Analysis

How energy shocks affect inflation

Josien Demmers, Roben Kloosterman, Rixt Swierstra, Annemieke Visser

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How energy shocks affect inflation
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Authors: Josien Demmers, Roben Kloosterman, Rixt Swierstra and Annemieke Visser

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De Nederlandsche Bank N.V.
Postbus 98 1000 AB
Amsterdam
Website: www.dnb.nl
Email: info@dnb.nl

Executive summary

Foreign energy shocks are an important source of inflation risk for the Netherlands. The renewed rise in oil and gas prices in 2026 illustrates how geopolitical tensions can translate into higher energy costs for households and firms. Inflation in the Netherlands is exposed to such shocks because energy is used throughout production chains. The Netherlands is particularly exposed to gas market developments, as gas accounts for a relatively large share of final energy use compared with other EU countries. Moreover, gas frequently plays a price-setting role in the Dutch electricity market. At the same time, exposure to energy shocks extends far beyond direct energy imports, since energy is also embedded in imported intermediate inputs and final goods. Energy-related products play a central role in global production networks, meaning that energy shocks propagate through production chains. Manufacturing plays a particularly important role in the transmission to Dutch consumer prices, while wholesale and retail trade, transport and storage are also important channels.

Energy shocks affect Dutch consumer prices both directly through household energy consumption and indirectly through the energy used in the production of other goods and services. Households consume energy, including fuel, gas and electricity, which directly exposes them to developments in global energy markets. However, as household energy bills cover more than the cost of energy inputs, consumer energy prices do not increase at the same rate as crude oil and gas prices. Furthermore, households are also indirectly exposed to disruptions in energy markets because energy is used as an input in the production of non-energy products, including food, services and non-energy industrial goods (NEIG). Around 7% of the inputs used in the production of Dutch household consumption are energy-related inputs, of which around 4 percentage points originate from outside the European Union.

Energy shocks can affect inflation long after the initial rise in household energy prices. Historical estimates show that household energy prices respond relatively quickly, with the response to a gas shock initially stronger than that to an oil shock, likely reflecting the higher weight of gas in energy consumption and its effect on electricity prices. The effects on food, NEIG and services prices typically emerge after around four to eight months after the shock and can persist for several years. This pattern is consistent with firms gradually passing higher energy costs on to consumers. The persistent response of services inflation may also indicate broader second-round effects, including wages gradually wage adjusting to higher living costs. Moreover, the strength and speed of pass-through depend on economic conditions, implying that the inflationary impact of an energy shock can vary across the business cycle. State-dependent estimates show that oil and gas price increases are transmitted more strongly or more rapidly to consumer prices when the output gap is positive.

While indirect and second-round effects following the March 2026 energy shock have so far remained limited, historical estimates suggest that the inflationary effects could extend well beyond 2026, although the magnitude and speed of transmission are highly uncertain. Since the start of the war in March 2026, consumer energy prices, particularly fuel prices, have increased. As fixed-price energy contracts expire, gas and electricity prices are likely to rise further. Importantly, a substantial part of the eventual inflationary impact depends on the extent and speed with which higher energy costs are passed through to the prices of food, industrial goods and services. This analysis shows that even if oil and gas prices start to decline again, the shock may continue to affect prices across the Dutch consumption basket for several years due to indirect and second-round effects. Broader inflationary pressures could therefore become more visible from late 2026 onwards and continue into 2027 and beyond.

The magnitude and speed of transmission are uncertain, as several factors could either amplify or dampen the inflationary effects of the 2026 energy shock. The shock is relatively large, with the closure of the Strait of Hormuz disrupting around 25% of global seaborne oil trade and almost 20% of global LNG trade. Its size could accelerate pass-through if firms respond to large cost increases by adjusting their prices more rapidly. Relatively low European gas storage levels could further increase inflationary pressures. In addition, the recent period of elevated inflation may make firms and households more responsive to renewed price increases, raising the risk of indirect and second-round effects. At the same time, several factors could dampen these effects. Large energy price increases can trigger larger substitution, lower demand, inventory releases and additional supply, moderating the initial increase in energy prices. In addition, households' fixed-price energy contracts may delay the pass-through of wholesale gas and electricity prices to consumer prices. Moreover, demand pressures in the Dutch economy are currently weaker than during the 2022 energy shock. This may limit firms' ability to pass higher energy costs on to consumers and workers' ability to secure wage increases that compensate for higher living costs, thereby dampening indirect and second-round effects. Finally, large shocks are more likely to trigger a policy response, which can influence the magnitude and timing of pass-through. Their effect, however, depends on the type of policy. Overall, historical estimates provide useful information about the timing of transmission, but the eventual magnitude of the inflationary impact of the 2026 shock remains uncertain.

These findings have implications for monetary and fiscal policy. For monetary policy, the main concern is the extent to which an initially supply-driven rise in inflation broadens across the consumption basket and becomes embedded in wages, firms' price-setting behaviour and inflation expectations. Because higher energy costs are passed on gradually, a modest initial rise in non-energy inflation does not necessarily mean that broader inflationary pressures will remain limited. Persistently high energy prices may also increase pressure on governments to compensate households for the resulting loss of purchasing power. If such compensation is broad-based or insufficiently targeted, it may sustain aggregate demand and thereby add to inflationary pressures. Any support measures should therefore be timely, temporary and targeted, focusing on vulnerable households while preserving incentives to reduce energy consumption and limiting unnecessary demand stimulus.

The broader lesson is that energy resilience and price stability are connected. Monetary policy remains responsible for maintaining price stability when energy shocks occur, but it cannot eliminate the underlying sources of these shocks. Energy policies focus on long-term goals and pursue broader objectives, such as improving strategic autonomy or reducing climate-related risks. By reducing dependence on fossil fuels and strengthening the resilience of European energy supply, such policies can also reduce the impact of geopolitical energy shocks on inflation.

Contents

Executive summary 2

1 Introduction 5
1.1 Energy supply shocks: a new normal? 5
1.2 Increasing energy prices: renewed inflationary risks? 8

2 Energy as an input in the production of consumer goods 10
2.1 Data 10
2.2 Origin of energy inputs in the HICP consumption basket 11
2.3 Energy inputs in household energy consumption 12
2.4 Energy inputs in goods and services 13

3 Propagation of energy shocks 15
3.1 The role of energy in production networks 15
3.2 Sectoral contributions to energy shock transmission 17

4 Impact of energy shocks on inflation 19
4.1 Supply shocks in oil and gas prices 19
4.2 Inflationary impact of an oil and gas price shock 21
4.3 Difference in pass-through: positive versus negative output gaps 25
4.4 What does this tell us about the 2026 energy shock? 27

5 Conclusion and policy implications 31

References 34

Appendix 37

1 Introduction

Energy price shocks have ret-emerged as an important source of uncertainty for the inflation outlook. Recent geopolitical tensions and disruptions in global energy markets have again highlighted how developments in oil and gas markets can rapidly affect costs for households and firms. Understanding the effects of an energy shock on inflation requires looking beyond energy prices: it also requires understanding how energy is used in the production of goods and services consumed by households and how higher costs are transmitted through production chains.

This study examines how energy supply shocks ultimately affect Dutch consumer prices. In Chapter 2, we assess how energy is used in the production of final goods and services consumed by Dutch households. In Chapter 3, we investigate how an energy shock propagates through the production chain. Chapter 4 examines how strongly and quickly shocks to crude oil or gas prices affect Dutch inflation.

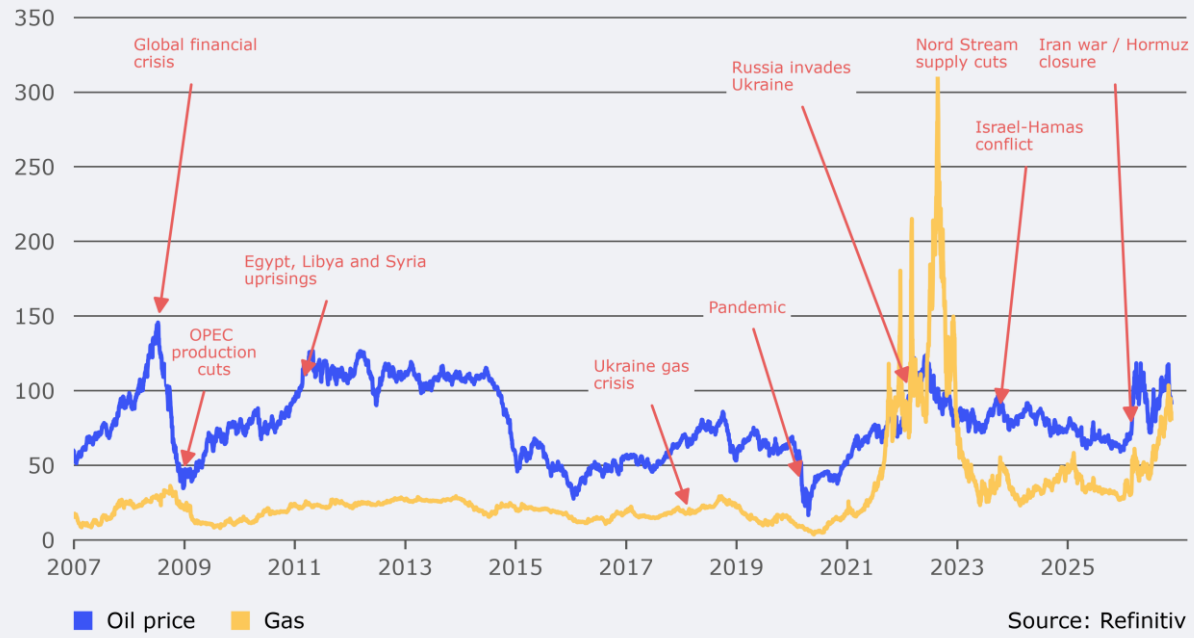
1.1 Energy supply shocks: a new normal?

Recent events have shown how quickly disruptions in global energy markets can lead to large movements in oil and gas prices. Russia's invasion of Ukraine triggered an unprecedented surge in European gas prices, while renewed tensions in the Middle East have highlighted the continued exposure of oil markets to geopolitical developments. Such episodes are not new: oil and gas markets have often been affected by wars, embargoes, production disruptions and periods of rapidly rising global demand (Hamilton, 2013; IEA, 2024). Figure 1 illustrates that Brent crude oil has experienced several periods of exceptional volatility, and that European gas prices experienced a major peak in 2022. What may be changing, however, is the environment in which these markets operate. Growing geopolitical fragmentation, increasing physical climate risks and changes in the global energy system could increase the likelihood of disruptions or amplify their consequences when they occur (Alvarez et al., 2023; EEA, 2024; IEA, 2025a).

Differences in oil and gas market structures can result in different price effects after a shock. As oil is traded in a highly integrated global market, disruptions in one region can quickly affect prices worldwide. Spare production capacity, commercial and strategic inventories, and the ability to redirect trade flows play an important role in absorbing shocks (IEA, 2024). Gas markets are less globally integrated because transporting gas requires specific infrastructure – either pipeline connections or LNG infrastructure – which limits the ability to redirect trade flows. Storage capacity, pipeline connections, LNG terminals and the availability of LNG cargoes play an important role in determining the persistence of gas shocks (Adolfsen et al., 2023; IEA, 2025a). The European energy crisis illustrated this difference: while Russia's invasion of Ukraine also affected global oil prices, the consequences for European gas prices were much larger because Europe had to replace substantial volumes of pipeline gas within a relatively inflexible regional market.

Figure 1 Crude oil and gas prices are sensitive to global events

Developments in Brent oil price (dollars per barrel) and TTF gas price (euros per MWh)

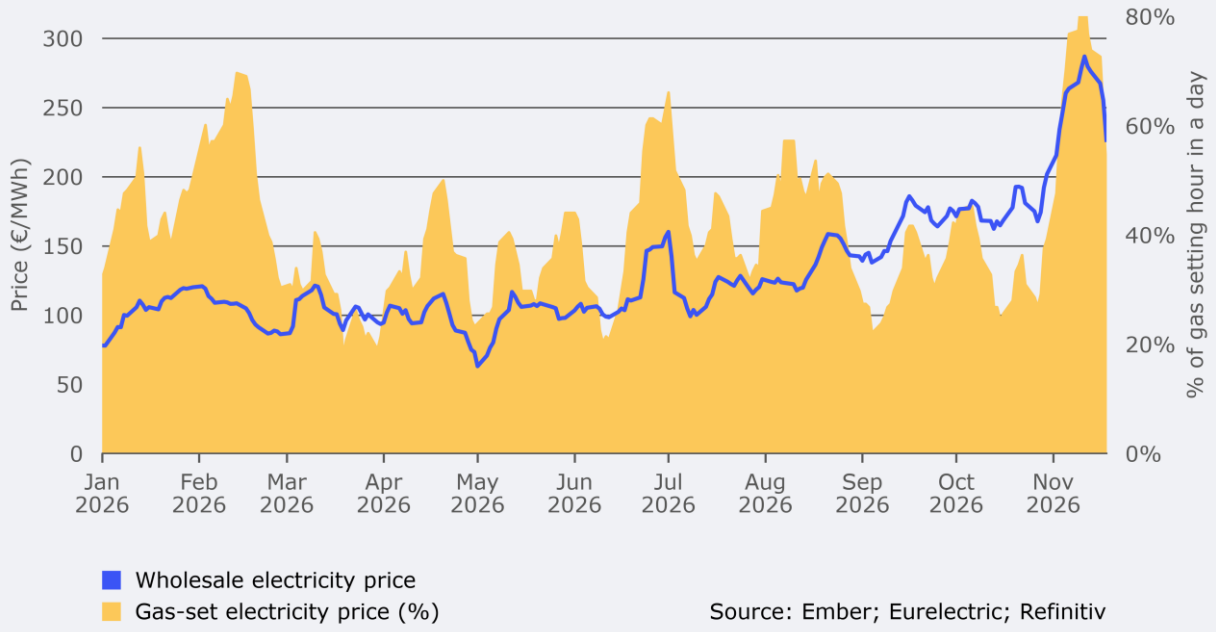


Note: The arrows mark selected geopolitical and economic events that affected global energy markets. For the sake of readability, only a selected list of events is shown. Oil prices refer to Brent crude; gas prices use the Dutch TTF benchmark.

Developments in gas prices have an impact on electricity prices. Wholesale electricity markets meet demand using several sources of electricity generation, and the market price is generally determined by the most expensive production source needed to meet demand. In the Netherlands, gas-fired power plants frequently play this price-setting role. This means higher gas prices increase the marginal cost of electricity generation and, as a result, wholesale electricity prices. The shaded area in Figure 2 shows that gas sets the electricity price for a substantial share of hours, although this varies over time depending on electricity demand and the availability of other sources of generation. When gas prices rise – as they have since March 2026 – so does the electricity price set by gas.

Figure 2 Gas prices are relevant for electricity price setting

Role of gas in setting wholesale electricity prices in the Netherlands



Source: Ember; Eurelectric; Refinitiv

Note: The right-hand axis shows the share of hours during which gas prices set the wholesale electricity price; the left-hand axis shows the wholesale electricity price in €/MWh.

The risk of energy market disruptions due to geopolitical events may remain elevated in the years ahead. Recent conflicts have shown how strategic chokepoints can be disrupted, forcing oil and gas flows onto longer and more costly routes, as occurred in the Red Sea (EIA, 2026). Such vulnerabilities are likely to remain relevant as large shares of global oil and LNG trade continue to pass through chokepoints with limited alternative routes available, such as the Strait of Hormuz and Bab al-Mandab (EIA, 2026; IEA, 2025a). Moreover, greater geo-economic fragmentation makes energy markets more vulnerable to the impact of disruptions. Fragmentation reduces the number of alternative suppliers that can be accessed at short notice and increases the concentration of trade within geopolitical blocs. IMF scenario analysis shows that fragmentation of commodity markets reduces opportunities for substitution and amplifies the price effects of country-specific supply disruptions (Alvarez et al., 2023). These vulnerabilities are particularly relevant for oil and gas, where production is geographically concentrated and international trade relies heavily on a limited number of producers and transport routes. The price effects of supply disruptions, however, differ between the two markets, reflecting differences in global integration and supply flexibility.

