise in production costs, two non-exclusive levers were mobilised: passing on the increase in production costs to sales prices or reducing activity. In countries where these measures were implemented, surveys indicate that passing on cost increases to prices often prevailed (see INSEE, 2022 and 2023,[4] and Corsello et al., 2023). However, this strategy undermined price competitiveness, leading to market share losses and, in many sectors, the substitution of domestic inputs with imports, which may have amplified the decline in local production (Chiacchio et al., 2023). In the most exposed cases, temporary shutdowns (ArcelorMittal and Aluminium Dunkerque for metal and metals products; Imerys and Yara for chemicals) and capacity reallocations to areas with cheaper energy (e.g., BASF for ammonia), such as the United States, occurred.

The 2022 shock mainly hit the most gas- and electricity intensive industries. Between August 2021 and December 2023 (the peak-to-trough period encompassing the sharp rise in energy prices), production in energy intensive sectors fell by 8.7% in the euro area (three-month moving average). The decline reached 13.0% in Germany, 9.3% in the Netherlands, and 7.1% in Italy. France and Spain were less impacted (-5.1% and -5.3%), illustrating the effect of initial energy exposures (see Chart 3).

C3 Industrial production in energy intensive sectors in the euro area

(index, 100=2019)



Source: European Commission (Eurostat); authors' calculations.
Note: Seasonally adjusted data. Three-month moving average. Last point: November 2025.
A sector is considered intensive if its intermediate consumption of gas and electricity in 2018 represented at least 5% of the value added it produced.

Germany accounted for a major share of the decline, due to the weight of its energy intensive industries and an external environment that was already weakened prior to the crisis. Due to the interdependence of value chains in the euro area, this slowdown spread to its most integrated industrial partners, primarily Italy. The German economic cycle was thus a powerful amplifier of industrial shocks at the European level (Flaccadoro, 2024).

The shock to production costs (energy and labour) played a major role in the decline in industrial production after 2021

Using an error correction model (ECM, see box), estimated separately for energy intensive and non-energy intensive sectors, we propose an orderly reading of the 2021-24 sequence: a sudden energy shock at the end of 2021, which caused production in energy intensive

4 When asked about their response to the sharp rise in energy prices in INSEE business surveys, industrial companies reported in December 2022 and March 2023 that they would prefer to raise their selling prices and squeeze their margins, and that they also wished to make investments to protect themselves. The planned reductions in activity mainly concerned energy intensive companies.

sectors to plummet; this shock was then prolonged due to second-round effects—on the supply side, with an increase in unit labour costs in response to inflationary pressures; on the demand side, with a weakening of foreign demand; and finally, a temporary tightening of access to financing in 2022-23.

In gas- and electricity intensive industries, soaring prices accounted for most of the slowdown in 2021 and the decline in 2022: energy costs skyrocketed, and some companies adjusted or halted production. When prices fell back from the end of 2023, the negative effect lessened and provided real support. However, this support was masked by other constraints, which were themselves largely induced by the initial shock: foreign and domestic demand remained sluggish; unit labour costs increased in the meantime; and financing conditions tightened at the height of monetary tightening in 2022-23, before gradually easing (see Chart 4).

In less energy intensive industries, the profile was different: these sectors were more resilient, particularly in 2022, supported by strong demand for goods in the wake of the Covid crisis. Production therefore remained dynamic, more so than expected given the fundamentals.

