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Box F:

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Modelling the duration of energy price shocks

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During 2021, there was a large surge in the price of energy commodities. The latest data for November 2021 show that the price of gas in Europe increased by 470 per cent on an annual basis (Figure 1). The price of Brent crude oil and coal were up 87 and 140 per cent, respectively.² As discussed in [Byrne and Zekaite \(2021\)](#) and [Byrne, Scally and Zekaite \(2021\)](#), supply and demand factors have both contributed to the recent surge in energy prices and this has created challenges for the global economy, including Ireland. For example, on the demand side, there was a strong recovery in global economic activity due to the easing of restrictions and vaccine rollout and increased demand due to weather related events, such as unusually cold temperatures in Europe and hotter summer conditions in other parts of the world. On the supply side, there have been disruptions to the supply of natural gas, lower coal production in China, and reductions in investment in oil and gas extraction.

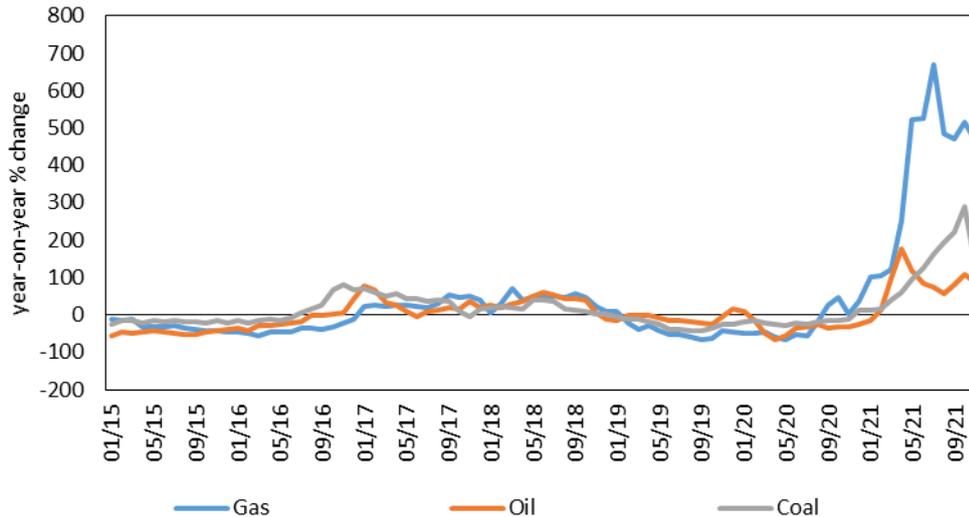
¹ Irish Economic Analysis Division.

² These figures refer to the average price of Australian and South African thermal coal.



Figure 1: Energy commodity prices surged in 2021

Chart: Energy commodity prices 2015-2021 (November)



Source: IMF (<https://www.imf.org/en/Research/commodity-prices>).

This box investigates the impact of an exogenous increase in the price of energy on the Irish economy using NiGEM and COSMO.³ This scenario is one of the key risks to the inflation outlook that could arise, for example, due to geo-political factors or changes to the weather and climate change. The purpose of the scenario is to assess the impact of higher commodity prices on inflation. However, this is an illustrative scenario and should not be viewed as a forecast of future likely developments in commodity markets.

Modelling Assumptions

Using NiGEM, we simulate the effect of an exogenous 100 per cent increase in the price of energy (oil, coal, and gas).⁴ To demonstrate that the persistence of the price increase matters, we consider two scenarios where the shock lasts 1 year and 3 years.⁵ We also assume that monetary authorities view the shock as temporary in nature and do not respond by raising

³ NiGEM is a global economic model developed by the National Institute of Economic and Social Research in the UK. The model documentation can be found at: <https://nimodel.niesr.ac.uk/> COSMO is a model of the Irish economy used by the Central Bank (see [Bergin et al \(2017\)](#) and [Conefrey, O'Reilly and Walsh \(2018\)](#)).

⁴ Note that the Department of Finance [Budget 2022 Economic & Fiscal Outlook](#) includes a simulation of the impact of a 50% oil price shock using COSMO.

⁵ The baseline scenario can be interpreted as a scenario without any shocks. The baseline scenario assumes that the price of oil is \$60 per barrel. The base price of coal and gas is equivalent to \$49 and \$18 per barrel, respectively. The simulation results are independent of the baseline assumptions.



interest rates in response to higher inflation. Moreover, we do not include other potential policy responses such as stockpile releases and fuel subsidy payments to households. It is important to note that the underlying cause of the price increase matters, meaning that scenarios driven by supply or demand shocks are different from exogenous shock scenarios (see Kilian 2009).⁶ The methodology we use is similar to Alonso and Suárez-Varela (2020).⁷

Transmission Mechanisms

In NiGEM, higher energy prices affect the economy through a number of channels. Higher energy prices improve the terms of trade for energy exporters, but worsen the terms of trade for energy importers. Energy is included in the production function and higher energy prices reduce the demand for energy and thus lower potential output. An increase in energy prices result in higher import prices and depending on the type of shock can also pass through to consumer prices. From the Irish perspective, the impact of the shock depends crucially on how the global economy and our main trading partners, in particular, respond.