Europe and the Netherlands are particularly exposed to developments in international energy markets because a large share of the energy they consume comes from abroad. Net imports covered 57% of the European Union's energy needs in 2024, while the Netherlands relied on other countries for 77% of its energy supply in 2025 (Eurostat, 2026a; CBS, 2026). For the Netherlands, this high share partly reflects the decline in domestic natural gas production, particularly following the phase-out of production from the Groningen field (CBS, 2026). The energy crisis following Russia's invasion of Ukraine demonstrated that dependence on foreign energy sources could become a significant vulnerability when supply from a key source is sharply reduced or even cut off

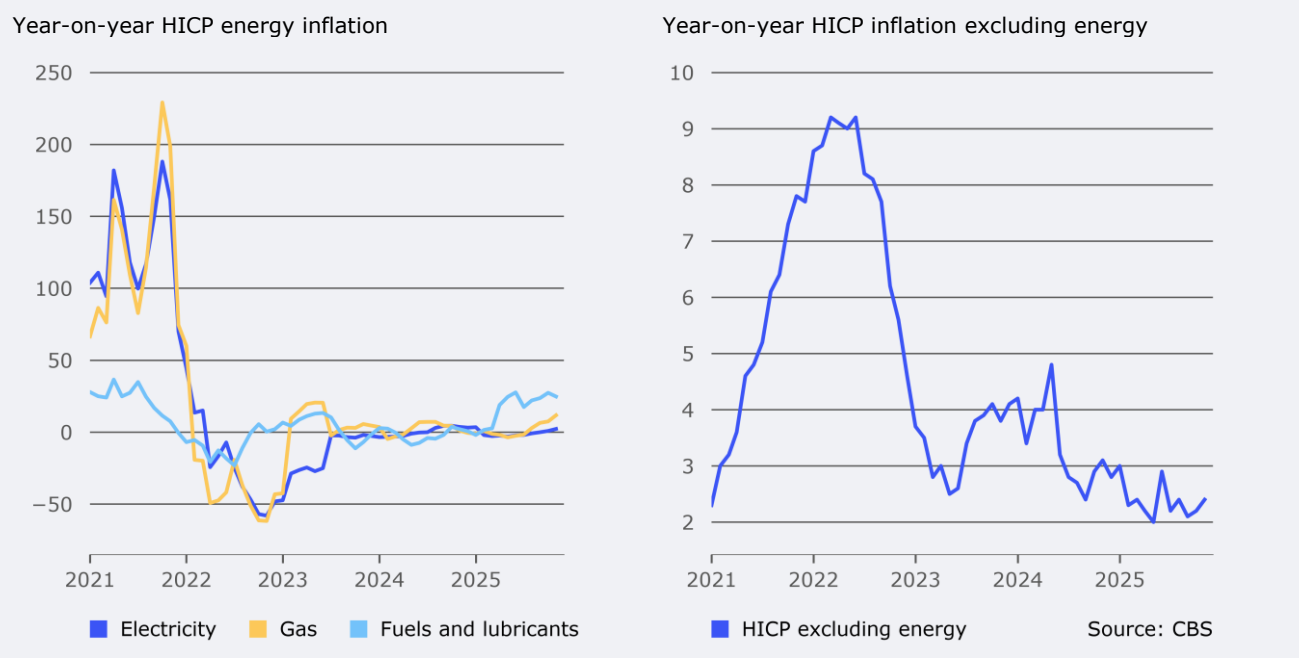
entirely. Since 2022, the European Union has been diversifying its energy imports in response to the decline in Russian pipeline gas, but it remains exposed to developments in global energy markets. The size and frequency of global energy shocks depends on the origin of the shock, the level of supply concentration among countries and transport routes, and how easily one source can be replaced by another when supply is disrupted (IEA, 2025b). Moreover, direct energy imports capture only part of the Netherlands' exposure to foreign energy shocks. Energy produced abroad is also used to manufacture imported intermediate and final goods, creating additional exposure through international production chains. Identifying the origin of the energy embodied in Dutch household consumption is therefore important for assessing the economy's vulnerability to potential supply shocks.

1.2 Increasing energy prices: renewed inflationary risks?

The renewed rise in energy prices in 2026 has brought energy-related inflation risks back to the fore. The war in the Middle East has disrupted global energy markets, causing oil and gas prices to rise sharply in the first months of 2026. Higher crude oil prices have subsequently driven up the costs of refined petroleum products and motor fuels, while higher gas prices also feed through to electricity prices and household energy bills. The initial effects are most clearly visible in the energy component of consumer prices. Motor fuel inflation has increased particularly strongly, while inflation in gas and electricity prices has followed a different pattern. This illustrates that changes in wholesale energy prices do not pass through uniformly or in a one-to-one way to the prices paid by households. Differences in production, processing and distribution, as well as the structure of household energy contracts, affect both the magnitude and speed of the pass-through.

The key question is how strongly and how quickly the 2026 energy shock will feed through to broader consumer price inflation. Figure 3 compares energy inflation and inflation excluding energy in the Netherlands over the past five years. Since March 2026, energy inflation has picked up, particularly for fuels and lubricants, although it remains well below the levels reached in 2022. At the same time, inflation excluding energy has remained broadly stable so far at around 2.2% in 2026. This contrasts with 2022, when non-energy inflation began to rise around the same time as energy inflation. The reopening of the economy following the coronavirus pandemic, accompanied by strong demand pressures, played an important role in pushing up prices at the time. Indirect and second-round effects from the energy shock also contributed to higher non-energy inflation (DNB, 2023; 2026a). The relatively muted response of non-energy inflation in 2026 may therefore partly reflect the fact that these effects take time to materialise, rather than indicating that the energy shock will have no further impact on non-energy inflation.

Figure 3 Non-energy inflation remains relatively stable and far below 2022 levels



The main goal of this analysis is to examine the role of energy inputs in the production of goods and services consumed by Dutch households, and how energy price shocks ultimately feed through to inflation. We first examine how energy is used along the production chains underlying Dutch household consumption, covering both direct energy expenditure and energy inputs into the production of food, industrial goods and services. We then trace the origins of these energy inputs, assessing the Netherlands' exposure to domestic, European Union and global energy supply. Finally, we examine the magnitude and speed of the pass-through of energy shocks to Dutch inflation. Taken together, the analysis addresses three closely related questions: where is energy used, where does it come from, and how do global energy shocks ultimately affect the prices Dutch consumers pay?

2 Energy as an input in the production of consumer goods

Energy shocks affect Dutch consumer prices both directly, through household energy consumption, and indirectly, through the energy used to produce other goods and services. Households consume fuel, gas and electricity and are directly exposed to developments in global energy markets. Consumer energy prices, however, do not move in direct proportion to crude oil and gas prices, as household energy bills also include non-energy cost components. In addition, households are indirectly exposed to energy market disruptions because energy is used in the production of food, services and non-energy industrial goods (NEIG). This chapter examines the share of energy inputs in Dutch household consumption and how this exposure differs across HICP components.

A substantial share of energy inputs used to produce goods and services consumed by Dutch households originates abroad. We trace the geographical origin of inputs to assess the exposure of Dutch consumption to disruptions in global energy supply. Energy accounts for around 7% of the inputs embodied in the Dutch household consumption basket, and 4 percentage points of this originates outside Europe. Although the prices of many oil and gas products are determined on international markets, the geographical dimension remains important when supply is disrupted. As energy supplies cannot always be easily replaced by alternative sources, such disruptions can spread through production chains, affecting the availability and costs of goods and services further downstream and ultimately putting upward pressure on consumer prices.

2.1 Data

We combine input-output data with consumer price data to identify the energy inputs underlying Dutch household consumption. Our main sources for identifying flows along production chains are the Full International and Global Accounts for Research in Input-Output Analysis (FIGARO) multi-country input-output tables. These tables describe how products from different countries flow through production chains into final demand. Each row represents the output supplied by a particular product category from a specific country (supply), while the columns show where these products are used (demand), either as intermediate inputs in the production of other products or for final uses such as household consumption. The data in these tables allow us to trace the products that households consume directly, as well as the products used indirectly as inputs throughout production chains. FIGARO distinguishes 64 product categories based on the Classification of Products by Activity (CPA) and records these flows in monetary values at basic prices, which is the price received by producers, excluding product taxes and trade and transport margins. This analysis uses the most recent FIGARO trade data available, which is for the year 2024.

Within FIGARO, we identify three product categories as energy-related inputs. First, FIGARO has a single product category (labelled Section B) that serves as a proxy for primary energy and mining inputs. This category includes coal and lignite, crude petroleum and natural gas, metal ores, other mining and quarrying products, and mining support services. Second, manufacture of coke and refined petroleum products (C19) captures the transformation of primary energy commodities into refined petroleum products. Finally, electricity, gas, steam and air-conditioning supply (D35) covers electricity and gas supply. Together, these three categories provide a broad measure of energy-related inputs entering directly or indirectly into the production of goods and services. Throughout this analysis, Sections B, C19 and D35 are collectively referred to as energy inputs.

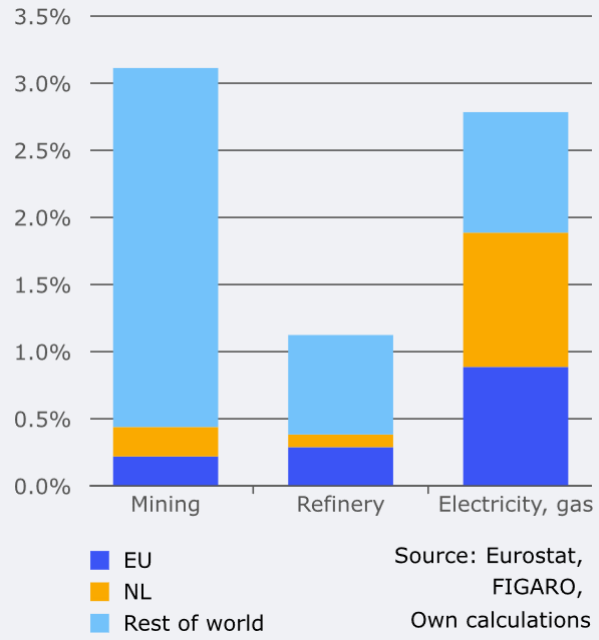
To assess how energy enters consumer prices, we link the FIGARO data to the Harmonised Index of Consumer Prices (HICP) consumption data. The HICP measures the prices of goods and services purchased by households. Changes in the index provide our measure of consumer price inflation throughout this analysis.

FIGARO and HICP use different product classifications: FIGARO uses CPA, while the HICP uses the Classification of Individual Consumption According to Purpose (COICOP). We map CPA products to COICOP consumption categories at the two-digit level using the bridge matrix from Cai & Vandyck (2020). The matrix allows us to use the FIGARO data to trace the energy inputs throughout the production chain of the goods and services that households ultimately consume. However, the price paid by households exceeds the production value of the goods and services they consume, as final consumer prices also include trade and transport margins and taxes less subsidies on products. We therefore add these components to the value of household consumption derived from FIGARO, bringing the resulting measure more closely in line with household expenditure as captured in the HICP.

2.2 Origin of energy inputs in the HICP consumption basket

Figure 4 Energy inputs in the Dutch household consumption basket mostly originate from outside Europe

HICP expenditure on energy-related CPAs, including trade and transport expenditure



Note: "Mining" refers to mining and quarrying (CPA B); "Refinery" to coke and refined petroleum products (CPA C19); and "Electricity, gas" to electricity, gas, steam and air-conditioning supply (CPA D35).

The geographical origin of energy inputs provides insight into the energy dependencies underlying Dutch household consumption. Although the prices of many energy products are determined on international markets, their physical supply originates from specific countries and regions. This geographical dimension becomes important when energy supply is disrupted. If the supply of an energy input is reduced and cannot easily be replaced by alternative sources, the production and delivery of goods and services further down the production chain may be affected. This means that tracing the origin of energy inputs reveals where Dutch household consumption depends on domestic and foreign energy supply, and where potential vulnerabilities to international supply disruptions arise. This geographical perspective complements the analysis of price exposure by providing insight into the availability and security of the energy supply underlying Dutch household consumption.

Around 7% of the inputs used in the production underlying Dutch household consumption are energy inputs, 4 percentage points of which originate from outside Europe. Figure 4 decomposes the energy inputs embodied in Dutch household consumption by energy type and geographical region, taking the entire production chain into account. It distinguishes three regions of origin: the Netherlands, the rest of the European Union and the rest of the world. Overall, energy inputs account for around 7% of the Dutch household consumption basket. Of this, around 3 percentage points consist of mining and quarrying inputs, 2.7 percentage points of electricity, gas, steam and air-conditioning inputs, and about 1 percentage point of coke and refined petroleum products. The

geographical composition of energy inputs has remained relatively stable over the sample period (2010-2024) (Annex A.3).

Mining and quarrying inputs are predominantly sourced from outside Europe. More than two-thirds of the primary energy and mining inputs embodied in Dutch household consumption originate in the rest of the world, reflecting Europe's dependence on imported crude oil and other raw energy commodities. As a result, developments in global commodity markets play an important role in determining the share of energy costs embodied in Dutch consumption. This international dimension reinforces the importance of global energy markets for domestic inflation dynamics.

Refined petroleum products also rely heavily on non-Dutch production. Although a larger share originates within Europe compared to mining and quarrying products, most refined petroleum inputs embodied in Dutch consumption still originate outside the Netherlands. This reflects the international nature of refining activities and petroleum supply chains. Consequently, shocks affecting refining capacity or petroleum markets abroad can influence Dutch consumer prices even when domestic energy production remains unaffected.

Electricity and gas supply is more domestic and European in origin. Compared with the other energy categories, a larger share of electricity and gas inputs originates within the Netherlands and elsewhere in the European Union. This reflects the more regional nature of electricity generation and energy distribution networks. Nevertheless, a substantial part of the electricity and gas inputs embodied in household consumption still depend on imported energy commodities and interconnected European energy markets.

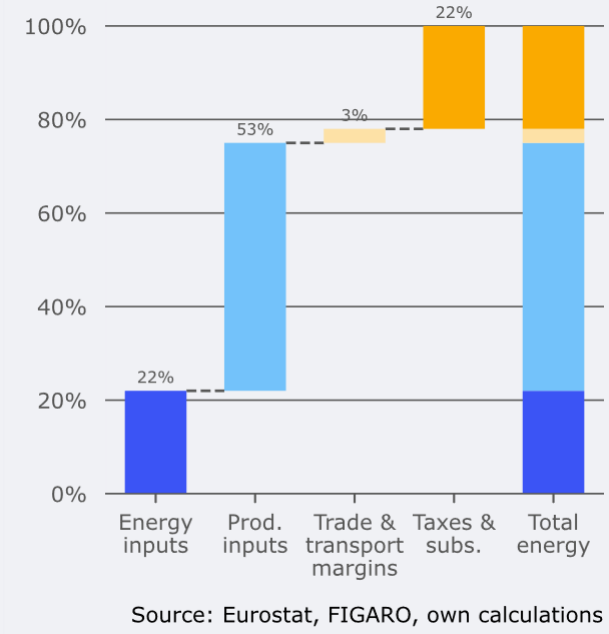
While the analysis so far provides an aggregate picture of energy inputs in Dutch household consumption, the importance and role of energy differs considerably across HICP components. Households consume energy directly through electricity, gas and motor fuels, while food, non-energy industrial goods and services embody energy used at different stages of their production chains. The following sections examine these components separately, assessing both the importance of energy inputs and where they enter the production chain. We begin with household energy consumption, before turning to food, non-energy industrial goods and services.

2.3 Energy inputs in household energy consumption

Household spending on energy covers more than energy inputs. The energy component of the HICP includes products such as electricity, gas and motor fuels. Our definition of energy differs slightly from the official HICP energy aggregate, as we use the two-digit COICOP categories 045 Electricity, gas and other fuels and 072 Use of personal transport equipment. The price consumers pay for energy products reflects all the activities required to transform crude energy into products that can be used by consumers. Crude oil and gas must be extracted, refined or processed, transported, distributed and sold before reaching households. Hence, final household expenditure on energy consists of more than energy inputs; it also contains other production inputs, trade and transport margins, and taxes and subsidies.

Around 22% of household energy spending can be attributed to energy inputs themselves. Figure 5 decomposes Dutch household expenditure on energy into the inputs and other components that make up the final consumer price. Energy inputs account for 22% of total spending on the energy component of HICP, while other

Figure 5 Household energy consumption consists of more than energy inputs



Source: Eurostat, FIGARO, own calculations

Note: Trade and transport margins also contain a small energy input (5.2% of trade and transport margins)

inputs required to process and deliver energy account for a further 53%. These include goods and services used to transform energy into products that households can consume, as well as business and transportation services. Trade and transport margins account for 3%, while taxes and subsidies represent 22%. Thus, for every euro that households spend on energy, around 22 cents reflect the underlying energy inputs. The remaining 78 cents reflect the other inputs, margins and taxes involved in processing and delivering energy to households.

