The rise in energy prices: its impact on inflation rate and economic activity

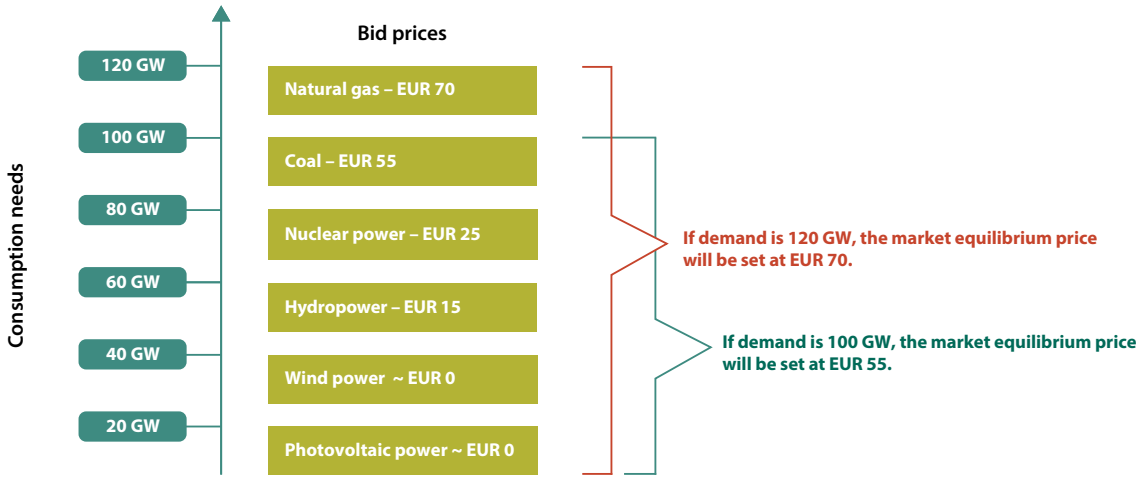
Energy is an essential resource for the day-to-day activity carried out by either households or economic agents. Hence, the recent sizeable increase in energy prices at European level will affect consumer price dynamics sooner or later, with the broad-based advance in inflation rates EU-wide likely to indicate the start of such adjustments. At the same time, concerns about the potential medium- and long-term effects of these shocks have started to increase, entailing the risks of de-anchoring economic agents' inflation expectations and of a slower economic recovery. Under the circumstances, this box aims to identify the causes of such price hikes in the natural gas and electricity markets and their (structural or transitory) nature, and to quantify the impact these increases will have on the future price dynamics and economic growth in Romania.

What has happened in the energy market since mid-2021 and how persistent is this shock?

As the restrictions imposed by the pandemic have started to be lifted and economies have been fully reopened, the recovery of global activity has entailed a swift growth of demand for natural gas used for electricity generation, as well as for industrial purposes. During the summer, this situation was amplified by the strong demand for electricity production on the back of heat waves, along with the contraction in the output of electricity from alternative sources (hydro and wind power) and supply constraints due to extreme weather events or extended maintenance works (given the postponement of such works in the acute phases of the pandemic). On the European market, an important driver of the quick rise in natural gas prices (up to historical peaks, unlike the developments in other regions) was an incidental factor, namely the low stock levels (about 77 percent in October 2021, compared to approximately 95 percent in October 2020[1]), caused by a prolonged winter, with temperatures below the seasonal average. The effect was enhanced by the impossibility of replenishing stocks during the summer, as the major suppliers limited their natural gas deliveries due to either structural reasons (the natural decline in production, the tendency to phase out coal-fired power plants and the lower investment in fossil fuels in the context of decarbonisation, the initiation of procedures to close the largest gas field in the Netherlands – the main EU producer, the fiercer competition for liquefied natural gas from Asian countries, as a result of the plan to reduce carbon emissions) or geopolitical reasons (the dependence on imports of Russian gas and the related supply issues). At the same time, the structure of the European gas market also played a role in price growth, as contracts with prices set depending on the demand-to-supply ratio have a prevailing share (i.e. 80 percent in 2020, to the detriment of oil price-linked contracts), which favours the faster transmission of market pressures. In Romania, the situation was relatively the same, with a considerably lower gas storage level than that reported in the previous year (about 74 percent in October 2021 versus 95 percent a year ago); in addition, the domestic market has also seen a natural decline in production, which led to higher imports in recent years, thereby increasing the exposure to external shocks.