Simulations Results

The NiGEM simulations show that the energy price shock would lead to higher inflation in our main trading partners. On impact, inflation in the euro area, US and UK increases by 4.0, 4.6 and 2.6 percentage points in the first year, respectively. This initial inflationary spike fades out after 1-2 years of the initial shock. These inflation dynamics are similar to those found in Kilian and Zhou (2021). The shock also has an adverse effect on economic activity in our main trading partners with GDP falling by up to 0.4 per cent in the euro area and 0.6 per cent in the US. The UK is an exception with GDP remaining broadly unchanged over the shock period reflecting an energy and trade mix that is less exposed to the shock compared to the euro area and US. Taken together, these price and activity effects imply that the Irish economy would directly face higher imported inflation and a reduction in foreign demand for Irish goods and services.

Figure 2 shows the estimated inflation response for Ireland using COSMO. On impact, inflation increases by 2.7 percentage points, which is generally lower when compared to our main trading partners. This is in part due to the varying energy mix by country and the higher intensity of fossil fuel use abroad, particularly by heavy industry. Moreover, the reduction in

⁶ [Kilian \(2009\) Not All Oil Price Shocks Are Alike: Disentangling Demand & Supply Shocks in Crude Oil Market.](#)

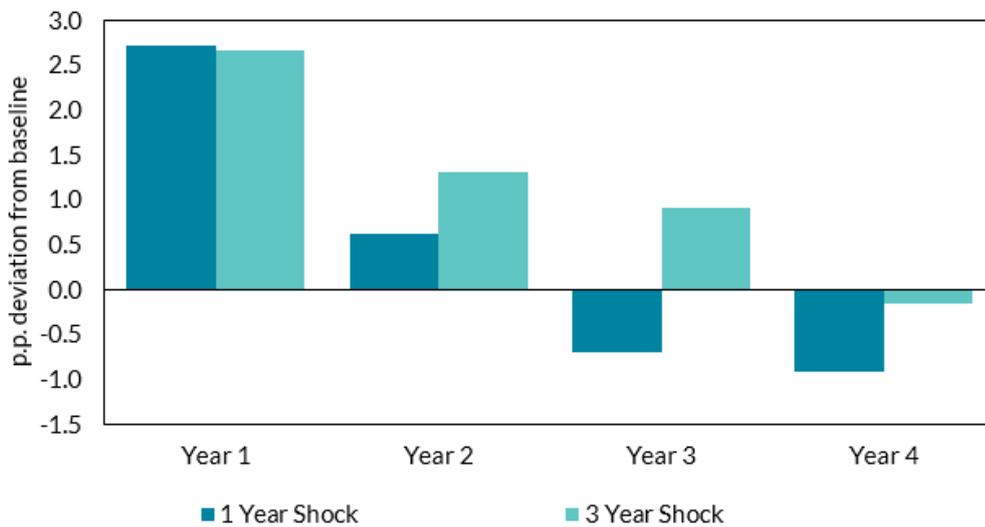
⁷ [Alonso and Suárez-Varela \(2020\) Box 2 An analysis of the global economic impact of the recent increase in energy commodity prices](#) and [Kilian and Zhou \(2021\) The Impact of Rising Oil Prices on U.S. Inflation Expectations in 2020-23.](#)



foreign demand is larger for Ireland and this partially offsets some of the inflationary pressures. The results, which take into account both the impact of higher imported inflation and the impact of higher costs in the domestic economy, show that the inflationary effects of the shock ease over time and tend to have diminished about 1-2 years after the shock. In the scenario where the shock lasts one year, inflation increases by 2.7 p.p. in the first year before falling to 0.6 p.p. in the second year. In the other scenario where the shocks lasts three years, inflation increases by 2.7 p.p. in the first year and is more persistent in the second and third years where it increases by 1.3 and 0.9 p.p., respectively. In both scenarios, the price level increases, but gradually returns to the baseline after the shock owing to the temporary nature of the shock. The projections in this *Bulletin* assume that energy prices begin to moderate in 2022, contributing to an expected reduction in inflation over the projection horizon. This analysis demonstrates the potential risks to the inflation outlook in the event of further increases in energy prices.

Figure 2: The initial inflationary spike fades out 1-2 years after the shock

Chart: Impact of shock on Irish inflation



Source: COSMO, authors' calculations.