

# The Impact of Oil Prices on Irish Inflation

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## Abstract

Oil prices have been characterised by large fluctuations in recent years. Strong volatility in oil prices has important implications for the Irish economy as Ireland has a relatively poor fuel endowment and relies heavily on imported oil. Energy price increases have been one of the principal drivers behind HICP inflation rates in Ireland in recent years. This article highlights the distinctive features of the Irish energy market which render the impact of oil price changes on Irish inflation different to the average impact felt at the euro area level. The direct effects on inflation are stronger in Ireland than in the euro area, reflecting the higher dependence on both oil and gas. The pass-through of higher oil prices to petrol and diesel prices at the pumps is slower than the euro area average but there is no evidence of pricing asymmetries. Indirect effects appear to be of a similar order of magnitude to the euro area average. Given the Irish economy's relatively high wage flexibility, and in particular the low incidence of automatic wage indexation, it is likely that second-round effects in Ireland are more contained than in the euro area. Irish pre-tax diesel and petrol prices are roughly comparable to euro area levels reflective of improved competition, whereas heating fuel is considerably more expensive. Pre-tax electricity and gas prices remain significantly above the euro area average and further steps are needed on the path to full liberalisation of the retail electricity and gas markets. Measures to reduce oil and gas dependency by, for example, greater recourse to renewable energy resources, will help mitigate the impact that oil price fluctuations have on Irish inflation.

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## 1. Introduction

Oil prices have been characterised by strong volatility in recent years. Having fluctuated around US\$20 a barrel for much of the 1990s, oil prices have risen sharply since 1999, peaking at US\$150 a barrel in mid-2008, before dipping below US\$30 by end-2008. In the first quarter of 2010, oil prices averaged US\$77 per barrel, representing an almost 71 per cent rise in nominal terms relative to the same period of 2009<sup>1</sup>. By international standards, the Irish economy is highly dependent on imported oil and hence particularly affected by oil price fluctuations. The main impact of oil price changes emerges through disproportionately negative terms of trade effects, with higher import costs reducing purchasing power and in turn weighing on domestic demand. The terms of trade deterioration can also produce adverse competitiveness effects, particularly relative to those trading partners with less reliance on oil. Such sharp price fluctuations also present challenges for the accurate forecasting of inflation and, at the euro area level, can make the task of deciding an appropriate monetary policy response more difficult.

Oil prices affect the Irish economy through several interlinked transmission channels, with this multiplicity due to the fact that oil is used both as an input in the production process and as a final consumption good. This paper uses a stylised framework similar to that adopted by the ECB (2010) to explain the channels through which changes in oil prices impact on inflation in the Irish economy. The propagation mechanisms are dependent on a wide range of factors including energy dependency, energy intensity, energy mix, and the level of competition. Furthermore, the transmission channels are complex and evolve over time due to shifts in the structure of energy markets, labour markets and macroeconomic conditions more generally. ECB (2010) provides a comprehensive assessment of the importance of energy price movements for the economic performance of euro area economies. With the aid of the results from the latter paper, this article highlights and expands on the distinctive

features of the Irish energy market which render the impact of oil price changes on Irish inflation different to the average impact felt at the euro area level. In this respect, it presents empirical results based on input-output tables and macro-econometric model simulations, which may be used as rules of thumb for how oil prices affect inflation in the Irish economy.