[1] According to Gas Infrastructure Europe.

Chart A. Illustration of the uniform price-setting mechanism in the wholesale electricity market

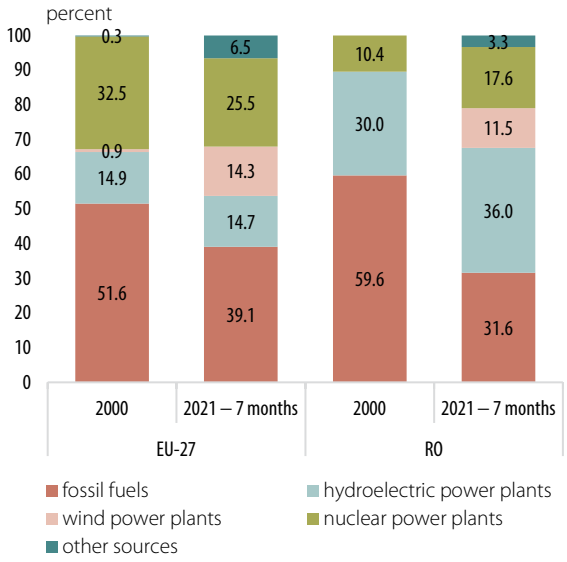


Note: The bid price of each producer stands at the specific level of its marginal production cost, each producer receiving in the end the market equilibrium price dictated by the last marginal unit needed to satisfy electricity demand.

Source: Agency for the Cooperation of Energy Regulators (ACER), NBR calculations and estimates

As regards the hike in electricity prices on the European markets in 2021 H2 and, implicitly, on the Romanian market, it was mainly accounted for by the sizeable increase in production costs for fossil fuel power plants – in particular, the substantial advance in natural gas prices (up to five times as against the same year-ago period) and coal prices (by approximately three times). Moreover, the higher prices of carbon dioxide emissions certificates further had an upward impact, following the measures taken at European level to accelerate the transition to a green economy (e.g., a steeper reduction in the carbon emissions cap or the faster backloading of excess allowances; ECB, 2021). To these added the decrease in the electricity output of hydro power plants and wind power plants (caused by the scarce rainfall and lack of wind), which thus had to be offset by electricity generation in thermal power plants that were already facing problems related to production costs. Ultimately, the exacerbated growth of electricity prices reflects, *inter alia*, the specific price-setting mechanism in this market, amid the alignment of prices of all power generating units with the marginal production cost of the last marginal unit to satisfy electricity demand (Blume-Werry *et al.*, 2021; Chart A). Although progress has been made in recent decades EU-wide, the accommodation of demand from polluting sources remains significant in the energy mix, including in Romania's case (Chart B).

Chart B. Energy mix



Source: Eurostat, NBR calculations

Starting with the spring of 2022, after the end of the cold season, the markets anticipate a relative price correction at European level, in view of an expected improvement in the severe supply-demand imbalance that is currently manifest. For instance, the futures prices of the TTF[2] gas price index show that in 2022 H2 gas prices will drop by half from their historical peak recorded in October 2021 on the spot market. A similar picture is also seen in the electricity market, with futures prices in some representative European economies (Germany, France, the Netherlands, Italy, Spain) standing at around EUR 100/MWh in 2022, as compared to current spot market prices of around EUR 200/MWh in October 2021. Nevertheless, the prices of both natural gas and electricity for delivery in 2022 will remain significantly higher (by 2.5-3 times) than those recorded in 2019, thus highlighting the importance of factors with more persistent effects. At the same time, one cannot rule out the protracted adverse influence of incidental factors, in the assumption that the 2021-2022 cold season will also be longer and colder than usual.