2.4 Energy inputs in goods and services

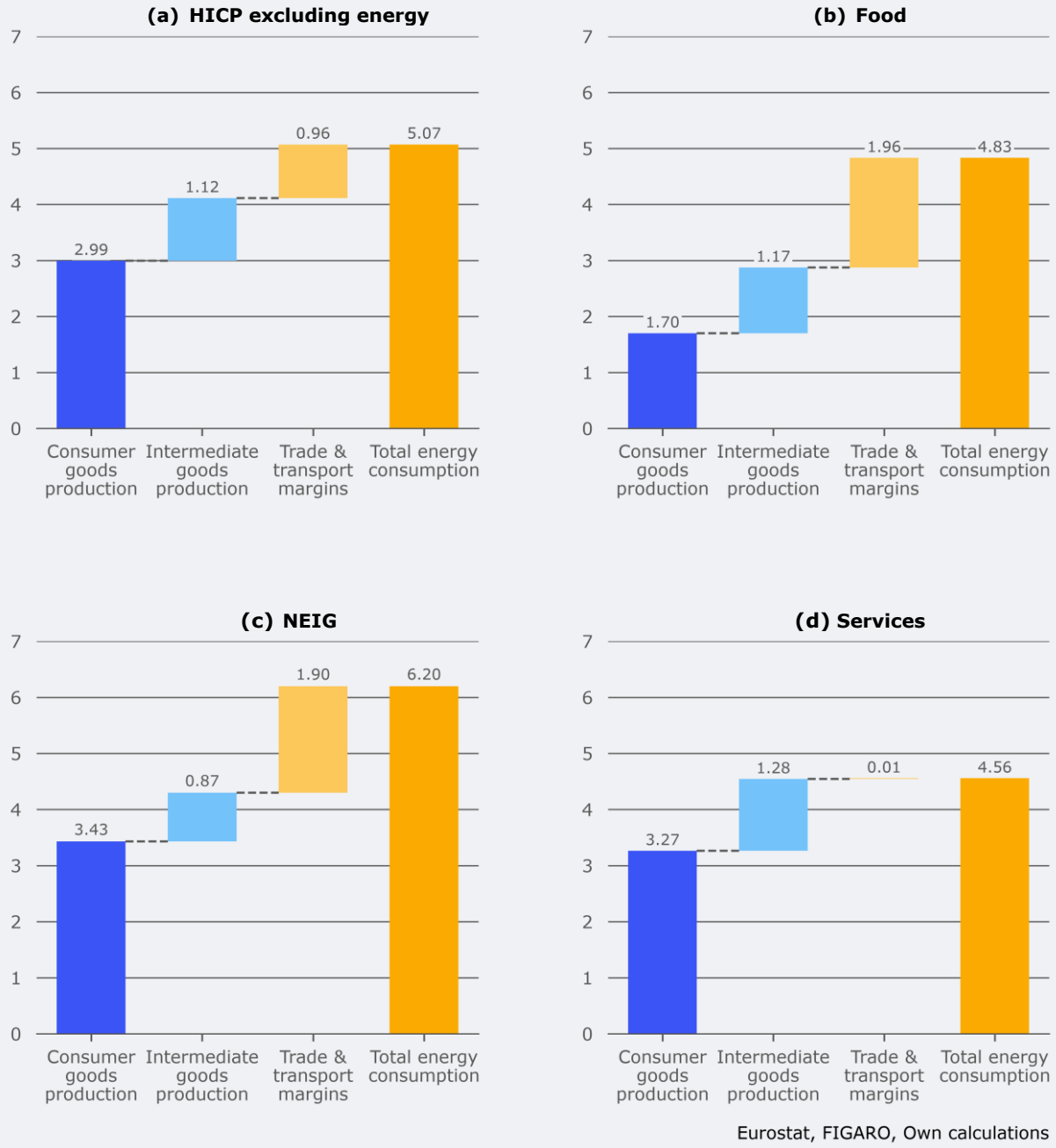
Energy inputs underlying household consumption are not confined to the HICP energy component. Energy is also used in the production of food, non-energy industrial goods and services. Assessing the overall exposure of consumer prices to energy shocks therefore requires looking beyond direct household energy expenditure to the energy embodied in other goods and services in the HICP consumption basket.

Energy inputs account for 5.1% of household consumption of non-energy goods and services, implying that energy shocks can also affect food, non-energy industrial goods (NEIG) and services. Figure 6 shows the share of energy inputs embodied in non-energy household consumption, both overall and separately for food, NEIG and services. It distinguishes between energy used upstream in the production of intermediate inputs, energy used directly in producing final goods and services, and energy used downstream in trade and transportation before the product reaches the consumer. The final bar combines these channels and shows the total energy input embodied in each consumption component. The total energy share is highest for NEIG and broadly similar for food and services. The relatively high energy content of services reflects activities such as catering, package holidays, and recreational and cultural services. Further details on the inputs used in production of non-energy goods and services are provided in Annex A.1, while Annex A.2 reports energy input shares for individual COICOP categories within NEIG and services.

Energy enters household consumption at different stages of the production chain, both upstream and downstream. For food and services, around a quarter of total energy inputs is used upstream in the production of intermediate inputs. For food and NEIG, trade and transportation account for more than a third of total energy inputs. So, a substantial share of the energy embodied in household consumption enters either before or after the final production stage. Focusing only on the energy used directly by final producers would consequently underestimate households' overall exposure to energy price shocks.

Figure 6 Energy inputs are used at different stages of goods and services production

Distribution of total energy inputs across production stages for different HICP components (p.p.)



Eurostat, FIGARO, Own calculations

Note: The figure shows how total energy inputs for each HICP component are distributed across different stages of the production process. The bars distinguish between energy used directly in the production of consumer goods and services, indirectly through intermediate goods, and in trade and transportation. Together, these contributions add up to the total energy input of each HICP component.

3 Propagation of energy shocks

This chapter shows that energy occupies a central position in production networks, enabling energy shocks to propagate through various stages of production before reaching Dutch consumers. First, we examine the role of energy in European and global production networks. Then, we identify the products that play the largest role in transmitting energy price shocks to Dutch household consumption. Manufacturing, trade and transport emerge as important propagation channels. The analysis considers a static shock and therefore does not account for adjustments within the supply chain. Moreover, we assume that increases in energy prices are fully passed on at each stage of production.

3.1 The role of energy in production networks

Energy products occupy central positions in European and global production networks, enabling energy price shocks to propagate beyond products that use energy directly. Network centrality provides an indication of how widely shocks originating in these products may propagate through the economy. To assess this, we use the Katz hub centrality methodology, which measures a product's importance as a supplier in the production network. The measure considers both direct and indirect production linkages. A product has a higher centrality score when it supplies inputs to many other products, with greater weight given to connections with products that are themselves well connected within the production network. Centrality therefore captures more than the number or size of a product's direct supply relationships: it also reflects its position in the wider production network. A higher centrality score indicates a more central position as a supplier in the production network, meaning that a shock originating in this product may reach a larger part of the production network through direct and indirect input linkages. The measure follows the Katz centrality methodology described in DNB (2026), which provides further methodological details.

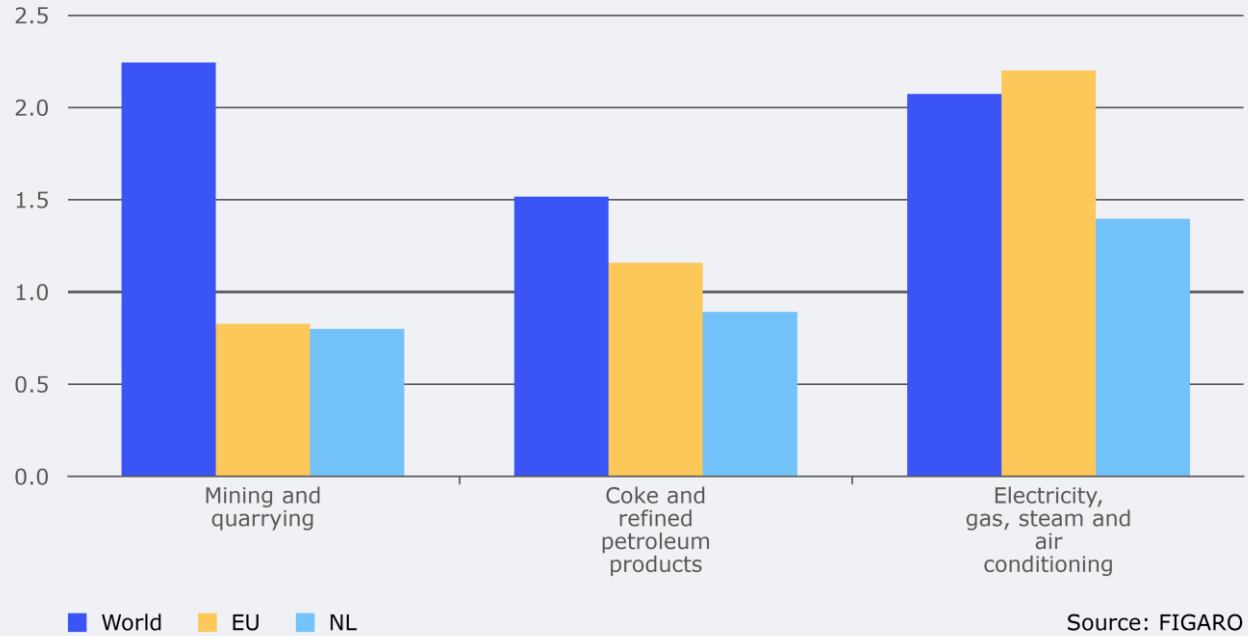
Figure 7 shows that centrality scores differ across energy products and geographical scopes of the production network. The figure compares the centrality of the three energy products across the global, EU and Dutch production networks. The global network includes all input-output linkages in the FIGARO dataset, while the EU network includes only linkages between EU countries, and the Dutch network includes only linkages between products within the Netherlands. Centrality is calculated separately for each geographical network and expressed relative to the average product centrality within that network, which is normalised to one. Values above one therefore indicate that an energy product is more central than the average within the respective network, whereas values below one indicate a less central position. Differences in centrality scores across geographical networks reflect differences in the structure of production networks (global production is more industrial whereas Dutch production is more services focused) and differences in the importance of energy.

Energy products occupy central positions in both European and global production networks. Figure 7 shows that the three energy-related products considered in this analysis play important, but somewhat different, roles in production networks. Mining and quarrying is particularly central at the global level, reflecting the upstream role of primary commodities such as crude oil, natural gas and coal. Refined petroleum products also occupy an important intermediary position in European and global value chains. Electricity and gas supply is highly central because it provides energy inputs used across a wide range of economic activities. These network positions help explain why shocks to energy markets can propagate beyond the energy products themselves and ultimately affect the costs of producing a broad range of goods and services.

The relatively high centrality scores in the global production network compared to the EU and Dutch production networks highlight the importance of the global perspective in assessing the effects of energy shocks. Mining and quarrying is particularly central in the global network. This reflects the upstream role of primary commodities such as crude oil, natural gas and coal in global production chains and complements the geographical exposure shown in Figure 4: most mining and quarrying inputs embodied in Dutch household consumption originate outside the EU. Hence, it is important to consider the entire production network to understand how energy shocks can spread to downstream goods and services. The importance of the global perspective is further illustrated by the geographical concentration of primary energy production. In 2025, the US, Saudi Arabia and Russia together accounted for around 40% of global oil production, while the US, Russia, Iran and China accounted for more than half of global natural gas production (Energy Institute, 2026). Further downstream, energy production is more geographically dispersed, with refining capacity spread across North America, Europe, Asia and the Middle East, while electricity and gas supply is more closely tied to regional energy systems and infrastructure (IEA, 2024; IEA, 2026a).

Figure 7 Energy is a central hub, especially in the global production network

Katz hub centrality relative to average centrality across different production networks



Source: FIGARO

Note: Katz hub centrality is calculated separately for the global, EU and Dutch production networks. Scores are expressed relative to average product centrality within each network, normalised to one. Values above one indicate above-average centrality within the respective network, while values below one indicate below-average centrality. The measure captures network linkages but not the geographical concentration of production.

3.2 Sectoral contributions to energy shock transmission

The contribution to energy shock transmission differs substantially across sectors, with manufacturing, trade and transport playing particularly important roles. Figure 8 shows how different sectors contribute to the transmission of shocks originating in mining and quarrying, coke and refined petroleum products, and electricity and gas supply to Dutch household consumption. A sector's contribution is larger when it uses relatively large amounts of the affected energy input and when its output is an important input in the production and distribution of consumer goods and services.

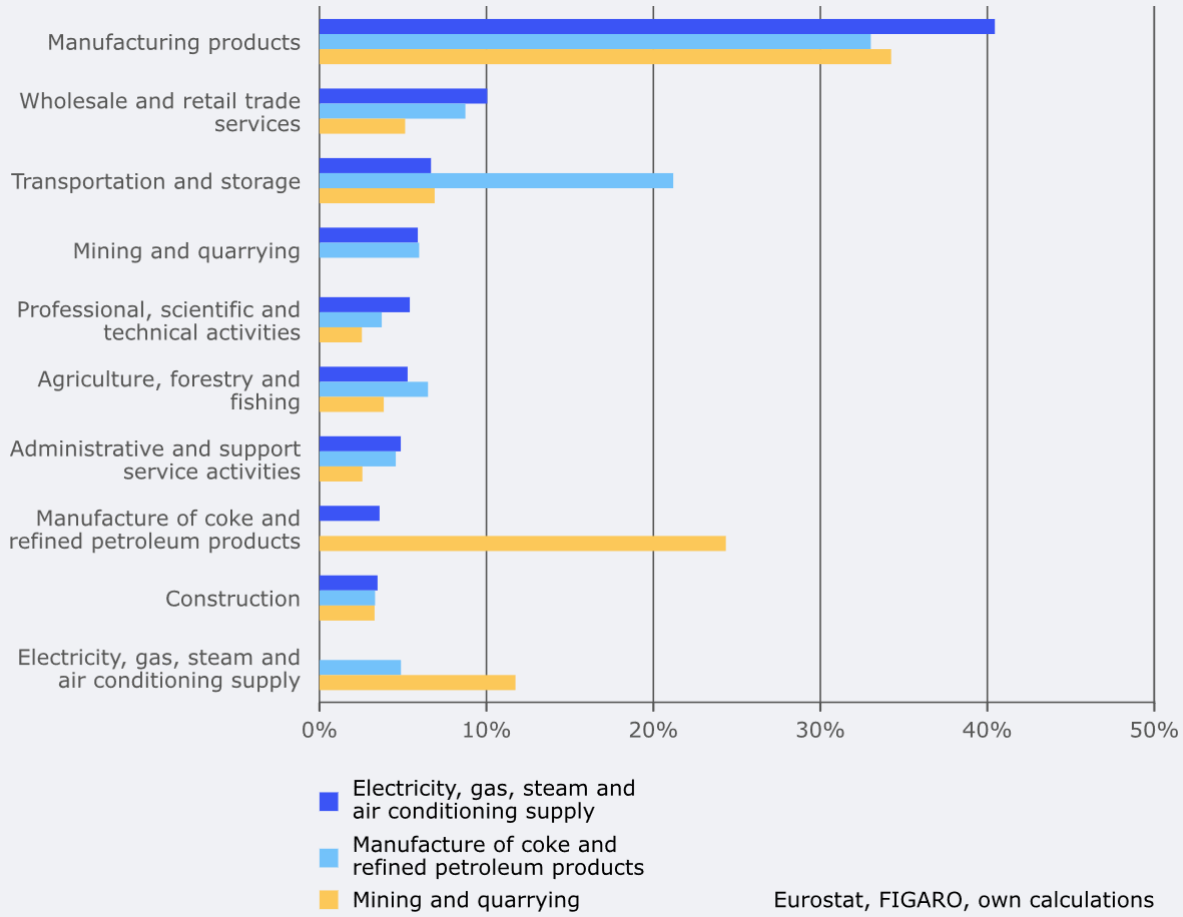
We quantify these sectoral contributions using a leave-one-supplier-out approach. Following Friesenbichler et al. (2026), each sector is removed in turn as a supplier of intermediate inputs, and its contribution is measured by the resulting reduction in the model-implied HICP effect relative to the full production network. A larger reduction indicates a larger role in propagating an energy shock. Further methodological details are provided in the final part of Annex A.4.

Manufacturing, wholesale and retail trade, and transport and storage emerge as key transmission sectors. Figure 8 shows the ten sectors that contribute most to the transmission of energy shocks to Dutch household consumption. Although their relative importance varies across the three energy shocks, there is considerable overlap in the sectors through which these shocks propagate. Manufacturing plays a particularly important role, accounting for more than 30% of total sector contributions. In the case of a mining and quarrying shock, coke and refined petroleum products and electricity and gas supply are also important propagation channels. Together, they account for around 37% of total sector contributions, reflecting their reliance on mining and quarrying inputs.

The importance of trade and transport and storage varies more strongly across shocks. Together, "wholesale and retail trade; repair of motor vehicles and motorcycles" and "transportation and storage" account for around 10% of total sector contributions for a mining and quarrying shock (B), 30% for a refined petroleum products shock (C19), and 17% for an electricity and gas supply shock (D35). Agriculture, forestry and fishing makes a smaller, but still relevant, contribution of around 3% to 5%, depending on the type of energy shock.

Figure 8 Manufacturing and trade services are important to monitor for the transmission of energy shocks

Top 10 products contributing to the transmission of energy shocks to energy-related products



Note: The bars represent the percentage contributions to the transmission of a shock in one of the three energy-related products, with a different colour for each energy type. The figure only shows the top 10 contributing products; contributions across all products sum to 100%. A bar is absent when the sector in question is also the sector in which the shock originates. In the leave-one-supplier-out analysis, a sector is not considered to transmit a shock originating within that same sector, so its contribution is set to zero. As a result, only two bars are shown for each of the three shock-sector categories.

4 Impact of energy shocks on inflation

Energy price shocks affect consumer prices beyond the direct energy component, with indirect and second-round effects emerging gradually over time. The input-output analysis in the previous chapters identifies the exposure of Dutch household consumption to energy shocks implied by observed input use and production linkages, as well as the sectors through which these shocks could propagate. However, it does not capture firms' pricing behaviour or actual transmission to consumer prices. This chapter therefore empirically examines how oil and gas supply shocks affect Dutch consumer inflation and its main components. While the previous chapter considers a static increase in energy prices that is fully passed on through the production network, here we identify sudden changes in energy prices driven by news about oil and gas supply and trace their effects on inflation over time.