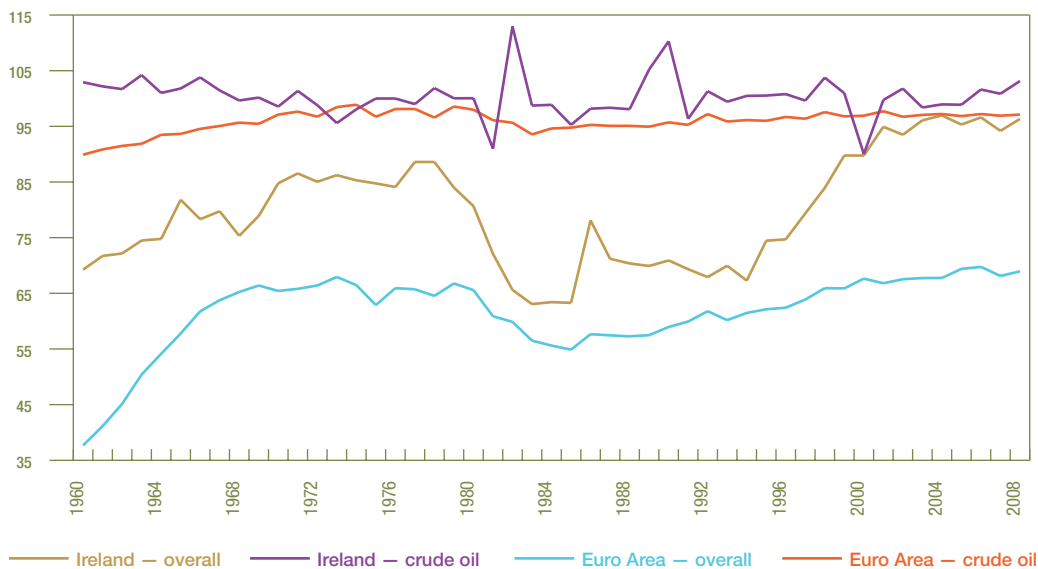
It is worth noting that in this article various energy market indicators are reported largely for 2007/2008 to allow comparison with euro area equivalent calculations compiled as part of ECB (2010). More updated energy information on 2009 Irish energy balances is available from SEAI. The article is structured as follows. Section 2 provides an update on the structure of Irish energy markets, with a particular focus on the importance of oil, and sets the stage for the subsequent analyses. Section 3 illustrates the main channels through which changes in oil prices impact on domestic inflation and provides empirical results using model simulations and input-output tables on the scale of direct, indirect and second-round effects. Euro area comparisons of the price levels of liquid fuels, gas and electricity are also provided. The final section then summarises the main findings.

## 2. Oil and The Irish Energy Market

The manner in which international oil price changes propagate through an economy depends partly on the structure of the economy's energy markets. The relative importance of international energy commodity prices can be seen by examining energy imported as a proportion of energy demanded. This is referred to as the energy dependency of an economy and Ireland's total energy dependency, at 96.3 per cent in 2008, is appreciably higher than the euro area average of 69.0 per cent (Chart 1). Oil dominates the energy landscape in Ireland in terms of consumption demand representing 64.8 per cent of total energy consumption in 2007, relative to a euro area average of 43.9 per cent. This to an extent reflects our relatively poor fossil fuel endowment and this leaves the Irish economy particularly exposed to the vicissitudes of international oil price movements. Moreover, as gas prices

<sup>1</sup> This article does not focus on the nature or persistence of energy price movements. An interesting overview of the evidence on the recent drivers of energy prices is provided in Box 1.1 of ECB (2010).

Chart 1: Energy Dependency (Net Imports as % Total Gross inland Consumption)



Source: ESCB staff and authors' calculations.

Note: The dependency ratio may exceed 100% when the energy stocks have been depleted. Gross inland consumption (GIC) is the total energy demand of a country or region. It covers consumption by the energy sector itself, distribution and transformation losses, final energy consumption by end users and statistical differences not already captured in primary energy consumption or final energy consumption figures. GIC does not include fuel oil provided to international maritime fuel bunkers.

are strongly correlated with oil prices, albeit with a significant lag, the gas import dependence is also relevant in an assessment of the impact of oil price changes. In Ireland, oil and gas together dominate our energy import structure (Chart 2). This high oil and gas dependency is reflected in the high oil and gas inputs used in electricity generation (Chart 4). Furthermore, the price elasticity of oil demand is quite low due to the low substitutability of oil; the price elasticity for Ireland is estimated to be about  $-0.08$  in the short term, rising to  $-0.20$  in the long-term, and broadly similar to results for the UK (Cooper (2003)).