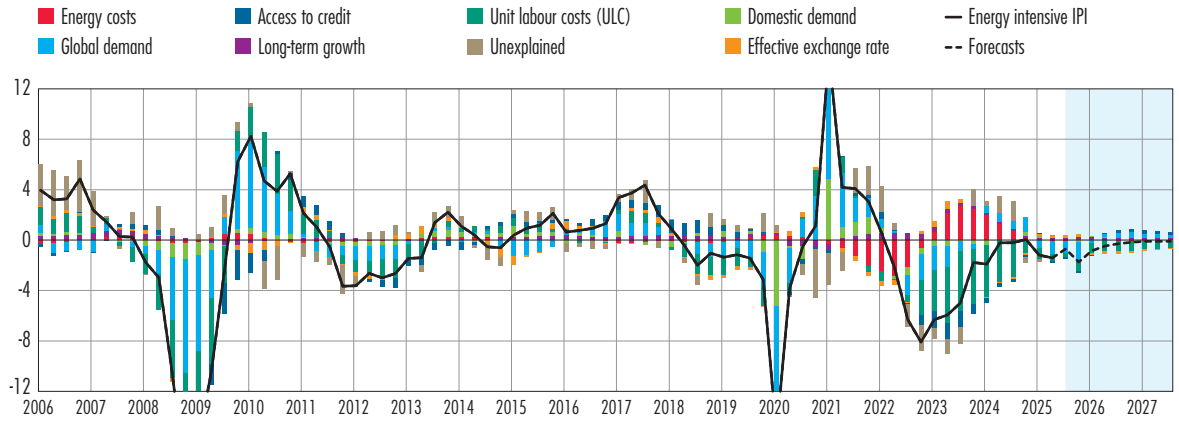
From the end of 2022 onwards, this momentum ran out of steam: domestic demand slowed, global demand declined, and unit labour costs in the manufacturing sector rose (see Chart 5 below).

A common lesson has emerged since the end of 2022: rising unit labour costs are the main factor slowing down industrial production, be it energy intensive or not. This increase reflects both the sharp rise in wages in response to inflationary pressures and, in 2023, the decline in productivity linked in part to labour retention (see Chart 6 below). The sharp increase in unit labour costs in the euro area, particularly in Germany, as well as higher energy prices, have contributed to a more general deterioration in the cost competitiveness of industry and to a loss of market shares (Deutsche Bundesbank, July 2025).

In our model, the effects of the nominal effective exchange rate remain limited; however, the currency appreciation in the course of 2025 should weigh slightly on production. On the financing side, the temporary deterioration in financing conditions in 2023 weighed on activity in the manufacturing sectors, which are generally more capital-intensive than those in the services sector.[5] However, this constraint gradually eased from 2025 onwards, as shown

C4 Historical breakdown of energy intensive production in the euro area

(in percentage points, year-on-year)



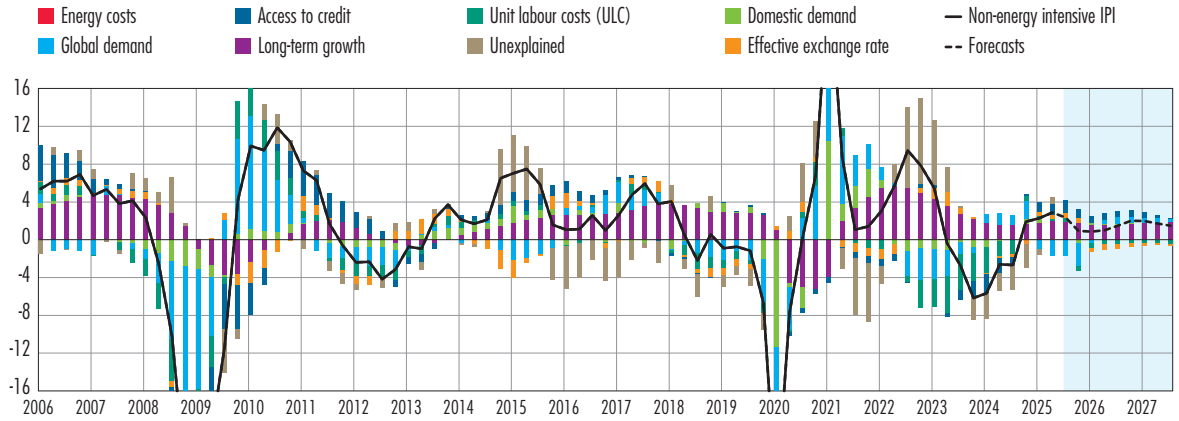
Source: European Central Bank (ECB); authors' calculations.
Notes: See box for model description. The blue shaded area corresponds to the forecast period. Forecasts are based on data from the ECB's September 2025 forecasts.
IPI: industrial production index.

5 Battistini and Gareis (2023) show that rate increases affect industry almost twice as strongly and rapidly than the services sector in the euro area.

by our indicators: lending conditions for businesses (Bank Lending Survey – BLS, net balance) for non-energy intensive sectors, and difficulties in accessing credit (European Commission surveys) for energy intensive sectors.