The results show that the transmission of energy shocks to consumer prices is gradual and persistent. Household energy prices respond relatively quickly, whereas effects on food, NEIG and services typically emerge after around four to eight months after the shock and can persist for several years. This pattern is consistent with firms gradually passing higher energy costs on to consumer prices and with wages adjusting to increases in the cost of living. The persistent response of services inflation may also be indicative of broader second-round effects. Moreover, the magnitude and speed of pass-through depend on economic conditions, implying that the inflationary impact of an energy shock can vary over the business cycle. Sections 4.2 and 4.3 examine these dynamics in more detail.

Historical estimates provide a useful benchmark for assessing the potential inflationary impact of the 2026 energy shock, but its transmission may differ from past episodes. The exceptional size of the disruption, as well as prevailing energy market and macro-economic conditions, may affect both the magnitude and speed of pass-through. Importantly, historical evidence suggests that the inflationary effects of an energy shock can continue well beyond the initial increase in household energy prices as higher costs gradually feed through to food, industrial goods and services and potentially generate second-round effects. Part of the inflationary impact of the 2026 shock may still lie ahead. Section 4.4 examines this issue and discusses which circumstances may amplify or dampen the pass-through of the current shock.

4.1 Supply shocks in oil and gas prices

The global nature of the oil market provides some flexibility in responding to disruptions. Oil trade relies on specialised infrastructure, including pipelines, tankers, ports and terminals, storage facilities, and refineries, so it is not frictionless. However, crude oil is generally easier to transport and store than natural gas, and most internationally traded oil is shipped by tankers. Cargoes can therefore often be redirected across regions when supply from a particular producer is disrupted, making conditions in the global market more important for European oil prices than the precise geographical origin of European imports (IEA, 2024). Commercial and strategic inventories provide additional buffers. These adjustment mechanisms can help dampen price effects: inventories can bridge temporary shortfalls, trade flows can be rerouted, and higher prices can, where spare capacity exists and generally with some delay, elicit additional supply, reduce demand, and encourage substitution. Nevertheless, crude oil production and trade remain concentrated among a limited number of major producers and strategic transport routes: OPEC members accounted for around 36% of global crude oil production in 2024, while around one-quarter of global seaborne oil trade passes through the Strait of Hormuz (OPEC, 2025; EIA, 2026). Increasing geo-economic fragmentation could reduce the scope to switch between suppliers across geopolitical blocks and thereby amplify the price effects of disruptions (Alvarez et al., 2023).

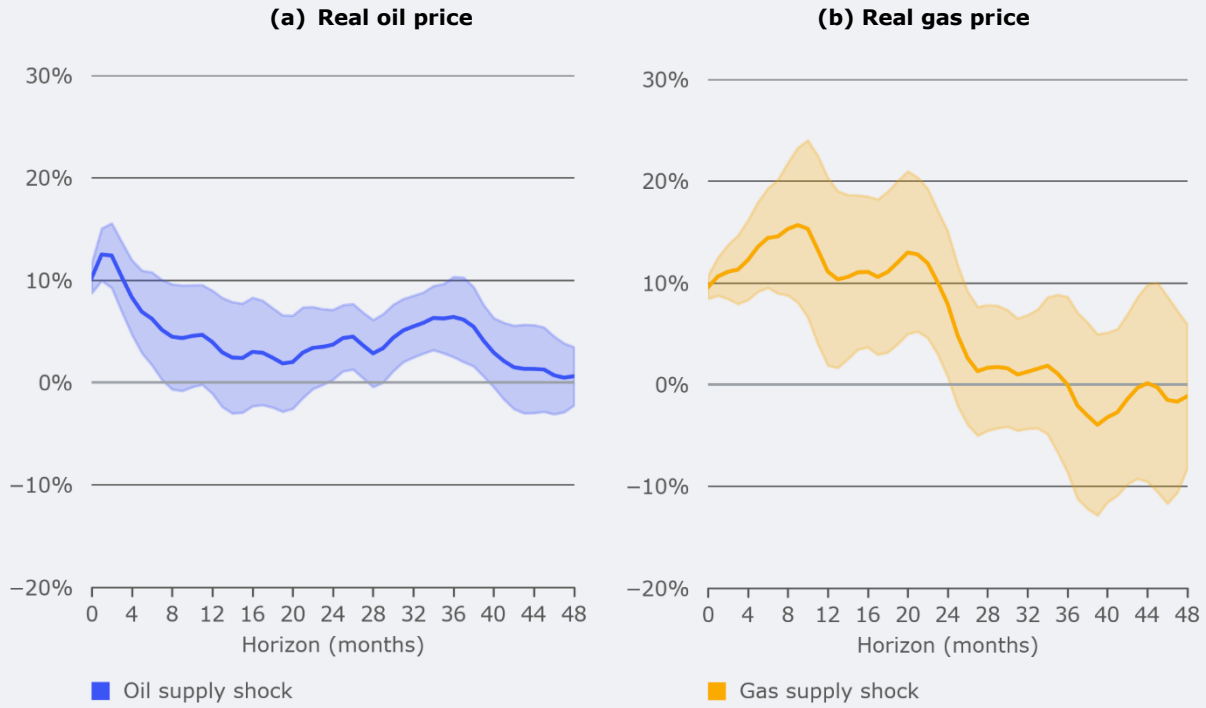
For natural gas, markets are more segmented because trade depends more strongly on route- and facility-specific transport infrastructure. Pipeline gas can only be redirected where connections and spare capacity are available, while LNG trade requires liquefaction capacity in exporting countries, specialised shipping, regasification capacity at the destination, and access to onward pipeline networks. Gas markets have therefore historically been more regional than oil markets, although the expansion of LNG trade has increased market integration and the scope for substitution between regions (Adolfsen et al., 2023; IEA, 2025b). This infrastructure dependence can make it difficult to replace lost supply at short notice and can cause disruptions to have particularly large regional price effects. This became apparent following Russia's invasion of Ukraine, when Europe had to replace substantial volumes of Russian pipeline gas by attracting LNG cargoes from the global market. Europe has since diversified its gas supply and expanded its reliance on LNG, reducing its dependence on Russian pipeline gas but increasing its exposure to the global LNG market, shipping conditions and competition with other importing regions (Adolfsen et al., 2023; ACER, 2024).

To estimate the effects of energy supply shocks on consumer prices, we use the news-based oil and gas supply shocks developed by Känzig (2021) and Alessandri and Gazzani (2025). These identification strategies use energy price movements associated with specific supply-related news to distinguish supply shocks from price changes driven by broader demand or business cycle developments. The shocks are scaled so that the initial response of the relevant energy price is 10% for both oil and gas. This normalisation makes the impact responses comparable, but it does not imply that oil and gas prices follow the same path thereafter. Differences between the estimated oil and gas price paths may reflect differences in the nature of the underlying oil and gas price shocks, as well as differences in market structures and how these shocks propagate. Figure 9 illustrates these dynamics by plotting the responses of real oil and gas prices to oil and gas shocks, respectively. By deflating commodity prices with the euro area HICP, we abstract from movements in the general price level and focus on the evolution of commodity prices relative to aggregate consumer prices. Despite being normalised to the same initial 10% price increase, the subsequent responses of oil and gas prices differ. One year after their respective shocks, oil prices are approximately 3% higher than before the shock, while gas prices are 10% higher. The gas price effect of the shock has disappeared 24 months after the shock. The oil-price response is more persistent and hovers around 3% 24 months after the shock. These differences in the intensity and persistence of the price responses seem to suggest differences in market structures and flexibility in adjustment for oil and gas.

Local projections (LPs), introduced by Jordà (2005), are used for estimating the dynamic effects of oil and gas shocks. The approach traces how a variable of interest evolves following a shock by estimating a sequence of regressions, one for each forecast horizon. The resulting coefficients can be interpreted as an impulse response function, describing the path of the variable over time after the shock occurs. Estimates at longer horizons should, however, be interpreted with caution, as they can become less precise, as reflected in wider confidence bands. Section A.5 of the Appendix discusses local projections and the model specifications in greater detail.

Figure 9 Gas prices initially respond more strongly to supply shocks, while oil-price responses seem more persistent

Impulse response functions of oil and gas to a news supply shock that cause the real oil and gas price to rise by 10% on impact.



Note: The shaded areas are the 90% confidence bands. The impulse response functions are smoothed using a 3-month centred moving average over horizons.

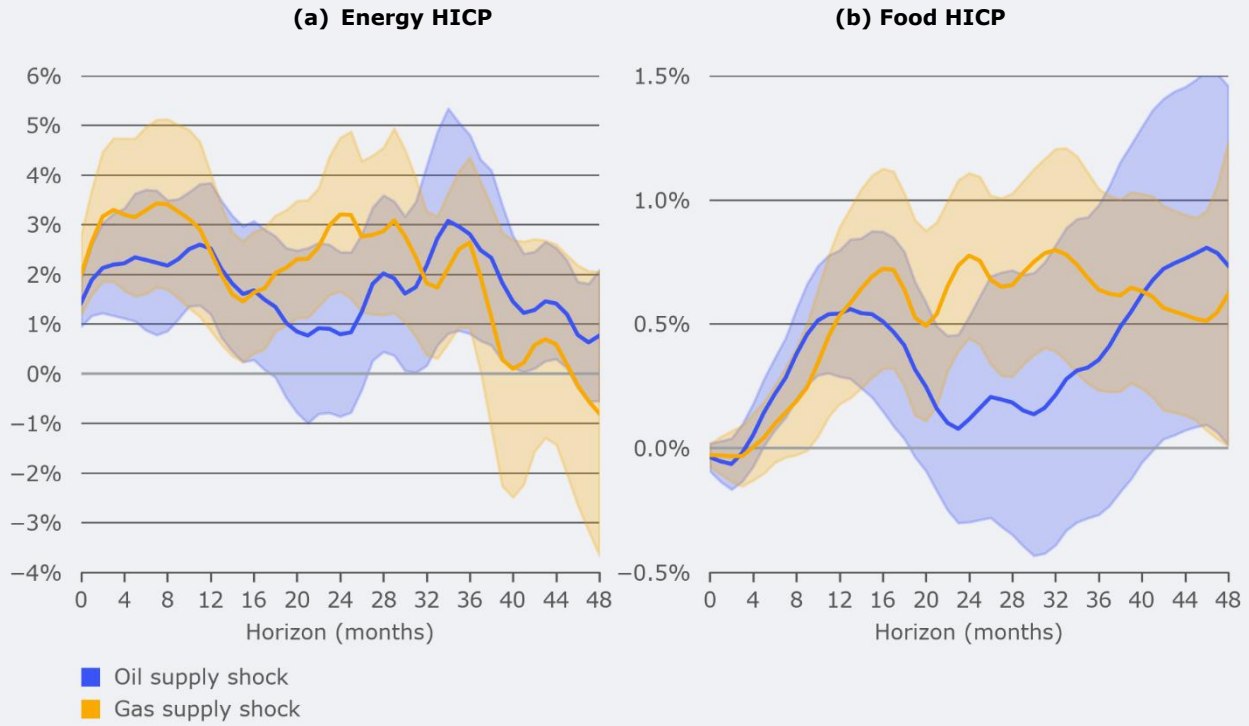
4.2 Inflationary impact of an oil and gas price shock

Oil and gas supply shocks affect consumer prices with different speeds and intensities across inflation components. The estimates show that energy shocks affect inflation through both direct and indirect channels. Direct effects are visible relatively quickly in household energy prices, while indirect effects emerge more gradually through higher production, transportation and distribution costs in other sectors of the economy. As a result, the inflationary consequences of an energy shock unfold over several years rather than appearing immediately across all components of the consumer basket.

The initial impact of oil and gas supply shocks is visible in household energy prices. Figure 10 (left-hand scale) shows that both shocks lead to an immediate increase in energy HICP, with the response peaking within six months. The initial response to a gas shock is stronger than that to an oil shock, likely reflecting the greater importance of gas in household energy consumption and its role in electricity generation. The stronger response to the gas shock in the first year likely reflects the larger first-year response of gas prices compared with oil prices. Despite this difference in the short-run response, the longer-run effects are similar: for both shocks, the cumulative impact approaches zero by the end of the horizon.

Figure 10 Energy prices respond immediately to energy supply shocks, while food prices respond with a lag

Impulse response functions of Energy HICP and Food HICP to oil and gas shocks that move the real oil and gas price 10% on impact



Note: The y-axis scale in the left-hand panel differs from that in the right-hand panel. The shaded areas are the 90% confidence bands. The impulse response functions are smoothed using a 3-month centred moving average over horizons.

Food prices respond gradually to both oil and gas shocks (Figure 10, right-hand scale). Energy enters the food supply chain at several stages, including agricultural production, fertiliser manufacturing, food processing, refrigeration and transportation. Higher energy costs can therefore feed through to food prices through various production stages. During the first year, the responses to oil and gas shocks are similar, but they diverge thereafter as the effect of the oil shock gradually diminishes relative to that of the gas shock. By the end of the projection horizon, however, the cumulative effects of both shocks have largely dissipated.

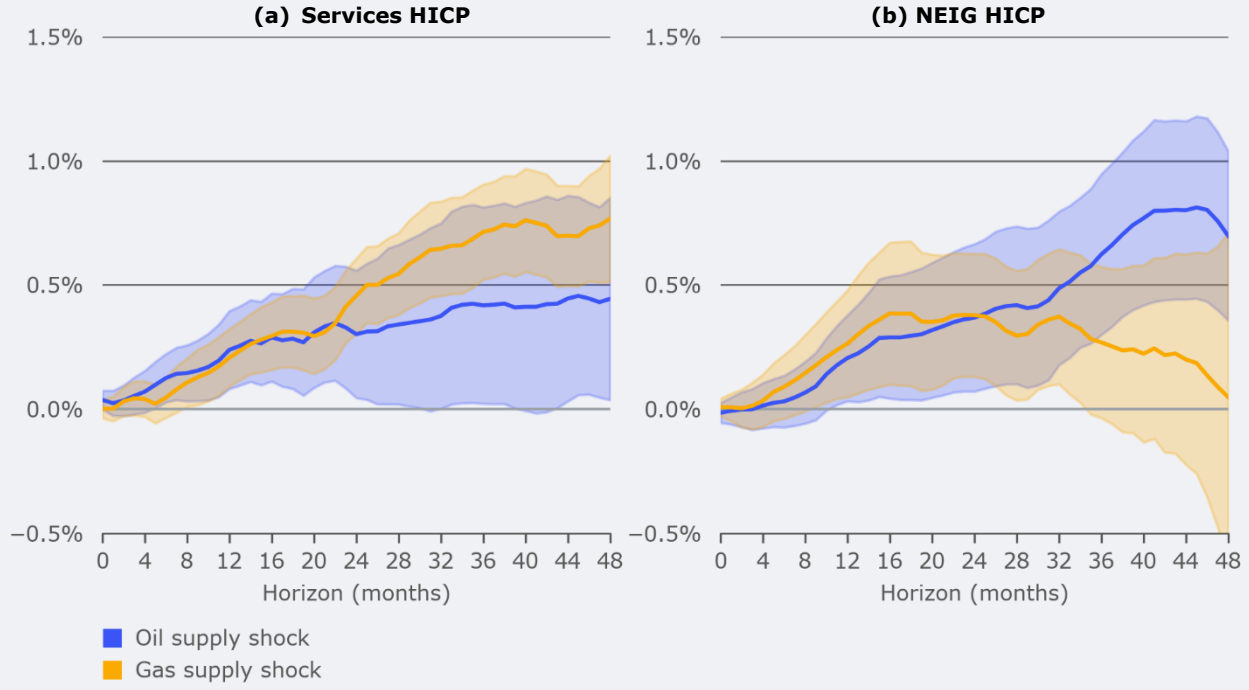
Non-energy industrial goods also show a delayed response, which is even more gradual than for food (Figure 11). This is consistent with the importance of energy inputs at different stages of NEIG production, as documented in Section 2.4. Although the static analysis indicates a higher energy input share for NEIG than for food, the estimated price responses are of similar magnitude. The longer-run effects differ between the two shocks: following a gas shock, the NEIG price level eventually returns towards its pre-shock level, whereas an oil shock leaves a persistent increase of around 0.5%. The long-term response to the gas shock should, however, be

interpreted with caution, as the confidence intervals widen considerably at longer horizons. The difference between the estimated responses may reflect differences in the underlying energy price dynamics: gas price shocks are initially larger but fade more rapidly, whereas oil price shocks are more gradual and persistent, resulting in a more prolonged pass-through to NEIG prices.

Services prices respond most slowly, but the effects are also the most persistent (Figure 11). Services use less energy directly than manufacturing but are indirectly exposed through transport, commercial buildings, catering, tourism and purchased intermediate inputs. Energy shocks may also affect services prices through second-round effects, including wage adjustments in response to higher living costs. The responses to oil and gas shocks begin to diverge after around two years, with gas shocks producing a more persistent increase in the services price level. This pattern is consistent with the stronger initial increase in gas prices and the extended period for which they remain elevated. A more prolonged period of high energy prices may provide greater scope for indirect and second-round effects to feed through to services prices.

Figure 11 Services and NEIG prices respond to energy supply shocks with a lag

Impulse response functions of Services HICP and NEIG HICP to oil and gas shocks that move the real oil and gas price 10% on impact.



Note: The shaded areas are the 90% confidence bands. The impulse response functions are smoothed using a 3-month centred moving average over horizons.