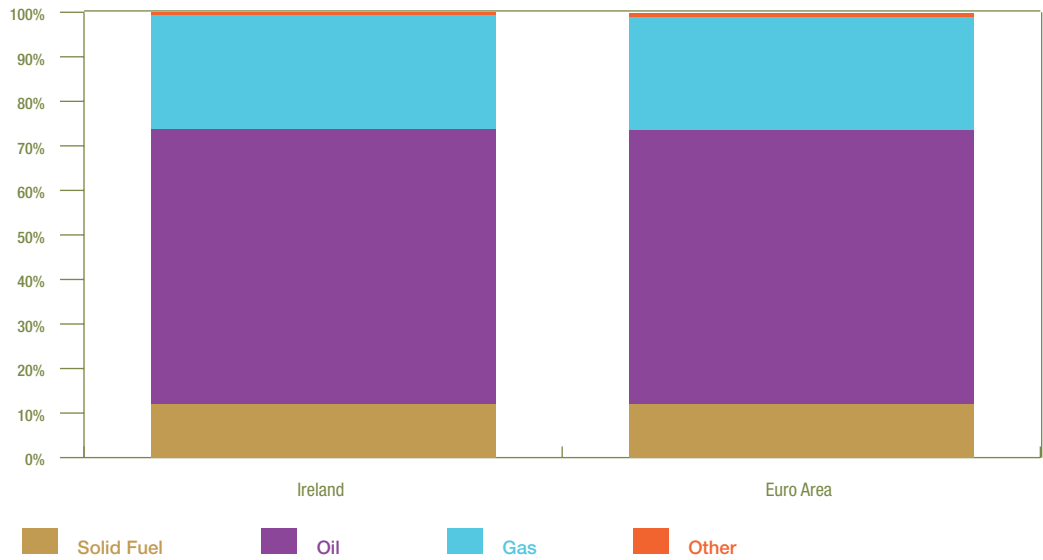
While overall energy dependency has tended to fluctuate within a relatively narrow band over time (at least relative to some main trading partners such as the UK and US), oil dependency in particular has always been high in Ireland (Chart 1). As oil dependency in Ireland is higher than the euro area average, a priori, the direct and possibly indirect effects of changes in international oil prices may be larger in Ireland, but other important factors such as energy intensities will also play a role (see Section 3). The significantly lower energy

dependence of other euro area countries is reflective of stronger domestic primary production of energy.

The energy production sectors both in Ireland and in the euro area are undersized relative to their respective energy needs in terms of final consumption, with total primary production only covering 10.6 per cent of total final energy consumption in Ireland in 2007, relative to a euro area figure of 56.2 per cent. As can be observed in Chart 3, Ireland's production is heavily weighted in favour of solid fuels (e.g. peat) with the latter accounting for a significantly greater share of primary production than the euro area average<sup>2</sup>. Oil and gas only account for zero and 26.2 per cent, respectively. In terms of final energy production in Ireland, note that 61.8 per cent of electricity is generated from oil and gas (compared with 26.0% in the euro area). While nuclear fuels contribute over 50 per cent to electricity generation in a number of euro area

<sup>2</sup> Primary production of energy is the extraction of energy products in a useable form from natural sources either from exploitation (coal mines, crude oil fields, hydro power plants) or the fabrication of bio-fuels. It excludes any energy which is transformed from one form to another (electricity, heat generation, or coke production).