C5 Historical breakdown of the non-energy intensive IPI in the euro area

(in percentage points, year-on-year)

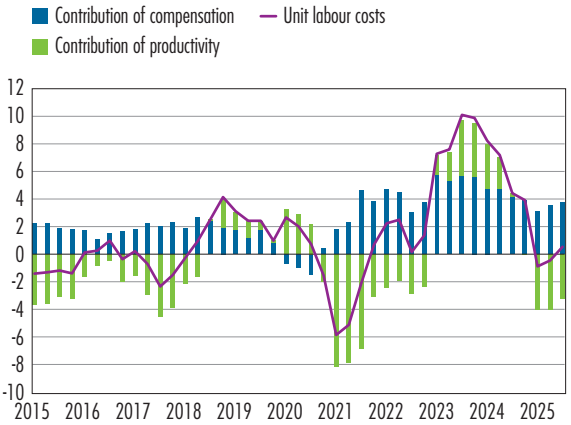


Source: European Central Bank (ECB); authors' calculations.
Notes: See box for model description. The blue shaded area corresponds to the forecast period. Forecasts are based on data from the ECB's September 2025 forecasts.
IPI: industrial production index.

C6 Unit labour costs (ULC) in the manufacturing sector

a) Breakdown of their growth in the euro area

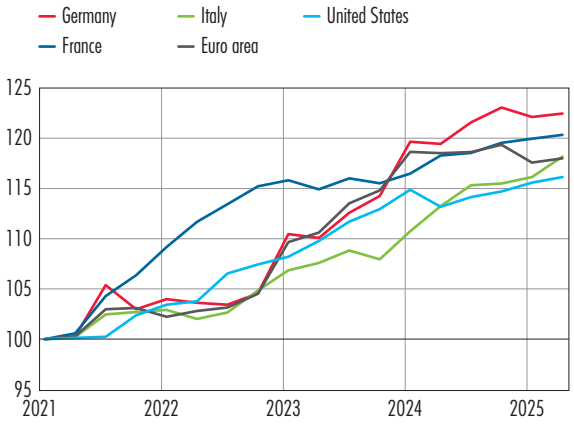
(%)



Source: European Commission (Eurostat); Banque de France calculations.
Note: Interpolation of unit labour cost (ULC) series for the second quarter of 2020 to adjust for the effect of short-time work.

b) International comparison of their growth since 2021

(index, 100= 1st quarter 2021)



Sources: Federal Reserve Bank of St. Louis (FRED database – Federal Reserve Economic Data) and European Commission (Eurostat).
Note: Seasonally adjusted data.

BOX

Modeling the energy intensive Industrial Production Index (IPI) and the non-energy intensive IPI in the euro area using a simple error correction model

We use an error correction model (ECM) to reconcile the long-term determinants and short-term fluctuations of industrial production, and model energy intensive and non-energy intensive sectors separately to reflect their different sensitivities to energy constraints.

In the long term, the level of production, as measured by the IPI, responds to the level of demand, which we approximate using real GDP, and to cost competitiveness, summarised by unit labour costs (ULC) in the manufacturing sector (adjusted for short-time work in the first quarter of 2020). In the short term, the IPI temporarily deviates from the long-term relationship under the effect of supply and demand shocks measured by various variables: the cost of energy, via energy sector production prices (PPI for NACE sector D35, year-on-year $\Delta\log_{(t-4,t)}$); domestic demand (aggregate of consumption, investment, public spending and inventory changes), denoted *DDR* and taken as the difference $\Delta\log_{(t-1,t)}$, to capture the internal cycle; global demand for the euro area (denoted *WDR*, also in $\Delta\log_{(t-1,t)}$); changes in unit labour costs in the manufacturing sector ($\Delta\log_{(t-1,t)}$ CSU); the nominal effective exchange rate ($\Delta\log_{(t-1,t)}$ NEER), which summarises relative prices vis-à-vis trading partners; and financing conditions derived from surveys — perceived constraints on access to financing for energy intensive industries or credit standards for loans to firms (Bank Lending Survey – BLS, net balance) for non-energy intensive industries — for the financial channel (CREDIT, level on stationary series).