The full pass-through of an energy shock to consumer prices takes several years to materialise. While the immediate impact is concentrated in household energy prices, headline HICP continues to rise after the direct energy effect has peaked, as higher energy costs gradually pass through to other components of the consumption

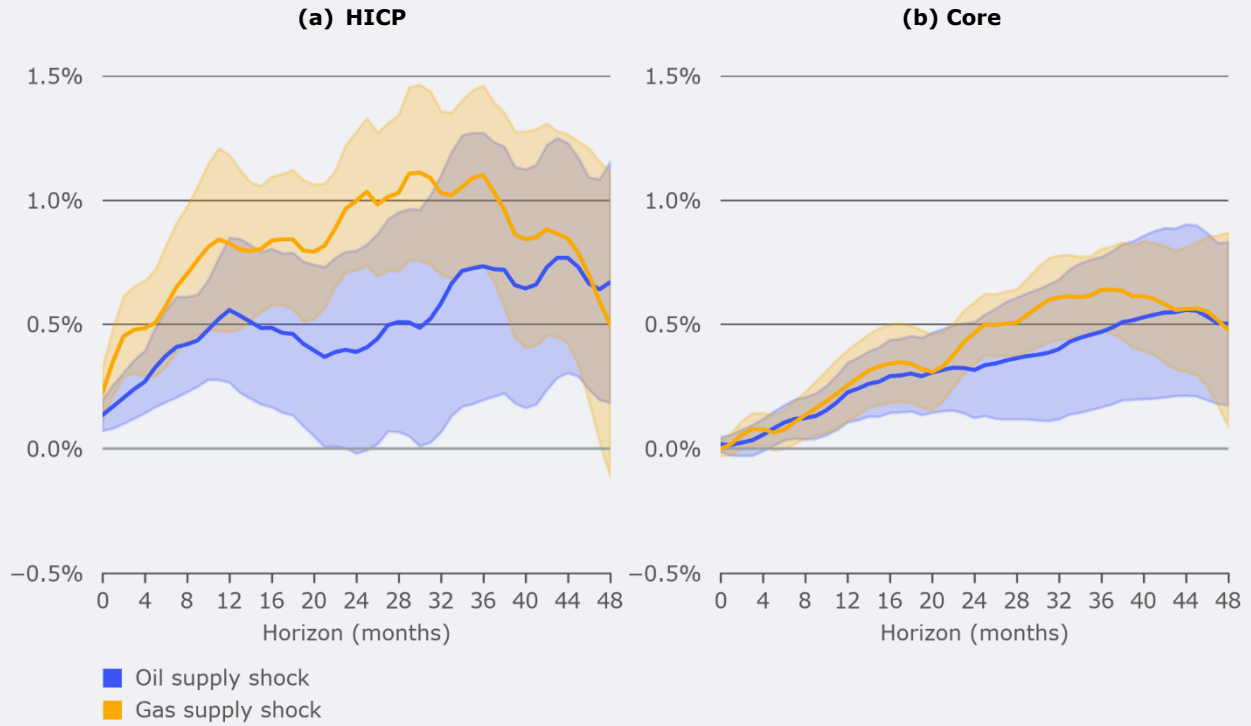
basket (Figure 12). The transmission differs between oil and gas shocks. A gas price shock generates a substantially larger peak response in headline HICP, raising the price level by around 1.1%, compared with roughly 0.6% following an oil price shock. This reflects the stronger initial increase in gas prices. The effect of the gas shock subsequently fades, whereas the effect of the oil shock is more persistent. Despite these different adjustment paths, the estimated effects on the HICP price level are similar towards the end of the projection horizon.

The comparison between headline and core HICP highlights the gradual broadening of inflationary pressures. Headline HICP responds immediately through its energy component, whereas core HICP increases more gradually as higher energy costs pass through to food, manufactured goods and services. The inflationary impact of an energy shock therefore cannot be assessed solely from its initial effect on household energy prices: broader price pressures may continue to build even after the direct energy effect has peaked.

Taken together, the results suggest that energy shocks can leave a persistent imprint on the overall price level. Food, NEIG and services prices continue to respond well after the initial increase in energy prices. This delayed response is consistent with firms gradually passing higher costs on to consumers as contracts are renewed and inventories are replenished. The particularly persistent response of services prices may also reflect broader second-round effects, including wage adjustments in response to higher living costs. Energy shocks therefore spread well beyond the energy component itself, propagating through production networks and gradually affecting a broad range of consumer prices.

Figure 12 Indirect effects account for important part of the inflationary impact of energy shocks

Impulse response functions of headline HICP and Core HICP to oil and gas shocks that move the real oil and gas price 10% on impact.



Note: The shaded areas are the 90% confidence bands. The impulse response functions are smoothed using a 3-month centred moving average over horizons.

4.3 Difference in pass-through: positive versus negative output gaps

The extent to which energy price shocks translate into consumer price inflation depends not only on the size of the shock itself but also on the broader macroeconomic environment. When the economy is operating below potential, weak demand may limit firms' ability to pass higher energy costs on to consumers. In contrast, periods of strong economic activity are likely to provide greater scope for price adjustments. To examine whether the transmission of energy price shocks varies over the business cycle, we compare the pass-through for positive and negative output-gap regimes.

To assess whether the transmission of energy price increases to consumer prices depends on the state of the business cycle, we focus on pass-through rather than the impulse responses presented above. The impulse response functions illustrate how inflation responds to an energy price shock. This response combines the effect of the shock on energy prices with the transmission of those energy price changes to consumer prices. The pass-through, on the other hand, normalises the response such that it answers the question: given a 1% increase in energy prices, how much of that increase feeds through to inflation? In other words, the pass-through

analysis controls for differences in the magnitude of the oil and gas price reaction. This is important because the same shock can generate very different oil and gas price responses depending on whether the output gap is positive or negative. Consequently, differences in inflation impulse responses may reflect differences in the energy price response itself rather than differences in pass-through. By controlling for these differences, the pass-through analysis allows us to compare, on a like-for-like basis, how strongly a given increase in energy prices is transmitted to consumer prices across different phases of the business cycle.

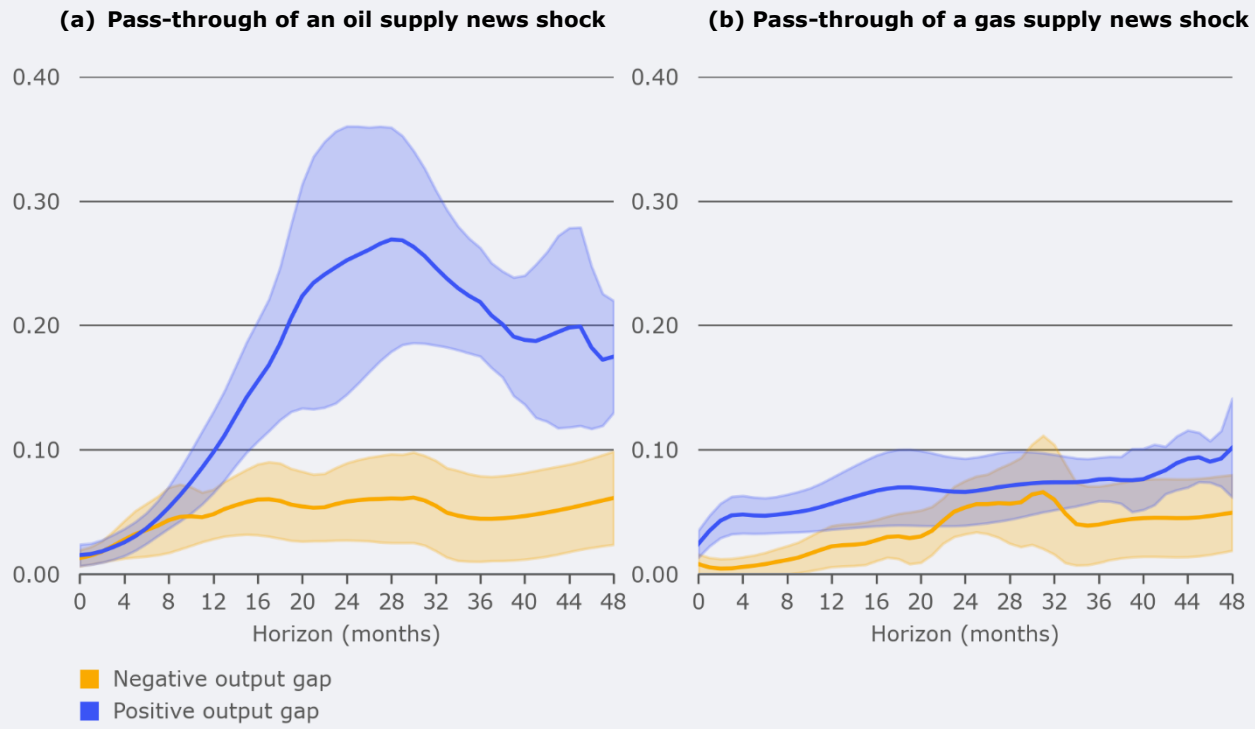
Figure 13 shows that the pass-through of energy price increases differs depending on the state of the economy. For oil, the difference is mainly in the magnitude of pass-through: transmission is weaker when the output gap is negative and stronger when it is positive. For gas, the difference is particularly pronounced in the short run, with pass-through occurring more rapidly when the output gap is positive. Interpretation of the state-dependent results warrants some caution, as the largest energy price shocks in the sample occurred during periods with a positive output gap, while comparable shocks are largely absent during periods with a negative output gap.

The results reveal particularly strong state dependence for oil price shocks. On average, a 1% increase in oil prices raises headline inflation by around 0.09%. However, this pass-through is substantially lower when the economy is operating below potential and significantly higher when output is above potential. This finding is consistent with firms being better able to pass higher production costs on to consumers when demand is strong. When demand is strong, firms appear better able to raise prices, amplifying the transmission of oil price increases to inflation. Moreover, wage responses to higher energy prices are also likely to be state-dependent. In periods of strong economic activity, workers may be better able to secure compensating wage increases, which can generate additional inflationary pressures through second-round effects.

In contrast to oil prices, the main business-cycle effect for gas prices appears to operate through the speed rather than the ultimate extent of pass-through. When the economy is operating below potential, the short-run transmission of gas price increases to headline inflation is limited and initially close to zero. Over time, however, pass-through gradually increases, indicating that higher gas costs are eventually transmitted to consumer prices even when the output gap is negative. When economic activity is above potential, pass-through occurs much more rapidly, consistent with firms having greater scope to raise prices in response to higher production costs. As a result, differences in the long-run pass-through of gas price shocks across business-cycle states are relatively modest, while short-run differences are substantial.

Figure 13 Pass-through of energy shocks to HICP is state dependent

Pass-through of oil and gas shocks to headline inflation over time in either a positive output gap state or negative output gap state



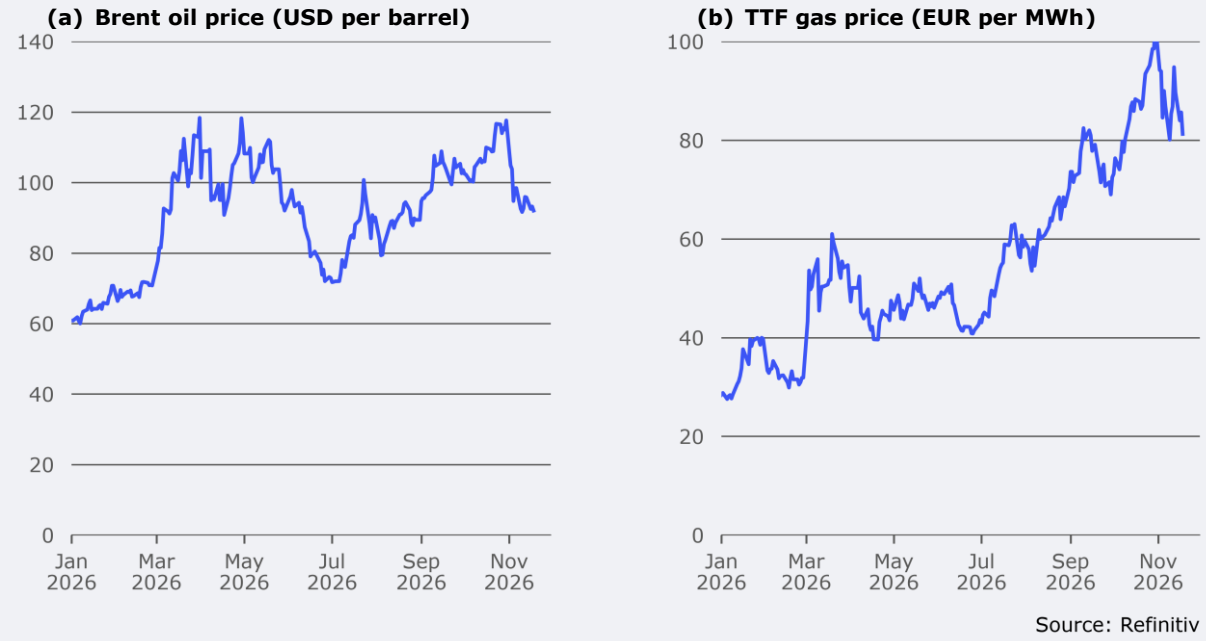
Note: The shaded areas are the 90% confidence bands. The impulse response functions are smoothed using a 3-month centred moving average over horizons.

4.4 What does this tell us about the 2026 energy shock?

As tightness in oil and gas markets persists, energy prices remain elevated. Oil and gas prices initially rose sharply following the escalation of the conflict in the Middle East, but their paths have diverged since the summer (Figure 14). Crude oil prices have increased more moderately, as the Persian Gulf oil exports are recovering towards their 2025 average (IEA, 2026b). European gas prices, by contrast, have risen more strongly since July as LNG flows through the Strait of Hormuz remain only a fraction of pre-war levels and Europe increasingly competes for LNG cargoes to rebuild inventories ahead of winter (IEA, 2026c). In early November, EU gas storage stood at 74% of capacity, roughly 15 percentage points below its historical seasonal average and at its lowest level at the start of the heating season since 2013 (GIE, 2026; IEA, 2026a). Low inventories provide a smaller buffer against additional shocks, making European gas prices more sensitive to a cold or prolonged winter, further disruptions to pipeline or LNG supply or stronger competition for LNG cargoes from Asia (ENTSOG, 2026; IEA, 2026a). A large drawdown over the winter could also increase Europe's need to replenish inventories in the summer of 2027, potentially keeping gas prices elevated for longer (IEA, 2026a).

Figure 14 Crude oil and gas price paths differ in 2026

Developments in oil and gas prices



Note: The data series end on 18 November 2026.

Several factors could either amplify or dampen the inflationary effects of the 2026 energy shock. Compared with the average shock underlying the estimation sample, the current energy shock is substantially larger (Reuters, 2026) and the relationship between shock size and pass-through might be non-linear. On the one hand, several factors may reinforce inflationary pressures. Large energy price shocks can lead firms to adjust prices more frequently, resulting in stronger pass-through (Bobeica et al., 2025; Cavallo, Lippi and Miyahara, 2024). In addition, relatively low European gas storage levels could amplify the impact of supply disruptions on wholesale gas prices (IEA, 2026), while heightened inflation salience following the recent episode of elevated inflation may increase the likelihood of indirect and second-round effects. On the other hand, several factors may dampen inflationary pressures. Large shocks may induce substitution away from energy-intensive goods and services, reduce demand, and trigger inventory releases and supply responses, including additional LNG supply, thereby mitigating part of the initial energy price increase (IEA, 2023; Demuth, Manu and Stalla-Bourdillon, 2026). Moreover, weaker aggregate demand and a negative output gap could restrain firms' pricing power. Finally, monetary and fiscal policy responses may affect both the magnitude and speed of pass-through, particularly because exceptionally large shocks are more likely to trigger policy interventions than the average shock in the estimation sample (Adolfsen et al., 2024; De Santis and Tornese, 2025; López et al., 2024; Dao et al., 2023). The main implication of the historical estimates is therefore not a precise prediction of the size of the inflationary impact, but that the effects of the 2026 energy shock are likely to extend well beyond 2026.

Despite these important differences, the development of oil and gas prices in 2026 broadly follows the patterns suggested by the historical estimates. Oil prices responded relatively quickly following the disruption of shipping through the Strait of Hormuz in March 2026, whereas gas prices increased more gradually and gained momentum from July onwards. This is consistent with the impulse response functions, which indicate that the response of oil prices is concentrated earlier after a supply shock, whereas the response of gas prices builds for longer and peaks after around eight months. This comparison should, however, be interpreted with caution. Whereas the historical impulse responses capture the effect of an isolated supply shock, the 2026 episode likely reflects a sequence of disruptions of varying magnitude occurring over several months. The historical estimates are therefore more informative about the timing and shape of the price response than about the precise magnitude of the observed price increases.

The direct price level effects observed in 2026 so far are qualitatively consistent with the estimated dynamics, although the transmission to household gas and electricity prices has been slower. Fuel prices increased immediately following the energy shock in March. Similarly, the estimated impulse responses show that the first effects on energy HICP appear on impact and increase during the subsequent months. For gas and electricity, however, the observed adjustment has been slower than the historical estimates would suggest. One important explanation is the change in the measurement of household energy prices by CBS. Since June 2023, the price index has taken into account the prices paid under existing energy contracts rather than only the tariffs of newly concluded contracts (CBS,2023). According to the "Monitor Consumentenmarkt Energie" published by the Autoriteit Consument & Markt (ACM), a substantial share of households currently has fixed-price contracts. As a result, changes in wholesale energy prices feed through to measured consumer prices only gradually as contracts are renewed.