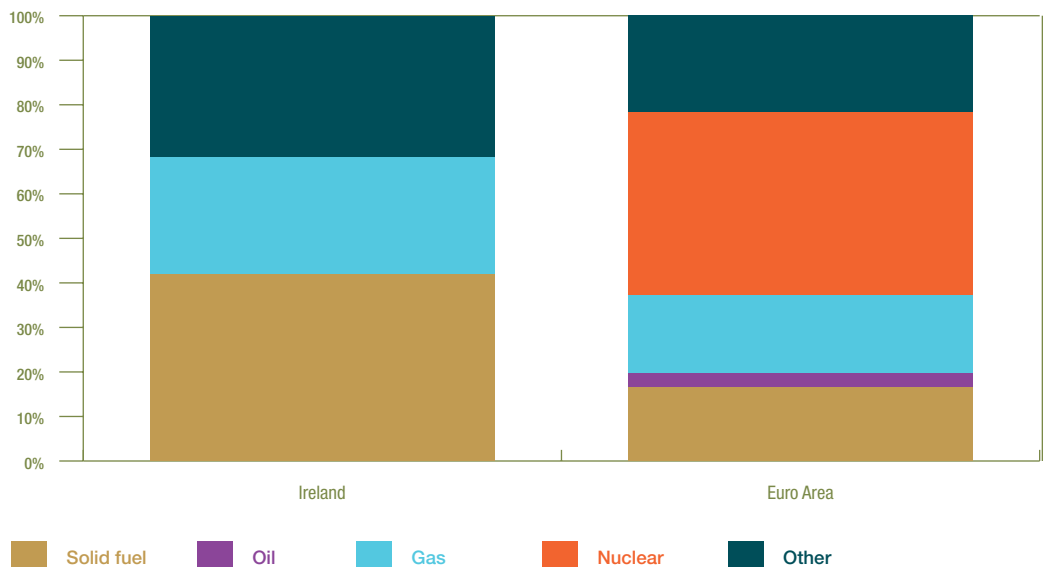
Chart 2: Import Structure of Energy Products, by Fuel Type, 2006



Source: Eurostat Energy & Transport in Figures (2009).

Note: 'Other' includes Renewables, Electricity and Derived Heat.

Chart 3: Primary Production of Energy, by Fuel type, 2007



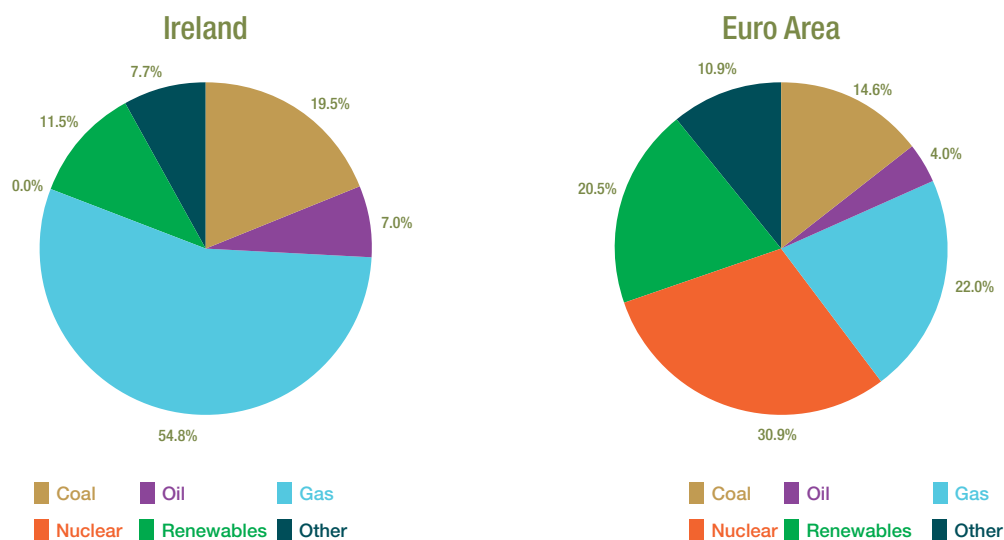
Source: ESCB staff and authors' calculations. The entirety of solid fuel production related to peat. 'Other' captures mainly renewables including of biomass, wind and hydro.

countries (such as Belgium, France and Slovakia), Ireland has no nuclear energy production. Overall, the greater reliance on oil and gas is reflected in the findings in Section 3, where the direct effect of an oil price rise on consumer price inflation is found to be greater in Ireland than in the euro area. Of note is that even if Ireland had greater primary production of oil and gas to reduce this import dependency, the prices of the domestically produced oil and gas would likely fluctuate in line with international prices so Irish firms and consumers would remain exposed to such price movements. Although gas accounts for a proportionately greater relative share of all primary energy produced in Ireland, the actual level of gas produced remains low. Looking ahead, the share of solid fuels in primary production is likely to fall for Ireland over the coming years, as the current peat electricity generation subsidy is gradually being phased out and is due to be eliminated by 2019. However, the growth in renewable generation, including the development of wind capacity on the system, (the Government's target is to have 40 per cent of electricity demand sourced from renewables by 2020) will likely help to compensate for the decline in solid fuels.