Logarithmic variations are denoted $\Delta\log_{(t-1,t)}$ for quarterly changes and $\Delta\log_{(t-4,t)}$ for year-on-year changes. We estimate the following ECM for the euro area in a single step over the period from the second quarter of 2005 to the third quarter of 2025. For energy intensive industries:

$$\Delta log\ IPI_{(t-1,t)} = \kappa - \lambda\ (log\ IPI_{(t-1)} - \beta_1\ log\ GDP_{(t-1)} - \beta_2\ log\ CSU_{(t-1)}) + \alpha_1\ \Delta log\ DDR_{(t-1,t)} + \alpha_2\ \Delta log\ WDR_{(t-1,t)} + \alpha_3\ \Delta log\ CSU_{(t-1,t)} + \alpha_4\ \Delta log\ PPI^{D35}{}_{(t-4,t)} + \alpha_5\ \Delta log\ NEER_{(t-1,t)} + \alpha_6\ CREDIT_{(t-1)} + \varepsilon_t$$

For non-energy intensive industries (where energy is much less of a determining factor), the structure is very similar without energy and with a different financial variable:

$$\Delta log\ IPI_{(t-1,t)} = \kappa - \lambda\ (log\ IPI_{(t-1)} - \beta_1\ log\ GDP_{(t-1)} - \beta_2\ log\ CSU_{(t-1)}) + \alpha_1\ \Delta log\ DDR_{(t-1,t)} + \alpha_2\ \Delta log\ WDR_{(t-1,t)} + \alpha_3\ \Delta log\ CSU_{(t-1,t)} + \alpha_5\ \Delta log\ NEER_{(t-1,t)} + \alpha_6\ CREDIT_{(t-3)} + \varepsilon_t$$

The parameter λ measures the speed of adjustment towards long-term equilibrium: the larger λ is, the faster the catch-up. Prior to estimation, we check that the long-term relationship is econometrically sound: as the level series are non-stationary, an Engle-Granger test concludes to cointegration between IPI, GDP and CSU.

.../...

Coefficients estimated by ordinary least squares (OLS)

Variable	Energy intensive IPI	*p-value*	Non-energy intensive IPI	*p-value*
Constant	1.19	0.01	-3.93	0.00
Long-term adjustment term	-0.23	0.00	-0.23	0.00
Unit labour costs (long term)	-0.14	0.01	-0.09	0.09
Demand (long term, GDP)	0.04	0.20	0.36	0.00
Domestic demand (short term)	0.32	0.00	0.69	0.00
Global demand (short term)	0.46	0.00	0.76	0.00
Labour costs (short term)	-0.37	0.00	-0.41	0.00
Energy	-0.01	0.02	—	—
Real effective exchange rate (short term)	-0.07	0.18	-0.19	0.02
Financial constraints — (EC, survey)	-0.003	0.07	—	—
Credit standards — businesses (ECB [BLS])	—	—	-0.0004	0.02
Adjusted R^2	**0.89**		**0.90**	
Durbin–Watson	2.3		1.9	

Sources: European Central Bank (ECB; Bank Lending Survey) and European Commission (EC; Eurostat); authors' calculations.
Note: Quarterly calculations for the euro area, from the second quarter of 2005 to the third quarter of 2025. Estimation using the ordinary least squares (OLS) method. Indicator in the first quarter of 2015 for the non-energy intensive industrial production index (IPI) equation.

3 The energy crisis has reinforced a long-standing industrial restructuring process

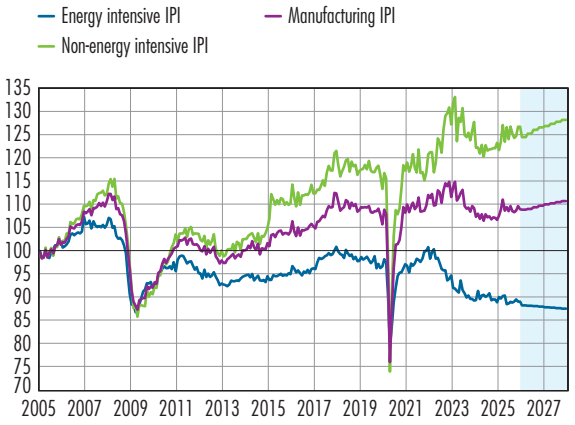
The ratchet effects of the various crises have gradually reduced the weight of energy intensive industries

Following the energy crisis of 2022, non-energy intensive sectors recorded a marked recovery. Activity in these sectors is expected to remain strong in the coming years. Conversely, activity in energy intensive sectors has remained sluggish and is expected to remain weak. However, the difference in the pace of recovery depending on the sectors' energy intensity is not new. It has existed since the 2000s (see Chart 7).