The path of food inflation in 2026, by contrast, appears to differ from the estimated historical response. The historical estimates suggest that the effect of an energy shock on food inflation starts to become more pronounced around four to eight months after the shock and peaks considerably later. This would imply increasing upward pressure from the March energy shock during the second half of 2026. Yet actual food inflation declined and even turned negative in August and September. However, this does not necessarily contradict the estimated response, as observed food inflation reflects many developments besides the energy shock. Favourable earlier developments in farm-gate and food producer prices exerted downward pressure on food inflation, while more recently the contribution from energy-related costs has started to increase (DNB, 2026b). The historical estimates therefore suggest that the contribution of the energy shock may increase further, with material effects potentially extending into 2027.

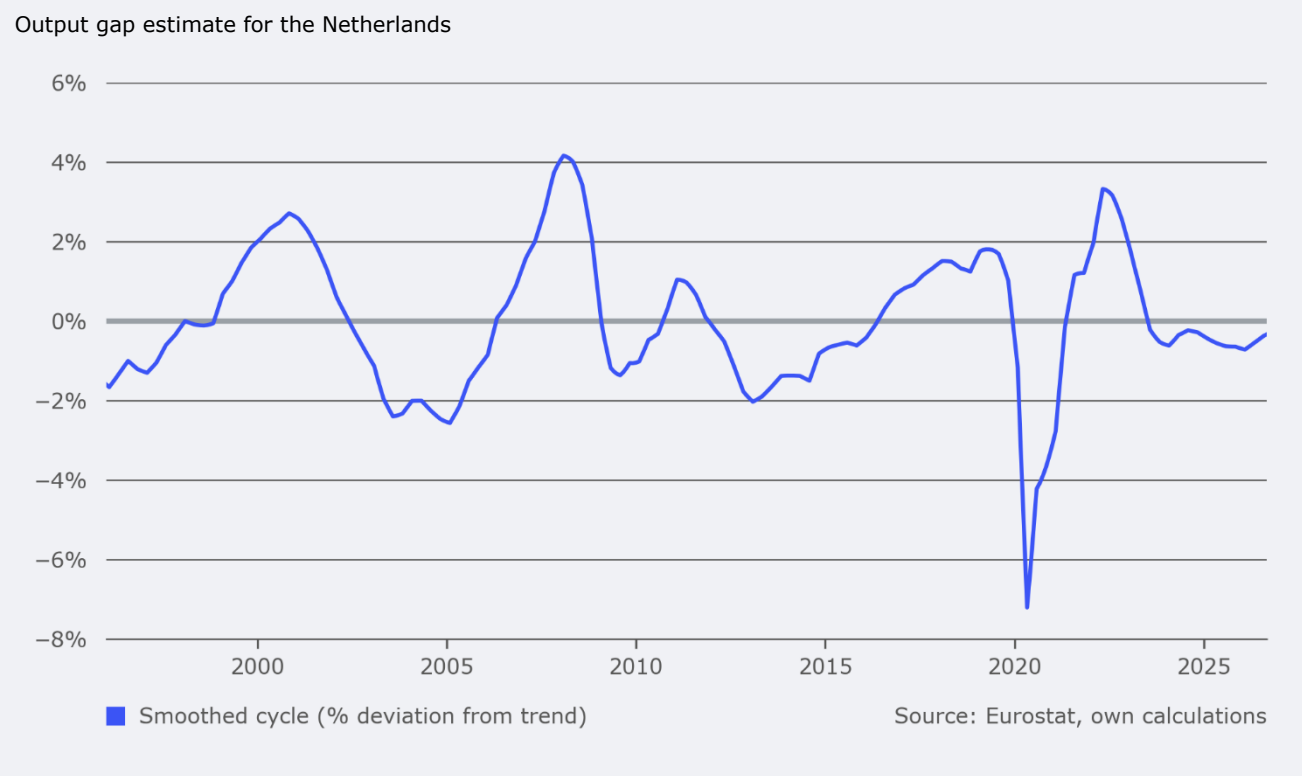
For core inflation, the historical estimates point to an even more gradual transmission, consistent with the absence of a clear increase in core inflation so far in 2026. The estimated indirect effects take substantially longer to emerge than the direct effects on household energy prices. For NEIG inflation, the estimated response peaks approximately one and a half years after the shock, while for services the peak occurs only after around two to three years. Based on these historical relationships, the indirect effects of the March 2026 energy shock could therefore become more visible in 2027 and beyond.

More generally, the inflationary consequences of the energy shock are unlikely to be confined to 2026 and may become more visible in 2027. The results in Section 4.2 suggest that household energy prices respond quickly and directly, and that higher energy costs eventually propagate to food, industrial goods and services price

levels. Even if oil and gas prices subsequently decline, part of the shock may continue to affect prices across the Dutch consumption basket for several years. The eventual inflationary impact will therefore depend not only on how energy prices themselves develop, but also on the extent and speed with which higher energy costs are passed through to food, industrial goods and services.

At the same time, current macroeconomic conditions suggest the transmission could be weaker than during the 2022 energy shock. The state-dependent estimates in Section 4.1 indicate that the transmission from oil and gas price increases to consumer prices is stronger when the output gap is positive than when it is negative. Our estimates suggest that the Dutch output gap is slightly negative (Figure 15), potentially limiting firms' ability to pass higher input costs on to consumers. However, output gap estimates are subject to uncertainty and can change as new information becomes available. As a result, this interpretation should be viewed as indicative rather than definitive. This contrasts with 2022, when the output gap was generally estimated to be positive.

Figure 15 Demand conditions are weaker in 2026 than during the 2022 energy crisis



5 Conclusion and policy implications

Energy is used throughout the production chains underlying Dutch household consumption and originates to a large extent from outside the Netherlands and the EU. The geographical exposure differs across energy products. Primary energy inputs, including crude oil and natural gas, originate predominantly outside the EU. To a lesser extent, this also holds for refined petroleum products. Electricity and gas supply, by contrast, are more Dutch and European in origin. In addition, part of the energy embodied in Dutch consumption enters through production chains abroad. Adequate infrastructure, storage and strategic reserves, together with diversified suppliers and transport routes, can strengthen resilience to physical supply disruptions. However, these measures cannot shield Dutch inflation from international energy price shocks. Oil is traded in a highly integrated global market, while the growing role of LNG has increased the integration of regional gas markets. Supply disruptions abroad can therefore raise the prices faced by Dutch consumers and producers even when Dutch physical energy supplies are not directly interrupted. Furthermore, global disruptions to gas markets also affect electricity prices as gas-fired plants frequently set the marginal electricity price. Strategic reserves and diversification can reduce the vulnerability of Dutch households and firms to physical supply disruptions, but exposure to global energy price movements and shocks transmitted through international production chains remains.

Energy supply shocks can have broad and persistent effects on Dutch inflation, extending well beyond their initial impact on household energy prices. The empirical results show that the inflationary effects of energy shocks materialise gradually. Household energy prices respond relatively quickly, while the responses of food, non-energy industrial goods and services build over a longer period. This pattern is consistent with higher energy costs passing through successive stages of production, transport and distribution before reaching consumer prices. Consequently, broader inflationary effects can continue to materialise after the initial pressure on household energy prices has started to fade. The production network analysis provides additional insight into the sectors through which these cost pressures may propagate: manufacturing, wholesale and retail trade, and transport and storage make relatively large contributions to the transmission of the energy shocks considered in this analysis. Developments in these sectors can therefore provide relevant information about the extent to which an energy shock is spreading through production chains, although the analysis does not imply that higher costs in these sectors are necessarily or fully passed on to consumers.

While indirect and second-round effects following the March 2026 energy shock have so far remained limited, historical estimates suggest that its inflationary effects could extend well beyond 2026, although their magnitude and timing remain uncertain. Indirect effects start to become more pronounced around four to eight months after an energy shock, initially through components such as food, while the transmission to core inflation takes considerably longer. In particular, services prices respond only gradually and remain affected for several years, a pattern that may reflect broader second-round effects, including gradual wage adjustments. Applied to the current shock, these historical patterns suggest that broader inflationary pressures could become more visible from late 2026 onwards and continue into 2027 and beyond, even if energy prices themselves start to decline. The magnitude of the effect, however, is uncertain. The relatively large size of the shock could lead firms to adjust prices more frequently and the 2022 period of elevated inflation may make firms and households more responsive to renewed price increases, increasing the risk of indirect and second-round effects. At the same time, large energy price increases can trigger more substitution, lower demand, inventory releases and additional supply, limiting the increase in energy prices. In addition, fixed household energy contracts could delay the pass-through of higher wholesale gas and electricity prices to consumer energy prices, since price adjustments only gradually reach households as contracts are renewed. Moreover, demand pressures in the Dutch

economy are currently weaker than during the 2022 energy shock, which means that firms may have less scope to pass higher costs on to consumers and workers may have less scope to secure compensating wage increases. Historical estimates therefore provide useful information about the timing of transmission, but the eventual magnitude of the inflationary impact of the 2026 shock remains highly uncertain.

The recent increase in gas prices poses a particular challenge for Dutch households and firms, given the Netherlands' relatively high reliance on gas. Gas accounted for 33% of final energy usage in the Netherlands in 2024, the highest share in the EU and well above the EU average of 20% (Eurostat, 2026a). Dutch households also rely relatively heavily on gas, increasing their direct exposure to higher gas prices (Eurostat, 2026c). Relatively low gas storage levels, currently at their lowest for this time of year since 2013, pose an additional upside risk to gas prices and inflation, as they make the gas market more sensitive to supply disruptions. Moreover, gas frequently plays a role in setting electricity prices in the Netherlands, meaning that higher gas prices can also feed through to electricity prices and thereby broaden the impact of a gas price shock. Rising gas prices may therefore be particularly relevant for the Dutch inflation outlook, especially as persistently high inflation may give rise to second-round effects. Persistently high energy prices may also increase pressure on governments to compensate households for the loss of purchasing power. If compensation measures are introduced, they should be timely, temporary and targeted, focusing support on vulnerable households while preserving incentives to reduce energy consumption and avoiding unnecessary demand stimulus.

For monetary policy, energy shocks remain particularly challenging supply-side disturbances. Monetary policy cannot prevent disruptions to energy markets or remove their underlying causes, while tightening in response to supply-driven inflation may come at a cost to economic activity. At the same time, a limited initial response of non-energy inflation does not necessarily imply that broader inflationary pressures will remain contained, as the analysis shows that indirect effects can take considerable time to materialise. The appropriate monetary policy response therefore depends not only on the initial increase in energy prices, but also on the size and persistence of the shock, the extent to which price pressures spread across the consumption basket, and the broader macroeconomic environment. In particular, the risk that an energy shock becomes embedded in wages, prices and inflation expectations is important when assessing its implications for medium-term price stability.

Reducing the sensitivity of inflation to geopolitical energy shocks ultimately requires reducing the economy's dependence on oil and gas. Energy efficiency can reduce the amount of energy required for transport, heating and production. The energy transition can also reduce exposure to international energy price shocks. However, as long as gas-fired generation links electricity prices to international gas markets, gas supply shocks will continue to feed through to electricity costs. Expanding and diversifying electricity supply while reducing reliance on imported fossil fuels can weaken this link and make energy supply less directly exposed to geopolitical disruptions along international transport routes. Furthermore, greater European energy-market integration and stronger cross-border infrastructure can facilitate the sharing of available supply across countries and make substitution easier. However, exposure cannot be eliminated entirely, as internationally determined energy prices and energy costs embedded in imported goods and intermediate inputs continue to affect the cost of Dutch consumption.

The broader lesson is that energy resilience and price stability are connected. Monetary policy remains responsible for maintaining price stability when energy shocks occur, but it cannot eliminate the underlying sources of these shocks. Energy policies operate on a different horizon and pursue broader objectives, such as improving

strategic autonomy or mitigating climate risks, but by reducing dependence on fossil fuels and strengthening the resilience of European energy supply, they can also reduce inflation's exposure to geopolitical energy shocks. In an environment in which the risk of oil and gas market disruptions may remain elevated, continuing the energy transition, supported by European integration and international cooperation, can therefore help reduce an important external source of inflationary risk.

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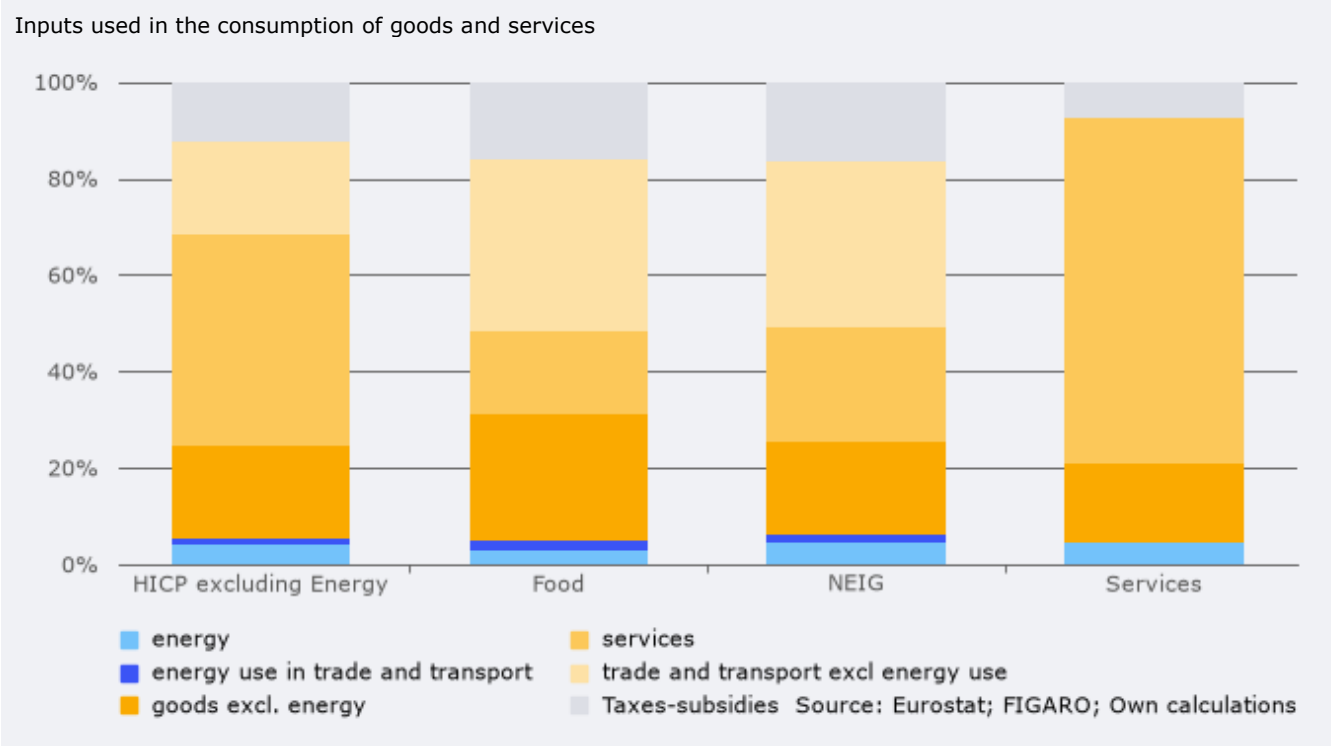
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Appendix

A.1 Decomposition of goods and services household consumption into its inputs

Figure A.1.1 Energy is used in all goods and services



The figure decomposes the production inputs embodied in HICP consumption categories. The composition of inputs differs substantially across different HICP categories. For food and NEIG trade, and transport margins make up a large share of total inputs, reflecting the role of wholesale and retail activities in bringing the final goods to the consumer. In contrast, services use almost no trade and transport as an input. The figure also shows that energy is an input in all consumption categories, but that the size depends on the category.