Over a longer time horizon, the energy prices in Europe could stabilise at lower levels, under the prevailing action of a structural factor, namely the faster transition to a green economy at EU level. The process involves the swift increase in the production of electricity from renewable sources (concurrently with the electrification of households' heating systems; EC, 2021), implying a lower impact of higher production costs of electricity from fossil fuels (EC – DG Energy, 2021). The transition is expected to be rather uneven, given the commitment of European and national authorities to faster reduce greenhouse gas emissions in the EU (down 55 percent by 2030 as against the 1990 level, compared to the previous target of 40 percent). The strategy implies the more rapid phase-out of fossil fuel plants, especially coal-fired power plants[3], and the shifting of their production to low-carbon sources such as nuclear power or the energy from renewable sources (hydro, wind, solar power). Due to the volatility of electricity output from renewable sources, the occurrence of supply-demand imbalances is likely to generate new, large price fluctuations in the transition years. The National Recovery and Resilience Plans have allocated significant amounts for investment in renewable energy, other measures to facilitate the process being aimed at increasing the integration of European electricity markets (through the expansion of interconnection capacities), developing reliable and affordable storage facilities of renewable electricity at a much faster speed and enhancing the energy efficiency at end-user level.

Impact on the inflation rate

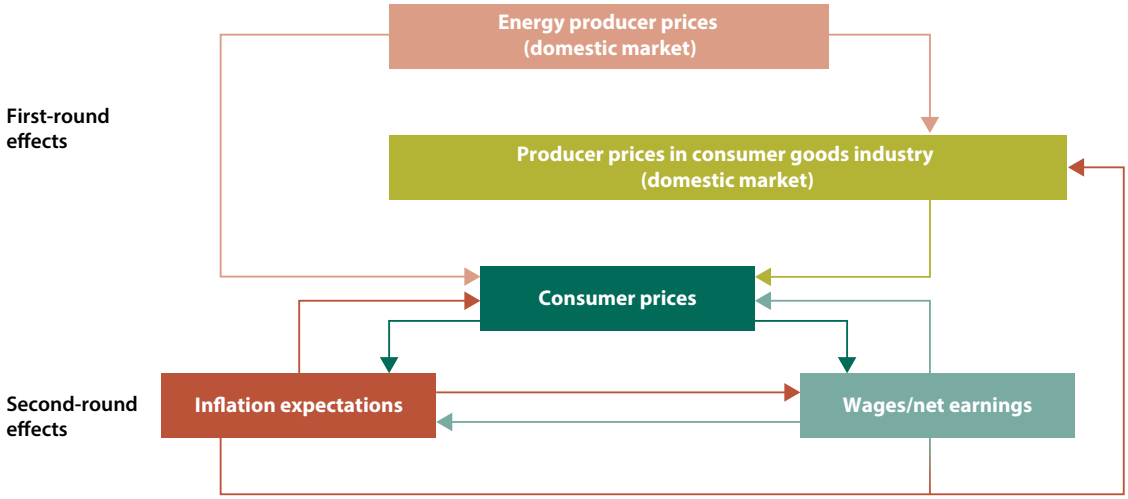
Fluctuations in the wholesale prices of electricity and natural gas pass through into the inflation rate both directly, via end-user prices, and indirectly, via production costs of other goods and services in the consumer basket. These first-round effects

2 Title Transfer Facility (TTF) – the virtual trading point for natural gas in Rotterdam, the benchmark index in the European market.

3 During the latest UN Climate Change Conference (COP26, 31 October – 12 November 2021), 190 states and organisations committed to discourage investment in new coal-fired power plants and gradually phase out coal by 2030 in developed economies and by 2040 in other countries.

are seen as transitory, their impact on the annual inflation rate persisting for four quarters in the case of direct effects and, sometimes, for a longer period in the case of indirect effects, because the transmission of the rise in production costs into prices is not always immediate nor linear. Subsequently, absent a monetary policy reaction, sizeable price increases for a prolonged period could however affect economic agents' inflation expectations over the medium term, influencing their price- and wage-setting behaviour in the future. These second-round effects are more persistent in nature and can mark the trajectory of prices for a longer time compared to first-round effects (Chart C).