Since the mid-2000s, European industry has undergone a structural reorganisation in which energy intensive sectors have seen their relative weight decline. With each crisis—2008-2009, 2012, and then 2022—these activities appear to suffer a sharp decline, like the rest of the industry, but do not subsequently return to their pre-shock levels. Conversely, less energy intensive segments, such as pharmaceuticals, electronics, and certain capital goods, benefit more from recoveries, gradually shifting the productive fabric toward higher value added activities such as electronics and pharmaceuticals (see Chart 8 below).

C7 Differentiated trends in manufacturing output in the euro area, 2005-27

(index, 100=2005)



Source: European Commission (Eurostat); authors' calculations.
Notes: Seasonally adjusted data. Last point: November 2025.
The blue shaded area corresponds to the forecast period up to the fourth quarter of 2027 (monthly quarterly forecast).
IPI: industrial production index.

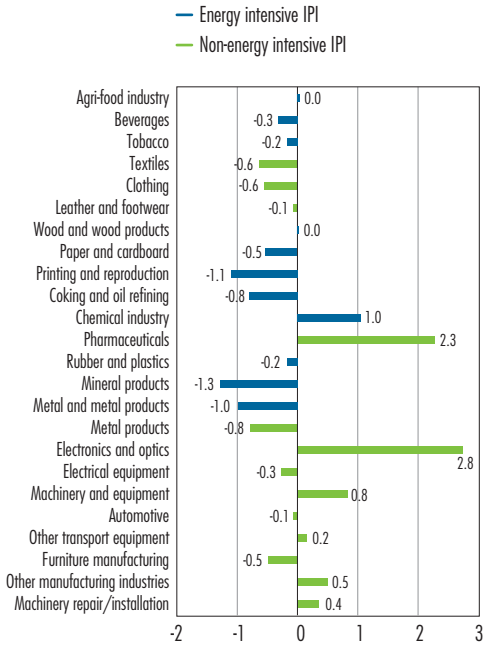
Our estimates confirm that sensitivity to demand varies across industries: non-energy intensive industries are more responsive to changes in demand – particularly domestic demand – and their production therefore recovers more easily during upturns, unlike energy intensive industries.

- This divergence can also be explained qualitatively by the composition of the markets. Energy intensive industries mainly supply inputs to downstream sectors (construction, automotive, capital goods), several of which have structural weaknesses. Construction, which is a major consumer of steel, glass, and cement, has remained depressed since 2009 and has again been affected by tighter lending conditions since 2022. The automotive industry, another major market, is facing rapid technological transition, regulatory uncertainty, and increased international competition (particularly from China). Conversely, final demand has shifted towards more technology-intensive products: pharmaceuticals, electronics and optics are growing, driven by digitalisation, innovation and demographic aging. Ultimately, crises do not create divergence; they widen it.

- On the supply side (amplifier since 2022), even though our estimates indicate that sensitivity to unit costs is at least as strong in energy intensive and non-energy intensive sectors, comparable cost constraints may be more damaging to energy intensive industries. These industries have fewer non-price differentiation levers, more rigid processes, and narrower margins. They also face, by definition, a greater energy constraint, due to the direct use of gas and electricity and related inputs.

C8 Changes in sector weights within the manufacturing sector in the euro area, 2005-21

(in percentage points)



Source: European Commission (Eurostat).
Note: The growing weight of the chemical industry is driven by a very dynamic year in 2021, which masks a sharp decline in the industry's output from 2022 onwards.

A restructuring set to continue

Since the mid-2000s, the ratio between the production index for energy intensive sectors and that for non-energy intensive sectors has been on a downward trend, signaling a gradual restructuring to the detriment of the most energy intensive sectors. The energy shock of 2022 did not trigger this movement, but it did accentuate it in the short term.