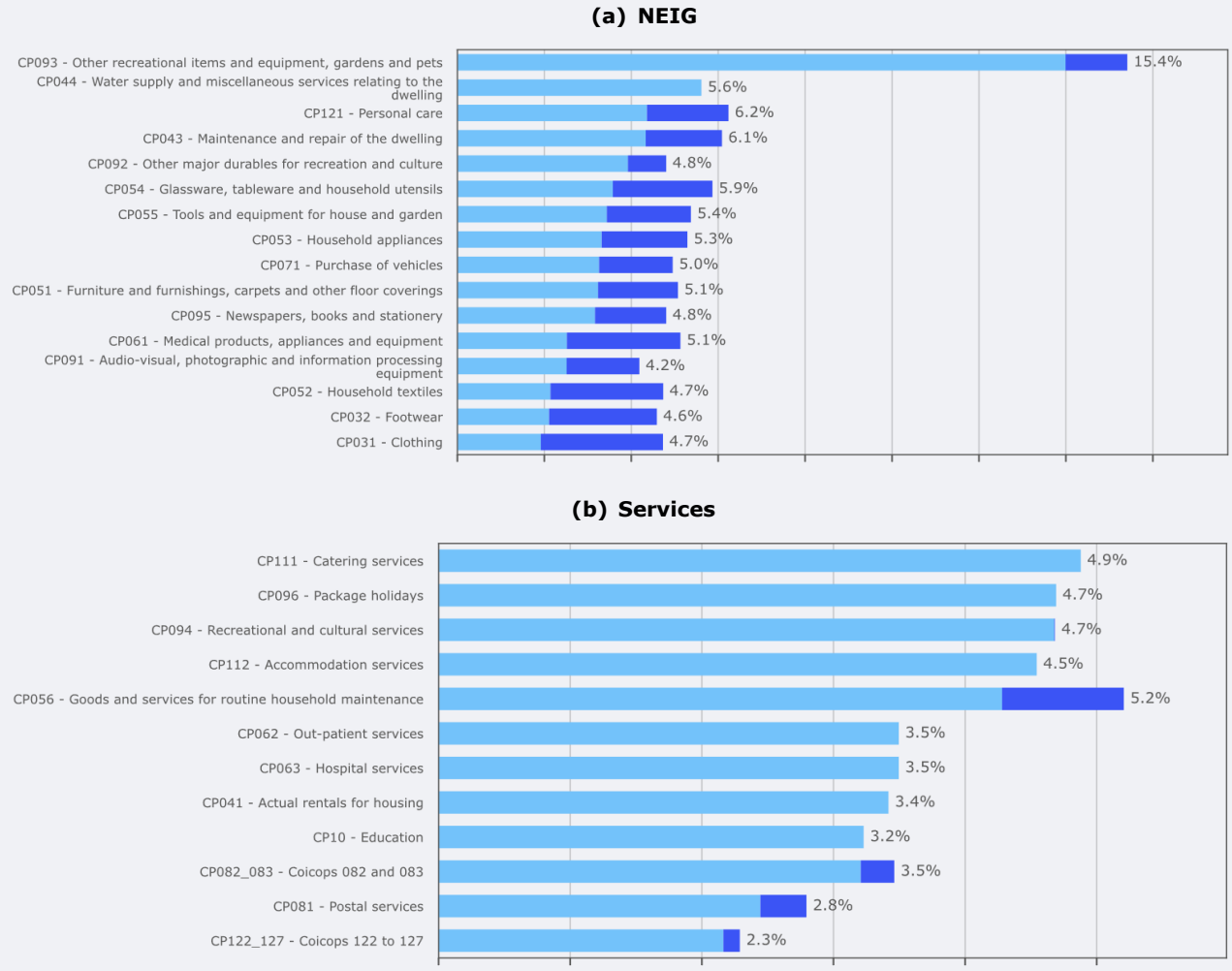
A.2 Energy use in NEIG and services

Goods and services also have energy as inputs. Figure A.2.1 and A.2.2 show the HICP-weighted energy input shares for Dutch NEIG and services consumption categories at the COICOP level. The figures distinguish between energy used in the production of the good or service, and energy used in trade and transportation before the product reaches the consumer.

In both categories the combined energy share is fairly similar, ranging mostly from about 3% to 6% with a couple of exceptions. Other recreational items and equipment, gardens and pets has a much higher energy share, at approximately 15.4%, driven mainly by energy use as an input itself. Overall, energy used in trade and transport contributes to most goods categories, but not to services, although the size of this contribution varies across categories.

Figure A.2.1 Energy is used across all COICOP categories in NEIG and services

Energy input shares by NEIG and services consumption categories



5.1 A.3 Energy inputs in HICP

Figures A.3.1 and A.3.2 show the share of energy inputs in HICP over time. The first figure shows the energy content of trade and transport margins from 2010 to 2024, reported separately for total and direct inputs. Both series fluctuate within a relatively narrow range. We see that energy inputs decline slowly up until 2020, with a peak in expenditure in 2022 and declining again after.

The second figure shows annual HICP spending on energy-input CPAs, split by country of origin and excluding energy used in trade and transport. For each year, the adjusted input shares are weighted by HICP spending weights and displayed as stacked bars for the three energy CPA groups. The contributions appear broadly stable over time, suggesting that the origin composition of energy-related HICP spending does not undergo a major change during the period.

Figure A.3.1 The energy share in trade and transport is relatively stable over time

Energy input in trade and transport over time (%)

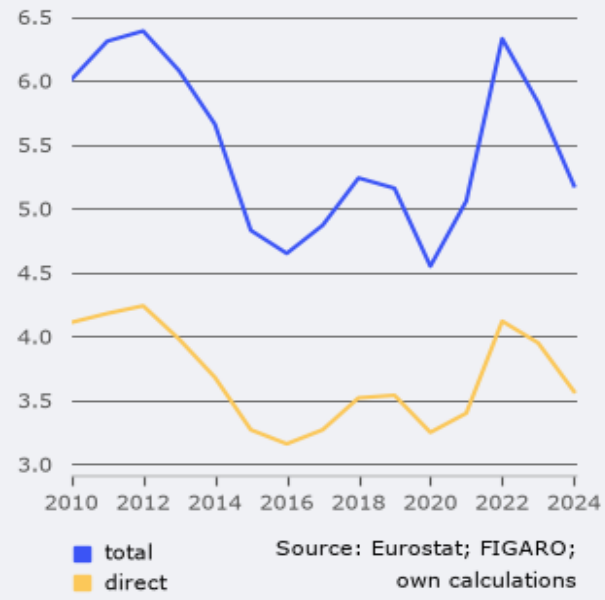
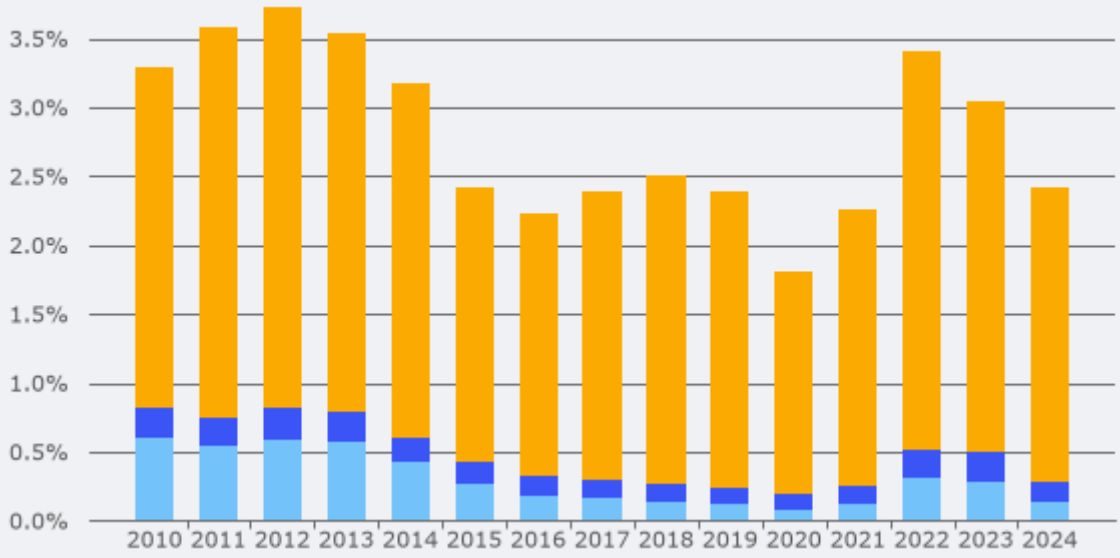


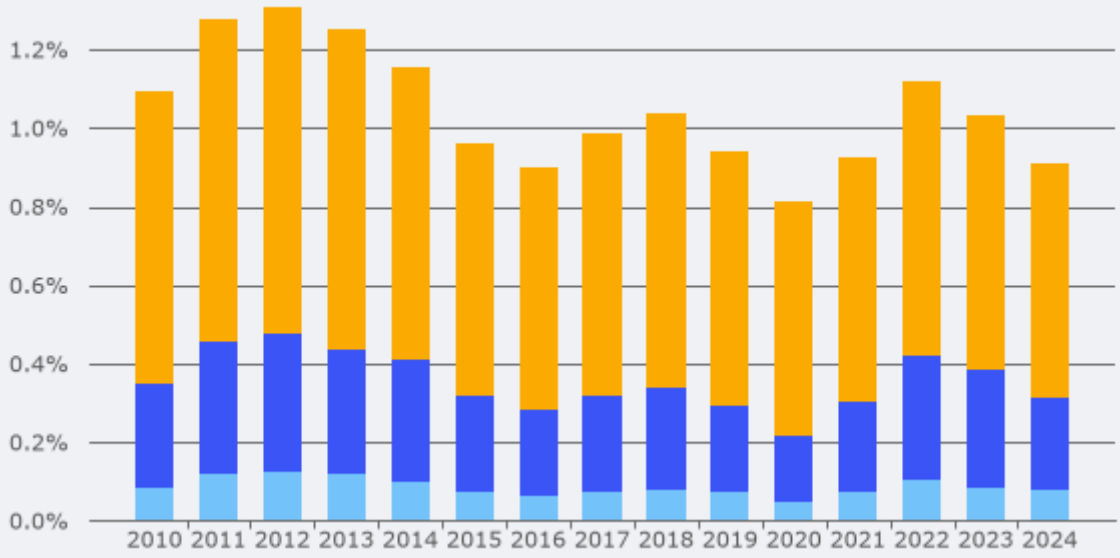
Figure A.3.2 Energy expenditure remains relatively stable over time

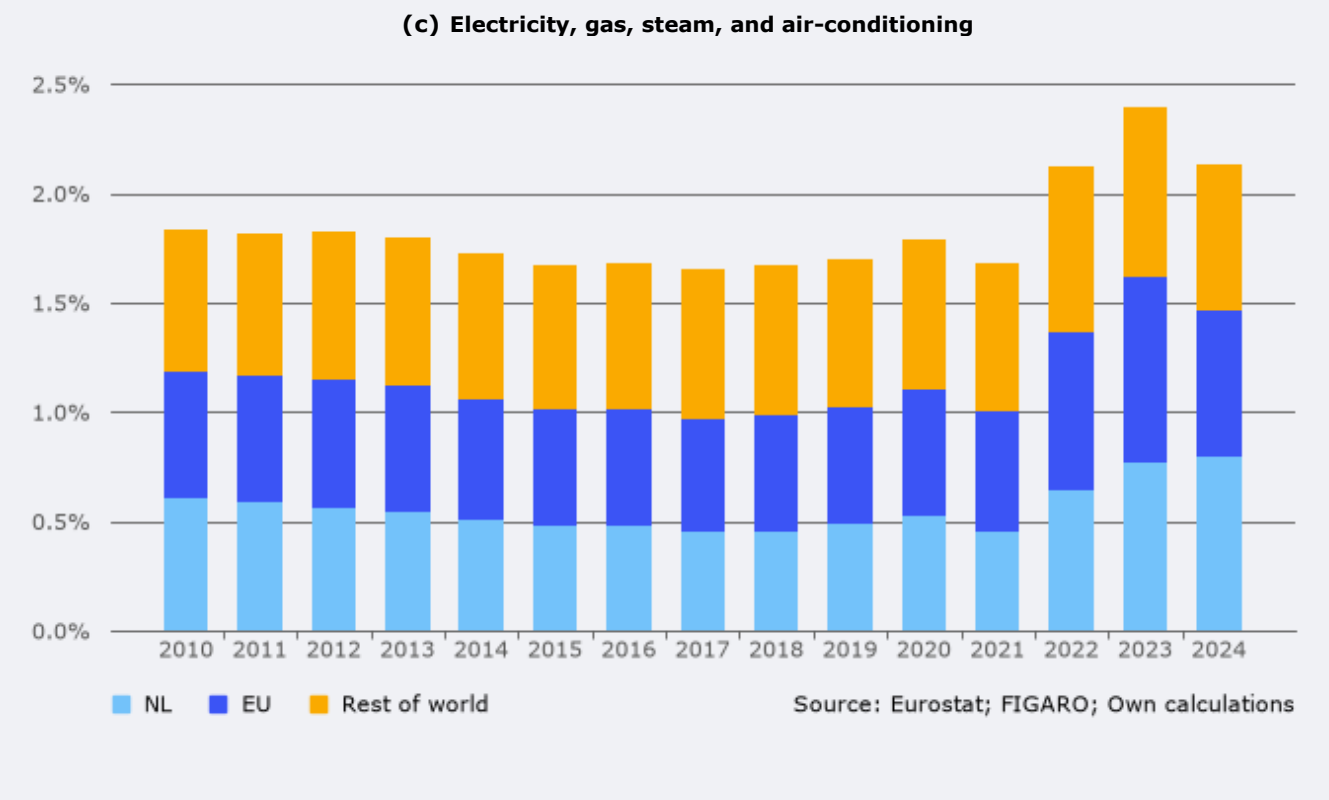
HICP expenditure on energy-input CPAs by origin over time, excluding energy use in trade and transport

(a) Mining and quarrying



(b) Coke and refined products




(c) Electricity, gas, steam, and air-conditioning
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
NL
EU
Rest of world
Source: Eurostat; FIGARO; Own calculations

A.4 Methodology for analysing energy as an input in production of consumer goods

This section explains the methodology of the analysis. To get to these results we use different datasets and techniques. First, FIGARO input- and output (IO) data is used to calculate import shares. We look at final consumption expenditure by households per CPA. Adjusted imports are estimated using the Leontief inverse, which takes intermediate inputs and value added into account. Next, we adjust for taxes and subsidies and trade and transport margins via national account data. Finally, we use a bridge matrix (Cai & Vandyck, 2020) to map each CPA to the right COICOPS to translate IO-data to HICP.

First, we explain how input-output (IO) data are used to trace the inputs required to produce goods and services consumed by households and to identify where these inputs originate. The objective is to account for the full production network underlying these products. A product purchased by households may be produced domestically while relying on imported intermediate inputs. Similarly, those intermediate inputs may themselves require inputs from other countries and industries. Looking only at the direct supplier of a final product would therefore underestimate the role of foreign production in household consumption. The IO framework allows us to trace these direct and indirect production requirements throughout the supply chain. We use the Leontief input-output framework for this purpose. Starting from household final demand, the Leontief inverse determines the gross output that must be produced by each country-product combination to satisfy that demand. This gross output can subsequently be decomposed into intermediate inputs and value added.

A.4.1 Notation

The input-output data is defined for n country-product combinations. A country-product combination refers to a specific product produced in a given country. We use indices *i* and *j* to distinguish supplying and purchasing country-product combinations, respectively. The following notation is used:

- $Z \in \mathbb{R}^{n \times n}$: intermediate use matrix, where z_{ij} denotes sales from supplying country-product combination i (row) to purchasing country-product combination j (column).
- $A \in \mathbb{R}^{n \times n}$: technical coefficient matrix,

$$a_{ij} = \frac{z_{ij}}{x_j},$$

  where a_{ij} denotes the value of sector j's inputs purchased from sector i divided by total sales of sector j
- $d \in \mathbb{R}^{n}$: final demand vector.
- $x \in \mathbb{R}^{n}$: gross output vector.
- $V \in \mathbb{R}^{n}$: value-added vector.
- $L = (I - A)^{-1}$,the Leontief inverse.

A.4.2 Input-output identities

The decomposition underlying this tool relies on a number of standard input-output accounting identities. These identities establish the relationship between final demand, gross output, intermediate inputs, and value added.

They also provide the basis for tracing the direct and indirect production required to satisfy household consumption.

Identity 1: Final demand generates output

For each country-product combination i:

$$x_i = \sum_{j=1}^{n} z_{ij} + d_i,$$

stating that total output supplied by country-product combination i is sold either as an intermediate input to other country-product combinations or to final users. Using the technical coefficients,

$$x_i = \sum_{j=1}^{n} a_{ij}\, x_j + d_i.$$

Stacking all equations yields

$$x = Ax + d.$$

Solving for x gives

$$x = (I - A)^{-1} d = Ld.$$

The Leontief inverse therefore translates final demand into the total gross output required throughout the production chain. Consequently, x measures the output generated in each country-product combination to satisfy final demand d. Importantly, this includes not only the output directly required to satisfy final demand, but also the output needed to produce intermediate inputs, the inputs required to produce those intermediate inputs, and so forth throughout the supply chain.

Identity 2: Output is produced using intermediate inputs and value added

Value added of country-product combination j is defined as gross output minus spending on intermediate inputs:

$$V_j = x_j - \sum_{i=1}^{n} z_{ij}.$$

Rearranging gives

$$x_j = \sum_{i=1}^{n} z_{ij} + V_j.$$

Substituting the technical coefficients yields

$$x_j = \sum_{i=1}^{n} a_{ij}\, x_j + V_j.$$

This identity shows that each euro of output produced by country-product combination j consists of intermediate inputs purchased from supplying country-product combinations i and value added generated within country-product combination j.

Identity 3: Input and value-added shares sum to one

Define the value-added coefficient, that is, value added per unit of total output as:

$$v_j = \frac{V_j}{x_j}.$$

Dividing Identity 2 by x_j yields

$$\sum_{i=1}^{n} a_{ij} + v_j = 1, \qquad \forall j.$$

Hence, each euro of output produced by country-product combination j can be decomposed into intermediate inputs purchased from all supplying country-product combinations i and value added generated by country-product combination j.

Identity 4: Total value added equals total final demand

Summing Identity 1 over all country-product combinations gives

$$\sum_i x_i = \sum_i \sum_j z_{ij} + \sum_i d_i.$$

Using Identity 2,

$$\sum_i V_i = \sum_i d_i.$$

Thus, total value added in the economy equals total final demand. Intermediate transactions determine how production is distributed through the supply chain, but do not add to the aggregate value of final demand because they represent transactions between producers within the system.