Turning to the components of final consumption demand, oil products are currently the most important component of final energy consumption in the Irish economy representing 64.8 per cent of final energy consumption, compared with an average of 43.9 per cent for the euro area. Electricity and gas products in Ireland account for a further 16.8 per cent and 11.9 per cent of final consumption demand. Oil and gas prices tend to exhibit strong co-movement and therefore, in the context of oil prices changes, corresponding changes in gas prices should also be taken into account. Oil and gas related products combined (both direct products and the portion of electricity generated from oil and gas<sup>3</sup>) therefore account for 87 per cent of final energy consumption in Ireland, relative to 72.8 per cent at the euro area level. Oil accounts for a greater portion of final consumption in both the household and industry sector in Ireland, than their respective counterparts in the euro area, leaving Ireland relatively more exposed to losses in competitiveness.

<sup>3</sup> Although oil accounted for roughly 7% of electricity generated in 2007, as oil fuelled plants are closing or have already done so, the remaining oil-use in electricity generation relates primarily to starting other fossil fuel plants. This would suggest that the current figure is somewhat lower. Gas-fuelled generation on the other hand is growing in importance.

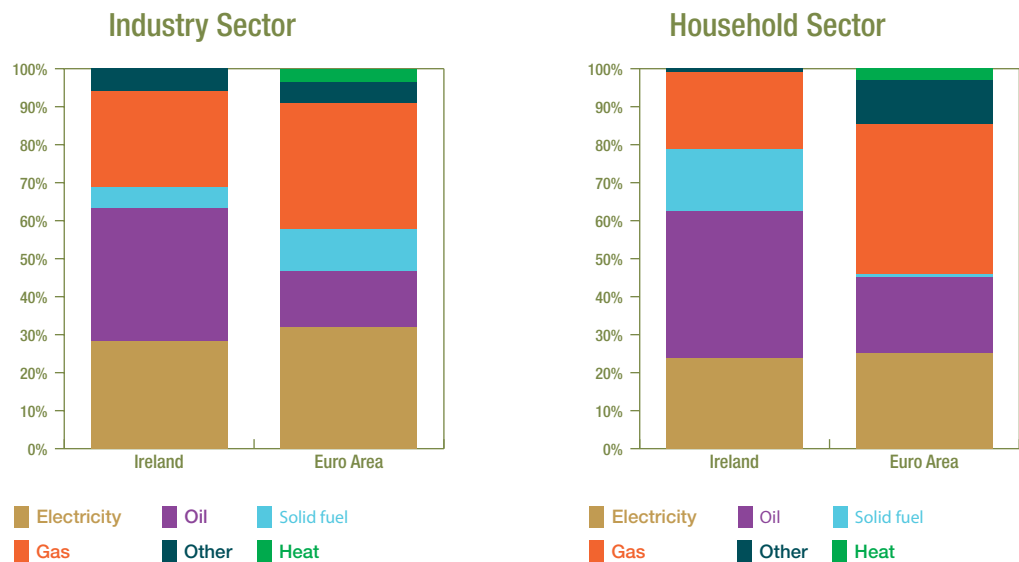
Chart 4: Electricity Generation, by Fuel Type (%), 2007



Note: Updated Energy Balance figures from SEAI suggest that the portion of oil use in electricity generation in particular has fallen to 3.3% in 2009 reflecting the closure of oil fuelled plants. These are not produced here as comparable figures for the Euro Area are not available.

Source: ESCB staff calculations.