Our simulations for the period from the third quarter of 2025 to the fourth quarter of 2027 suggest that this trend will continue, with a mixed balance of risks:

- On the downside: the substitution of domestic inputs with imported products, which began at the height of the crisis, could become permanent (Chiacchio et al., 2023). At the same time, the energy shock caused a sharp decline in investment in exposed sectors such as chemicals and metal and metal products, compromising their prospects for modernisation and upgrading (Anaya Longaric et al., 2024). The end of the energy partnership with Russia has permanently weakened the energy intensive industrial model. Gas prices in Europe remain structurally higher than before the crisis and higher than in the United States, and the price competitiveness advantage over Asia has been significantly reduced (Emter et al., 2023).

- On the upside: Germany's investment plan for 2030 (defense and infrastructure) will support European demand, while the rise of LNG, the development of renewable energies, and renewed interest in nuclear power could contain energy costs, with greater visibility on the energy mix also facilitating investment in industry.

In the long term, the main challenge for energy intensive industries will be their ability to successfully transition to a low-carbon economy.

References

Anaya Longaric (P.), De Sanctis (A.), Grynberg (C.), Kostakis (V.) and Vinci (F.) (2024)
"Energy shocks, corporate investment and potential implications for future EU competitiveness", *ECB Economic Bulletin*, No. 8, European Central Bank, August.

Baget (C.), Gaulier (G.), Carluccio (J.), Stalla-Bourdillon (A.), Gossé (J.-B.), Le Gallo (F.) and Schneider (A.) (2024)
"The gas price shock: never again?", *Banque de France Bulletin*, No. 252/1, Banque de France, May-June.
Download the document

Battistini (N.) and Gareis (J.) (2023)
"Monetary policy and the recent slowdown in manufacturing and services", *ECB Economic Bulletin*, No. 8, European Central Bank, December.

Battistini (N.), Grapow (H.), Hahn (E.) and Soudan (M.) (2022)
"Wage share dynamics and second-round effects on inflation after energy price surges in the 1970s and today", *ECB Economic Bulletin*, No. 5, European Central Bank, August.

Camba-Mendez (G.) and Forsells (M.) (2018)
"The recent slowdown in euro area output growth reflects both cyclical and temporary factors", *ECB Economic Bulletin*, No. 4, European Central Bank, December.

Chiacchio (F.), De Santis (R. A.), Gunnella (V.) and Lebastard (L.) (2023)
"How have higher energy prices affected industrial production and imports?", *ECB Economic Bulletin*, No. 1, European Central Bank, January.

Corsello (F.), Flaccadoro (M.) and Villa (S.) (2023)
"Quantity versus price dynamics: the role of energy and bottlenecks in the Italian industrial sector", *Questioni di Economia e Finanza*, No. 781, Banca d'Italia, June.

Deutsche Bundesbank (2025)
"What's behind the sustained decline in German export market shares?", *Monthly Report – July 2025*, Vol. 77, No. 7, July, pp. 19-54.

Dupraz (S.) and Marx (M.) (2025)
"The benefits of well-anchored inflation expectations", *Eco Notepad*, No. 396, Banque de France, March.
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Emter (L.), Gunnella (V.) and Schuler (T.) (2023)
"The energy shock, price competitiveness and euro area export performance", *ECB Economic Bulletin*, No. 3, European Central Bank, March 2023.

Flaccadoro (M.) (2024)
"The recent weakness in the German manufacturing sector", *Questioni di Economia e Finanza*, No. 902, Banca d'Italia, December.

Institut national de la statistique et des études économiques – Insee (2022)
"Companies coping with rising energy prices: contrasting situations and reactions", *Economic Outlook*, December.

Institut national de la statistique et des études économiques – Insee (2023)
"Focus – Faced with energy price rises, companies are reacting mainly by increasing their selling prices", *Economic Outlook*, 15 March.

International Energy Agency – IEA (2022)
A 10-Point Plan to Reduce the European Union's Reliance on Russian Natural Gas, 3 March.

Simon (O.) (2022)
"Which are the branches of activity where production is most dependent on energy?", *Economic Outlook*, Institut national de la statistique et des études économiques (Insee), 6 October.

Vogel (L.), Neumann (M.) and Linz (S.) (2023)
"Calculation and development of the new production index for energy-intensive industrial branches", *WISTA – Wirtschaft und Statistik*, No. 2, *Federal Statistical Office* (Destatis), February.