Chart C. Transmission channels of the change in energy producer prices on the domestic market into the change in consumer prices

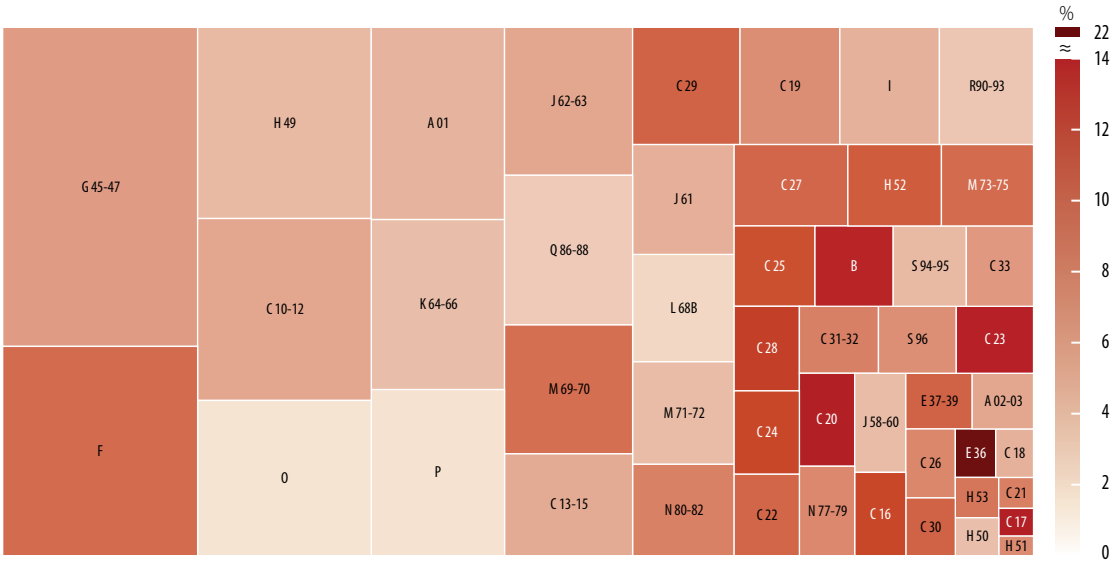


The easiest way to assess the extent to which energy prices impact household consumers relies on the utility bill breakdown, the share of commodity costs being approximately 70 percent for natural gas and about 50 percent for electricity. On the back of the latest developments and of the burden of commodity purchase costs, the main natural gas suppliers will implement price increases of around 40 percent in October-November, at least in respect of contracts for passive consumers[4] who have already been notified thereof. For electricity as well, the offers on the competitive market were approximately 30 percent higher in September 2021 than those specified in the contracts concluded at the beginning of the year, which suggests that in January 2022 (when most contracts on this market are renegotiated) the hike will also be reflected in the corresponding CPI component. Given the size of price increases and the further tense situation on the energy markets, the authorities adopted several measures to protect consumers, including vulnerable households. In September, the Law on the protection of vulnerable energy consumers (No. 226/2021) was adopted, whereby heating subsidies are granted during the cold season to low-income consumers. Given

[4] Over half of household consumers had not yet opted for an offer on the competitive market at mid-2021.

that the implementation of the law is assumed to be a lengthy process – the subsidies are granted after the supporting documents are submitted and get the approval of the local administration, followed by the notification of suppliers – Law No. 259/2021 approving GEO No. 118/2021 was adopted to cover the period from November 2021 to March 2022. The compensations set by this law are linked to consumption, being integrated directly into the utility bill of households (of which around two thirds meet the eligibility criteria). For the trajectory of prices, this compensation scheme essentially involves a redistribution of the price hike, which will be partly covered by the state during winter, when consumption is higher, whereas starting with April, the price will no longer be affected by the support measures and will return to the level stipulated in the contracts.