Chart 5: Final Consumption of Energy, by Fuel and Sector, 2007



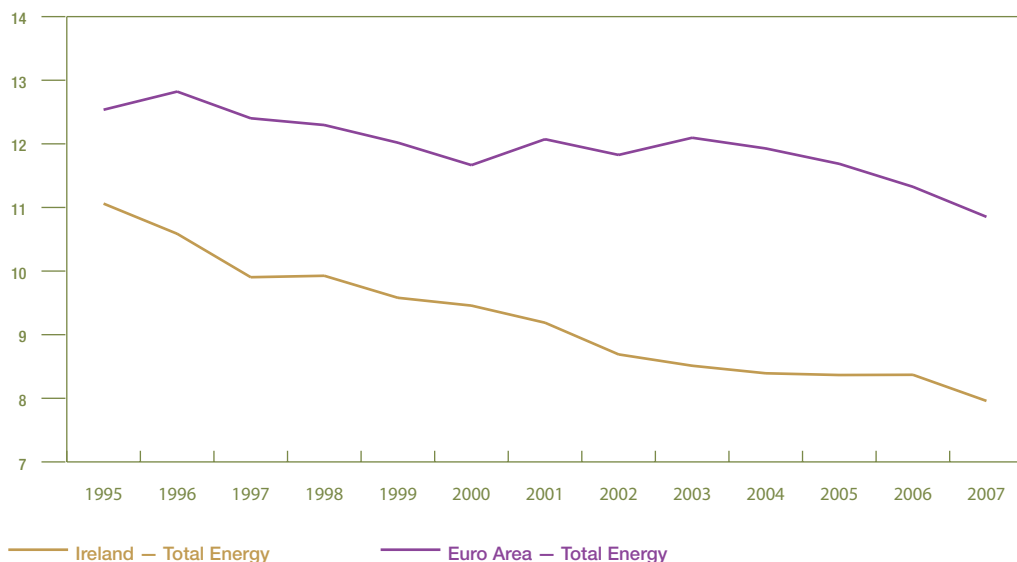
Source: ESCB staff and authors' calculations.

Energy intensity captures the link between energy consumption and economic activity, and can be used to proxy for the efficiency with which energy resources are used within the economy. Rather than efficiency, this is perhaps better described as energy productivity, since energy efficiency can be impacted by a range of factors such as structural change, activity, product mix and fuel mix. Whilst Ireland displays relatively high overall dependency, this exposure is partially offset by our relatively low and falling energy intensity. In fact, Ireland has witnessed sharper declines in energy intensity than any of our trading partners over recent years, improving our relative degree of insulation from energy price fluctuations. Energy saving techniques are often credited with having ushered in the general trend in declining energy intensities evident across the world in recent years. However, reductions in intensity can come about as a result of a shift in sectoral contributions to the economy and this was especially important in the case of Ireland. The services sector has advanced its share of Irish output considerably in recent years, and as this sector is relatively low in energy intensity, this structural shift has contributed to driving down Irish intensity ratings overall. There has also been a shift towards more high-tech

manufacturing, which tends to be less energy intensive than traditional manufacturing.

Although Ireland has the lowest overall energy intensity of all euro area countries, contributions to Irish gross value added are unduly influenced by certain high-tech sectors, such as the broad chemicals sector, possibly leading to some distortions in economy-wide intensity levels. The energy intensity of the Irish chemicals sector is by far the lowest of the corresponding sectors across euro area countries and energy expenditure as a portion of total expenditure in the chemicals sector in Ireland is especially low. This may have implications for the subsequent analyses on indirect effects. The lower relative energy intensity may be expected, a priori, to contribute to lower indirect effects in Ireland than in the euro area. However, important low energy intensity services and high-tech sectors produce much of their output for export and therefore often do not make significant contributions to indirect effects on domestic inflation. While the potential inflationary effects arising from higher energy intensity exports may leak out of the economy, it is worth noting that the energy intensity of imports is both high and has been rising substantially, explaining in

Chart 6: Energy Intensity (Energy Consumption ToE 000s /GVA €m constant 2008 prices)



Source: Authors' calculations.

Note: ToE refers to Tonnes of Oil Equivalent and is used as a harmonised measure of energy volumes across different fuel types. GVA is Gross Value Added of the entire economy expressed in constant 2008 prices.

part the persistence of indirect effects. Finally, an important caveat is that energy intensity movements may often be related to non-energy related parameters such as infrastructure, population density and the age of the housing stock.