Appendix
Construction of energy intensity activity indices

Definition of energy intensive sectors

The analysis is based on a distinction between energy intensive and non-energy intensive manufacturing sectors, established using the input-output matrices of the Organisation for Economic Cooperation and Development (OECD, 2021 edition, 2018 data), using an approach similar to, but not identical to, that developed by Destatis (Vogel et al., 2023) to construct an energy intensive industrial production index (IPI) for Germany. A sector is classified as energy intensive when the value of its intermediate consumption of energy products (NACE sector D35) – including electricity, gas, and steam – exceeds 5% of its value added. This arbitrary threshold is consistent with the type of thresholds used by INSEE (Simon, 2022).

This approach measures only the direct energy intensity of sectors, without taking into account indirect energy consumption via intermediate inputs (for example, a sector that uses large amounts of steel, which is itself energy intensive, is not considered as such). This distinguishes this method from other approaches based on "complete" intensities calculated in terms of inputs and outputs (see, for example, Chiacchio et al., 2023), which do not, however, alter the final results.

The intensive scope adopted in this study includes:

- not only traditional heavy industries: metal and metal products (C24), basic chemicals (C20), coking and refining (C19), non-metallic minerals (C23), paper and printing (C17-C18),

- but also, and this constitutes a major methodological difference with Destatis, the agri-food industries (C10 to C12) and woodworking (C16).

This inclusion reflects the fact that these sectors have significant energy intensities (often close to the 5% threshold) and play a central role in several euro area economies. However, it tends to moderate the decline observed since 2021 in countries where the agri-food sector is overrepresented and has experienced more favourable dynamics than heavy industries (particularly France and Spain). Thus, the IPIs for energy intensive sectors are, by design, less adversely affected since the energy crisis than those presented by Destatis.

A chained Laspeyres aggregation, better suited to industrial change

The summary indices are calculated using the chained Laspeyres aggregation method, which is updated annually to better capture changes in industrial structure. Unlike other methods, such as that used by Destatis, which sets weights for five-year periods, our approach updates the weights of the sectors annually to more accurately reflect sectoral changes.

$$IPI_t = IPI_{\{t-1\}} \times \frac{\left(\sum_i w_{\{i,t-1\}} \times \left(\frac{x_{\{i,t\}}}{x_{\{i,t-1\}}}\right)\right)}{\left(\sum_i w_{\{i,t-1\}}\right)}$$

where:

- IPI_t: the aggregate index for period *t*,
- $x_{\{i,t\}}$: the individual index for sector i for period *t*,
- $w_{\{i,t-1\}}$: the weight of sector i for period *t–1* (in terms of value added),
- the index is chained: it is obtained recursively from $IPI_{\{t-1\}}$.
- the indices are then rebased to an annual average over one year (2005 over the long term, 2019 over the short term).

Data used and practical assumptions

The weights are taken from the national accounts published by Eurostat, in terms of value added by sector (NACE Rev. 2). Where precise data are not available (as for certain sectors in value or volume terms in countries such as the Netherlands or Belgium), the weights are:

- either imputed from aggregate weights for the euro area (e.g., C12 for tobacco, which is often missing),
- or broken down from composite aggregates, using average ratios observed over a long period for the euro area. For example:
- C10–C12 (agri-food) is broken down as follows: 80% for C10, 17% for C11, 3% for C12,
- C13–C15 (clothing, leather): 41% for C13, 34% for C14, 25% for C15,
- C31–C33 (capital goods): 22% for C31, 31% for C32, 47% for C33.

In the absence of annual data for the most recent period for each country, the weights used are set at their 2022 value for the entire end of the period studied (2022–25).

A difference with Eurostat

Our method does not seek to reproduce exactly the manufacturing indices published by Eurostat, particularly at country level. Eurostat uses more complex internal weightings that are sometimes not publicly available. In this study, we offer a complementary reading tool, focused on the distinction between energy intensities, with its own analytical logic.

The differences observed between the published IPI and the recalculated IPI for certain countries do not call into question the robustness of growth profiles over two- to three-year periods, which remain highly consistent with official data. The indices obtained thus allow for a detailed analysis of the dynamics of industrial sectors according to their exposure to energy constraints.

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