Chart D. Energy intensity in industry (direct and indirect effects)



A01 – agriculture
A02-03 – forestry and fishing
B - mining and quarrying
C10-12 – food, beverages and tobacco products
C13-15 – textiles, wearing apparel and footwear
C16 – manufacture of wood
C17 – manufacture of paper
C18 – printing and recorded media
C19 – coke and refined petroleum products
C20 – chemicals and chemical products
C21 – pharmaceutical products
C22 – rubber and plastic products
C23 – other non-metallic mineral products
C24 – basic metals
C25 – fabricated metal products
C26 – computer, electronic and optical products
C27 – electrical equipment
C28 – machinery and equipment
C29 – manufacture of motor vehicles
C30 – other transport equipment
C31-32 – furniture, other manufacturing
C33 – repair of machinery and equipment
E36 – water supply
E37-39 – sewerage and waste management
F – construction
G45-47 – trade
H49 – land transport and transport via pipelines
H50 – water transport
H51 – air transport
H52 – warehousing
H53 – postal and courier activities
I – accommodation and food services
J58-60 – publishing activities, motion picture and broadcasting activities
J61 – telecommunications
J62-63 – computer programming and information service activities
K64-66 – financial service activities, insurance and reinsurance
L68B – real estate activities
M69-70 – legal and accounting activities, management consultancy activities
M71-72 – architectural and engineering activities, scientific research and development
M73-75 – advertising and market research, other professional activities
N77-79 – rental and leasing activities, employment activities, travel agency activities
N80-82 – office support and other business support activities
O – public administration and defence
P – education
Q86-88 – human health and social work activities
R90-93 – arts, entertainment and recreation
S94-95 – activities of membership organisations, repair of electronics
S96 – other service activities

Note: The economic sectors shown in the chart generate approximately 90 percent of total GVA economy-wide. Each rectangular area is proportional to the sector's share in GVA, while the colour intensity is proportional to the energy used, both directly and indirectly, in the production chain to meet final demand. The calculations were based on the most recent available data for the input-output table and refer to 2015.

Source: Eurostat, NBR calculations

Apart from the direct effects, proportional to the share of energy components in the CPI basket (electricity – 4.6 percent and natural gas – 3.1 percent), the shock on the energy market will pass through into the annual inflation rate also via production costs, as energy is an input in the manufacturing process, along with commodities, materials, labour. The more energy intensive the production process, the greater the impact, the most exposed sub-sectors being the intermediate goods or capital goods industries. As for consumer goods industries, which directly affect final prices, the share of energy expenses varies between 1 and 3 percent, according to the balance sheet data available for 2020. This approach is however incomplete, as it does not take into account the energy consumption along the production chain for the manufacture of the other production factors. Specifically, if the indirect energy consumption of the upstream sectors of the production chain is added to the direct consumption, the shares vary from under 5 percent in the production of food items and wearing apparel to around 7 percent for pharmaceuticals and manufacture of furniture, and over 8 percent for household appliances[5]. Looking at services to households, the energy intensity is lower for education and medical services (i.e. under 3 percent), slightly higher in the hospitality industry (approximately 4 percent) and significantly higher for courier and tourism services (over 7 percent; Chart D).

In order to quantify the extent to which a shock in energy producer prices on the domestic market passes through to final consumer prices, a series of VECM (vector error correction models) were estimated. The estimation involved two stages. The first focused on the transmission of energy producer prices on the domestic market ($IPPI^{dm}$ energy) into industrial producer prices for consumer goods ($IPPI^{dm}$ consumer goods). The second referred to the latter's pass-through into final prices, using a core inflation measure that ensures the best correspondence between the structure of industrial sub-sectors and that of the consumer basket, i.e. adjusted CORE2 excluding services, net of the first-round effects of VAT rate changes[6]. In the case of the first channel ($IPPI^{dm}$ energy – $IPPI^{dm}$ consumer goods), the estimates indicate a transmission of approximately 4 percent of the initial shock of $IPPI^{dm}$ energy into the change in $IPPI^{dm}$ consumer goods over one year. Further, the change in $IPPI^{dm}$ consumer goods is estimated to pass through into core inflation in a proportion of approximately 50-70 percent over the same time horizon. Overall, cumulating the estimated effects, a scenario assuming a 20 percent increase in $IPPI^{dm}$ energy would generate an impact of approximately 0.4-0.6 percentage points on core inflation over one year. The result reflects not only indirect first-round effects via production costs, but also second-round effects via economic agents' expectations. Given the magnitude of the shock affecting economic activity, economic agents may transfer the pressure on costs into final prices even more rapidly and to a greater extent compared to what econometric models show, based on historical data series.