A.4.3 Decomposing induced output per product consumed

Throughout the remainder of this section, index k refers to the CPA product purchased by households. Indices i and j refer to country-product combinations participating in the production chain required to produce that CPA product, where i denotes the supplying country-product combination and j denotes the purchasing country-product combination. Index s is used for the country-product combination to which contributions are attributed.

The analysis is performed using two alternative specifications:

$$\begin{aligned} M^{\text{first-step}} &= I + A, \\ M^{\text{total}} &= (I - A)^{-1} = L. \end{aligned}$$

The two specifications differ in how far they trace production through the supply chain. The "direct" or "first-step" specification,

$$M^{\text{first-step}} = I + A,$$

captures only the production directly required to satisfy final demand and the first round of intermediate inputs used by the direct producer. It therefore accounts for both the product directly purchased by households and the inputs purchased by its producer, but does not trace the production of these intermediate inputs further upstream. The total specification captures the full production chain. The Leontief inverse can be expressed as

$$L = (I - A)^{-1} = I + A + A^2 + A^3 + \cdots,$$

where A represents the first round of intermediate-input requirements, A^2 captures the inputs required to produce those intermediate inputs, and subsequent terms capture progressively further upstream production stages.

A.4.4 Isolating household demand for a specific CPA product

The key idea is to use the shares a_{ij} and v_{ij} , which are expressed in units of total gross output, and apply them to total induced gross output, which is obtained by isolating final demand for the relevant country–sector combinations.

To trace the production chain associated with product k, we construct a final-demand vector d^k that contains domestic household demand for product k and sets all other final-demand components equal to zero.

$$d_i^k = \begin{cases} d_i, & \text{if country-product combination } i \text{ corresponds to domestic production of CPA product } k, \\ 0, & \text{otherwise.} \end{cases}$$

The total induced gross output induced by domestic household demand for CPA product k is then

$$x^{*k} = Md^k,$$

where M is changes depending on the decomposition considered (first-step or total). The vector x^{*k} contains the gross output generated throughout the production chain in order to satisfy domestic household demand for product k under the chosen specification for M.

A.4.5 Decomposing induced output into intermediate inputs and value added

Applying the intermediate-input shares to x^{*k} yields the matrix of induced intermediate-input flows:

$$z_{ij}^{*k} = a_{ij}x_j^{*k},$$

or, equivalently,

$$Z^k = A\,\mathrm{diag}(x^k).$$

The element z_{ij}^{*k} measures production supplied by country-product combination i and used as an intermediate input by country-product combination j in the production chain associated with household demand for CPA product k.

Similarly, applying the value-added shares yields

$$VA_s^k = v_s x_s^k,$$

where VA_s^{*k} denotes the value added generated by country-product combination s in the production chain associated with household demand for product k.

To attribute intermediate-input production to the countries and products that supply the production chain, intermediate sales supplied by a given country-product combination are summed across all purchasing country-product combinations:

$$II_s^k = \sum_{m=1}^{n} z_{sm}^k.$$

Equivalently,

$$II^k = Z^k\mathbf{1}.$$

The quantity II_s^k therefore measures all intermediate-input production supplied by country-product combination s, while VA_s^k measures all value added generated by country-product combination s.

The total contribution of country-product combination s to domestic household demand for CPA product k is

$$C_s^k = II_s^k + VA_s^k.$$

Total induced output associated with CPA product k is obtained by summing the contributions of all country-product combinations:

$$X^k = \sum_{s=1}^{n} C_s^k.$$

The share of total induced output corresponding to value added generated by country-product combination s equals

$$s_{VA,s}^k = \frac{VA_s^k}{X^k},$$

while the share corresponding to intermediate-input production supplied by country-product combination s equals

$$s_{II,s}^k = \frac{II_s^k}{X^k}.$$

By construction,

$$\sum_{s=1}^{n} s_{VA,s}^k + \sum_{s=1}^{n} s_{II,s}^k = 1.$$

Hence, total output induced by domestic household demand for CPA product k can be fully decomposed into country-product-level contributions from value added and intermediate-input production throughout the supply

chain. These shares provide a detailed description of the production structure underlying household consumption of CPA product k. They identify both the country-product combinations supplying intermediate inputs and those generating value added along the production chain. Repeating this procedure for each CPA product produces the set of production-chain shares used in the remainder of this methodology.

A.4.6 Applying the production-chain shares to household expenditure

The previous section explained how, for each CPA product, a set of shares describing how its underlying production is distributed across country-product combinations. These shares capture both intermediate production and value added.

To translate this production structure into a decomposition of the HICP consumption basket, three additional steps are required. First, the FIGARO-based production shares are applied to domestic household expenditure from the national accounts. Second, the resulting basic-price decomposition is extended to purchaser prices by incorporating taxes less subsidies on products and trade and transport margins. Finally, CPA products are mapped to the COICOP classification used in the HICP

Step 1: Decomposition of demand in basic prices

Let b_k denote domestic household expenditure on CPA product k measured in basic prices. Applying the decomposition shares derived in the previous section yields the contribution of each country-product combination s:

$$DC_s^k = \left(s_{VA,s}^k + s_{II,s}^k\right) b_k.$$

Summing across all country-product combinations reproduces total expenditure on CPA product k:

$$\sum_{s=1}^{n} D\,C_s^k = b_k.$$

The vector

$$DC^k = [DC_1^k \quad DC_2^k \quad \cdots \quad DC_n^k]'$$

therefore represents a full decomposition of domestic household expenditure on CPA product k in basic prices across all country-product combinations participating in its production chain.
We use domestic household expenditure from the national accounts rather than from the FIGARO tables. This choice has two advantages. First, the national accounts provide more recent expenditure data. Second, they allow us to recover expenditure in purchaser prices, which is required for the HICP analysis below.

Step 2: From basic prices to purchaser prices

Households purchase goods and services at purchaser prices rather than basic prices. Purchaser prices include taxes less subsidies on products as well as trade and transport margins. Let τ_k denote taxes less subsidies on CPA product k, and let μ_k denote trade and transport margins associated with CPA product k. Expenditure in purchaser prices is therefore given by

$$p_k = b_k + \tau_k + \mu_k.$$

To decompose expenditure in purchaser prices, the additional purchaser-price components are allocated separately from the production-chain decomposition. The decomposition of CPA product k in purchaser prices can therefore be written as

$$PC^k = DC^k + T^k + R^k,$$

where

- DC^k contains the production-chain contributions obtained from the input-output framework;
- T^k contains taxes less subsidies on products;
- R^k contains trade and transport margins.

By construction,

$$\sum_{s=1}^{n} P\, C_s^k = p_k.$$

Hence, expenditure on each CPA product is fully decomposed into production-chain contributions, taxes, and distribution margins.

Step 3: Mapping CPA products into HICP categories

The decomposition above is available at the CPA-product level. The final step is to translate the decomposition from the CPA product classification used in the input-output and national-accounts data to the COICOP classification underlying the HICP. To construct the HICP consumption basket, CPA products are mapped into COICOP categories.

Let Θ denote the CPA–COICOP bridge matrix with dimension $N_{COICOP} \times N_{CPA}$. Applying Θ transforms the decomposition from CPA products into the corresponding HICP product categories:

$$PC^{COICOP} = \Theta PC^{CPA}.$$

The resulting decomposition is expressed in purchaser prices and organised according to the same consumption categories used in the HICP. At the same time, it retains the underlying information on the products and geographical origins involved in the production chain.

A.4.7 Calculating HICP effects

For this analysis we aim to see how a shock travels through the production network using the setup described above. To identify which parts of the production network are most important for transmitting an energy price shock to consumer prices, we follow a leave-one-supplier-out approach similar to Friesenbichler et al. (2026). Below is a description on how we use the tool to calculate the effects of an energy shock.

Transmission of energy price shocks

Let χ denote an exogenous vector of producer-price shocks. In our application, χ represents a shock to energy-producing country-product combinations. For example, a 10 percent increase in energy producer prices can be represented by a vector containing positive shocks for the relevant energy-producing country-product combinations and zeros elsewhere.

The input-output framework translates these producer-price shocks through the production network. The resulting impact on CPA products measured in basic prices is given by

$$\Delta p^{CPA,basic} = M\chi,$$

where $M = (I - A)^{-1}$ for the full transmission through all production rounds, or $M = I + A$ when only own production and first-round input requirements are considered.

Because households purchase products at purchaser prices, the resulting price effects must be expressed in purchaser-price terms. Let Λ denote the transformation from CPA basic prices to CPA purchaser prices, which incorporates taxes less subsidies and trade and transport margins. The corresponding purchaser-price effect equals

$$\Delta p^{CPA,purch} = \Lambda M \chi.$$

The CPA-level effects are subsequently mapped into HICP categories using the CPA–COICOP bridge matrix:

$$\Delta p^{COICOP} = \Theta \Lambda M \chi.$$

Finally, the aggregate HICP effect is obtained by weighting the COICOP-level price changes using the vector of HICP expenditure weights ω:

$$\pi^{\mathrm{HICP}} = \Delta p^{\mathrm{HICP}} = \omega' \Theta \Lambda M \chi.$$

Where

- ω is the vector of HICP expenditure weights;
- Θ is the CPA–COICOP bridge matrix;
- Λ converts CPA basic prices into CPA purchaser prices by adding taxes less subsidies and trade and transport margins;
- M captures price transmission through the production network. This is either M^{total} or M^{direct};
- χ is the vector of exogenous producer-price shocks.

The equation therefore measures the total impact of an energy producer-price shock on the HICP consumption basket after accounting for production-chain linkages, purchaser-price components, and HICP expenditure weights.

Contributions of supplying country-product combinations

To assess the contribution of each supplying country-product combination to the transmission of producer-price shocks through the production network, we proceed as follows. Let A_{-s} denote the technical coefficient matrix obtained from A by setting row s equal to zero, while leaving all other rows unchanged. Since rows of A represent supplying country-product combinations, this removes the role of country-product combination s as an intermediate-input supplier to all purchasing country-product combinations.

The resulting implied HICP inflation rate is then computed and denoted by

$$\pi_{-s} = \omega' \Theta \Lambda M_{-s} \chi,$$

with

$$M_{-s}^{\mathrm{total}} = (I - A_{-s})^{-1} \quad \text{and} \quad M_{-s}^{\mathrm{direct}} = I + A_{-s}.$$

The contribution of country-product combination s is calculated as

$$\text{Contribution}_s = \frac{\pi^{\mathrm{HICP}} - \pi_{-s}}{\pi^{\mathrm{HICP}}} = 1 - \frac{\pi_{-s}}{\pi^{\mathrm{HICP}}},$$

where π^{HICP} is the inflation rate obtained using the full matrix A.

The larger the contribution, the more important country-product combination s is in transmitting the producer-price shock through the production network.

A.4.8 Addressing the aggregation bias

The original FIGARO multi-country input-output tables distinguish a larger number of countries and product categories. For the purpose of this analysis, countries are aggregated into three regions: the Netherlands, the European Union excluding the Netherlands, and the Rest of the World. 62 Product categories are retained. All input-output calculations, including the construction of the technical coefficient matrix and the Leontief inverse, are performed on this aggregated system. Consequently, the analysis captures production linkages between 62 sectors across the three geographical regions.

We want to stress that aggregation is a common necessity in input-output analysis to keep the analysis and computations manageable. At the same time, it is well known that regional or sectoral aggregation introduces

aggregation bias, which affects the quantitative results of our analysis. Hence, depending on the granularity of our data, the provided outcome of the model might differ. In order to avoid varying quantitative results, we maintain one choice of aggregation as discussed above. For a detailed analysis of aggregation bias, we refer to Miller and Blair (2009).

A.5 Methodology empirical analysis

A.5.1 Data

All series are monthly. Dutch consumer prices are taken from the Eurostat HICP (index, 2015 = 100) for the headline index and six components: core (overall index excluding energy, food, alcohol and tobacco), energy, food (including alcohol and tobacco), non-energy industrial goods (NEIG) and services. Each index is seasonally adjusted and enters the regressions in log levels.

Real energy prices are expressed in euro-area terms. The Brent spot price (USD per barrel, FRED) and the World Bank Pink Sheet European natural gas price (USD per mmbtu) are converted into euro with the ECB monthly average USD/EUR reference rate e_t, and deflated by the seasonally adjusted euro area HICP:

$$p_t^j = \ln\left(100 \cdot \frac{\frac{P_t^j}{e_t}}{HICP^{EA}}\right), j \in \{oil, gas\}$$

The estimation data set starts in December 2000.

A.5.2 Energy shocks and normalisation

Oil shocks are the oil supply news shocks of Känzig (2021), identified from high-frequency oil futures surprises around OPEC announcements (updated to 2025M12). Gas shocks are the gas supply shocks of Alessandri and Gazzani (2025), identified from daily news on the Dutch TTF gas market (2025 update). Both series are treated as observed, exogenous shocks.
To make the oil and gas responses comparable, each shock is rescaled so that it raises its own real price by 10% on impact.

A.5.3 Business-cycle state

The state of the Dutch economy is measured using the cyclical component from an unobserved-components model of real GDP. Specifically, log real GDP is decomposed into a local linear trend, consisting of stochastic level and slope components, and a trigonometric stochastic cycle. Quarterly GDP observations are assigned to the middle month of each quarter, while observations for the remaining months are treated as missing. The model is then estimated at monthly frequency using the Kalman filter, yielding a monthly estimate of the output gap that can be used as the state variable in the state-dependent local projections. This approach avoids the need to first interpolate quarterly GDP using a monthly indicator series, a procedure that introduces its own modelling assumptions and may bias estimates towards the dynamics of the chosen reference indicator. The trade-off is that movements in output within a quarter are model-implied rather than directly observed. A positive cyclical

component indicates that output is above potential, while a negative component indicates that output is below potential.

A.5.4 Local projections

Linear model.

Impulse responses are estimated with local projections (Jordà, 2005). For an outcome , a shock and horizons $h = 0, \dots, H$,

$$y_{t+h} - y_{t-1} = \alpha_h + \beta_h s_t + \sum_{l=1}^{L} \gamma'_{h,l} w_{t-l} + u_{t+h}$$

where w_t is a vector of control variables and β_h is the cumulative response of y at horizon h .

State-dependent model.

Following Auerbach and Gorodnichenko (2013) and Ramey and Zubairy (2018), all coefficients are allowed to differ between two states:

$$y_{t+h} - y_{t-1} = I_{t-1}\left[\alpha_{1,h} + \beta_{1,h} s_t + \sum_{l=1}^{L} \gamma'_{1,h,l} w_{t-l}\right] + (1 - I_{t-1})\left[\alpha_{2,h} + \beta_{2,h} s_t + \sum_{l=1}^{L} \gamma'_{2,h,l} w_{t-l}\right] + u_{t+h}$$

where $I_{t-1} = 1$ if the economy is in state 1 in period $t - 1$ and zero otherwise. $\beta_{1,h}$ and $\beta_{2,h}$ are the cumulative responses in state 1 and state 2.

Pass-through (LP-IV).

Pass-through from an energy price p to an outcome y is estimated as a cumulative response ratio with LP-IV (Stock and Watson, 2018; Ramey and Zubairy, 2018). Define the cumulative changes $Y_{t,h} = \sum_{j=0}^{h}(y_{t+j} - y_{t-1})$ and $P_{t,h} = \sum_{j=0}^{h}(p_{t+j} - p_{t-1})$. Then

$$Y_{t,h} = I_{t-1}\left[\alpha_{1,h} + \theta_{1,h} P_{t,h} + \sum_{l=1}^{L} \delta'_{1,h,l} w_{t-l}\right] + (1 - I_{t-1})\left[\alpha_{2,h} + \theta_{2,h} P_{t,h} + \sum_{l=1}^{L} \delta'_{2,h,l} w_{t-l}\right] + e_{t+h},$$

Where $I_{t-1}P_{t,h}$ and $(1 - I_{t-1})P_{t,h}$ are instrumented with $I_{t-1}s_t$ and $(1 - I_{t-1})s_t$. $\theta_{k,h}$ is the cumulative change in y per unit of cumulative change in p up to horizon h in state k . It equals the ratio of the cumulative impulse responses of y and p to the shock, and it comes with a direct standard error. The linear version sets $I_{t-1} = 1$ for all t .

Implementation.

The shock s_t is the normalised oil or gas shock $\tilde{s_t}$ and the two shocks enter separate regressions. Outcomes y are the log real oil and gas prices, and the log headline, core, energy, food, NEIG and services HICP. We use $H = 36$ months and $L = 12$ lags. The control vector w_t contains the outcome, the shock and the log real oil and gas prices. State 1 is output below potential (a negative cycle) and state 2 is output above potential (a positive cycle). The state is based on the cycle lagged one month, so it is predetermined with respect to the shock. For pass-through, y is log headline HICP and p is the log real price of the commodity whose shock is used as the instrument.

Inference and presentation

The presented confidence bands are constructed using Newey-West standard errors that are heteroskedasticity- and autocorrelation-consistent. Figures show 90% confidence bands. For presentation only, point estimates and band limits are smoothed across horizons with a centred three-month moving average. The window shrinks at the endpoints, so the responses at $h = 0$ and $h = H$ are unsmoothed.