5 Calculations based on the input-output table (the latest available data refer to 2015).

6 See Box 1. "The Pass-Through of Industrial Producer Prices on the Domestic Market to Consumer Prices" published in the November 2017 *Inflation Report*.

In the case of a one-off shock of limited size, the transmission via economic agents' inflation expectations is expected to have a relatively low impact (e.g. referring to the previously described shock on IPPI^{dm} energy, the impact via this channel would be of approximately 0.1 percentage points). However, in the current context, characterised by recurrent supply-side shocks of a large magnitude – associated with changes in both energy and agri-food commodity prices, as well as with disruptions in global production and supply chains –, a potential worsening of medium-term inflation expectations could generate significant second-round effects, assuming that no monetary policy action was taken to prevent them.

Impact on economic activity

The increase in energy prices and in prices for other commodities and materials will also have a contractionary impact on real GDP dynamics over the coming periods, with effects anticipated to persist for at least a while. Among the relevant transmission channels of these shocks, worth noting are those related to households' real disposable income and to firms' available investment funds, given that energy inputs are difficult to substitute for other production factors, at least in the short and medium term. The cumulated impact of higher energy prices on real GDP dynamics is projected at approximately -0.4 percentage points in the next two years, and its magnitude is contingent upon the hypotheses adopted[7] and the information available at the release date of this *Report*. The shocks are foreseen to affect both the cyclical component (output gap), primarily as a result of lower domestic aggregate demand, and potential GDP dynamics.

The developments in household consumption, already riddled with uncertainties surrounding the health situation outlook, are expected to be hampered by the impact of hikes in energy prices on households' disposable income[8]. The worsening trajectory of investments, which showed, however, notable resilience in the pandemic context, translates into smaller capital investment and efficiency losses in the use of production factors, affecting potential GDP dynamics. The latter would also be influenced by the economy's lower capacity to create new jobs. The slower investment could result in a weaker activity of several key economic sectors (e.g. industrial production), *inter alia* as a result of higher production costs generated by energy prices. In their turn, exports of goods and services, already hit by the persistent disruptions in supply chains, are expected to reflect the difficulties of exporting companies caused by the increase in production costs (with an impact on external price competitiveness) and the decline in investment funds (with adverse effects on productivity). The dynamics of imports of goods and services are also envisaged to mirror domestic demand shocks, as well as shocks on exports of goods and services. However, imports could increase their market share

7 For example, the set of elasticities estimated with the help of the NBR's model for analysis and medium-term forecasting (MAMTF) that are employed, *inter alia*, in substantiating adverse scenarios.

8 A case in point is the rise in oil prices, which affects consumption via direct and indirect channels. See, for instance, the ECB reference, 2018.

for certain goods segments where domestic producers would be more affected by higher energy prices than their foreign competitors (with access to more energy efficient technologies).

References

European Central Bank, *Economic Bulletin* No. 6/2018, Box 3 – "Oil Prices, the Terms of Trade and Private Consumption"

European Central Bank, *Economic Bulletin* No. 6/2021, Box 5 – "EU Emissions Allowance Prices in the Context of the ECB's Climate Change Action Plan"

Blume-Werry, E., Faber, T., Hirth, L., Huber, C., and Everts, M. – "Eyes on the Price: Which Power Generation Technologies Set the Market Price", Economics of Energy & Environmental Policy, 10(1): 251-265, 2021

European Commission – *Questions and Answers – Making our Energy System Fit for our Climate Targets*, 2021, available at: https://ec.europa.eu/commission/presscorner/detail/en/QANDA_21_3544

European Commission, DG Energy – *Quarterly Report on European Electricity Markets*, Volume 14, issue 2, 2021

"Integrated National Energy and Climate Plan (INECP) 2021-2030", published as annex to Government Decision No. 1076/2021, *Monitorul Oficial al României*, Part I, No. 963 bis/8 October 2021