The presence of greater market competition may help to insulate the economy somewhat against sharp energy price movements, since greater competition generally leads to higher productivity and, all other things equal, lower price levels<sup>4</sup>. Also, pricing asymmetries are less likely to exist. In common with other euro area markets, there is no evidence of pricing in asymmetries in the Irish petrol and diesel markets (Bermingham and O'Brien (2010) and Meyler (2010)). In this respect, for example, Ireland has a comparable level of petrol stations per capita at 251 stations per 100,000 persons in 2007 relative to a euro area

<sup>4</sup> Greater competition may lead to higher productivity and consequently, lower price levels. However, if competition is perfect, this would imply that all upstream cost increases are passed on in full.

equivalent of 256. Ultimately more detailed data at the local level would be necessary to definitively determine the degree of competition in this sector.

Given the importance of oil and gas in terms of Irish electricity generation, further falls in market concentration in the retail electricity market in particular could help to mitigate the impact of sharp oil price increases. At the wholesale level, Irish energy markets have a greater degree of competition relative to euro area average. Evidence of this greater degree of competition is captured by the Herfindahl Hirschman Indicator (HHI) of market concentration which corrects for relative firm size within the market. On a HHI-basis, Ireland outperforms the euro area average, suggesting a greater degree of competition in the wholesale gas and electricity markets. Turning to the retail market, the market concentration in the electricity market is comparable to the euro area average but the gas market appears highly concentrated, reflecting the dominance of Bord Gais.

**Table 1: Energy Market Competition Indicators, 2007**

Indicator	Electricity		Gas	
	Euro Area	Ireland	Euro Area	Ireland
HHI Wholesale	4,062	1,526	4,076	1,780
Retail	4,215	3,434	4,078	9,822

Source: CER for Ireland and ESCB staff calculations for Euro Area average. Irish gas market figures relate to 2006. Given that retail consumers now have a greater choice among providers, the HHI figures have likely fallen significantly since 2006.

Note: HHI refers to Herfindahl Hirschman Indicator and takes into account the relative size and distribution of the firms in a market. It is calculated as the sum of the squared market shares of each firm operating in a market segment; a value of 10,000= monopoly, greater than 5,000= highly concentrated, and below 5,000 = moderate to low concentration. The HHI for wholesale electricity fell from 1,526 in 2007 to 1,388 in 2009. Wholesale electricity market shares are based on generation (retail shares on consumption). In wholesale terms, this may overestimate the impact of new entrants to the market, which tend to serve less profitable larger users first. Although the Residual Supply Index (RSI) is arguably a better measure of market concentration in wholesale electricity markets in particular, the HHI is reported here to place Ireland in a euro area context.

### 3. Impact of Oil prices on Irish Inflation

Strong fluctuations in oil prices in recent years have impacted significantly on Irish inflation. In this section, the main channels through which oil price changes affect inflation are examined and empirical estimates of the impact of oil prices changes based a range of approaches are presented.

#### 4.1 Transmission channels to inflation

A stylised framework of energy price pass-through channels is presented in Chart 7. It is worth noting that oil is priced in US dollars in international markets and so favourable euro/dollar exchange rates movements may mitigate the impact of higher prices for oil in dollars. Ultimately, it is the price of oil in euro that is relevant in terms of impact on domestic consumer prices. The price impact of oil price changes can be categorised as first- or second-round effects:

- According to our framework, first-round effects only give rise to a one-off increase in the price level and do not have lasting inflationary effects. First-round effects can be broken down into direct effects and indirect effects:

- Direct effects: Capture the impact on energy items contained in the index of consumer prices such as petrol and diesel prices. The impact on these consumer prices is fast and normally fully passed-through within one quarter in the euro area. Note that higher oil

prices tend to be followed by higher gas prices, albeit with a significant lag, and the impact of higher gas prices is sometimes also taken into account (and have been included here);

- Indirect effects: Capture the impact on consumer prices via production costs. Higher oil prices may raise the cost production of goods, particularly for energy-intensive processes in certain sectors. Higher oil prices may also apply significant upward pressure on the costs of transport services, especially for air fares which have a large oil input. Finally, higher oil prices may be gradually passed through to the prices of consumer goods more generally via higher distribution costs.

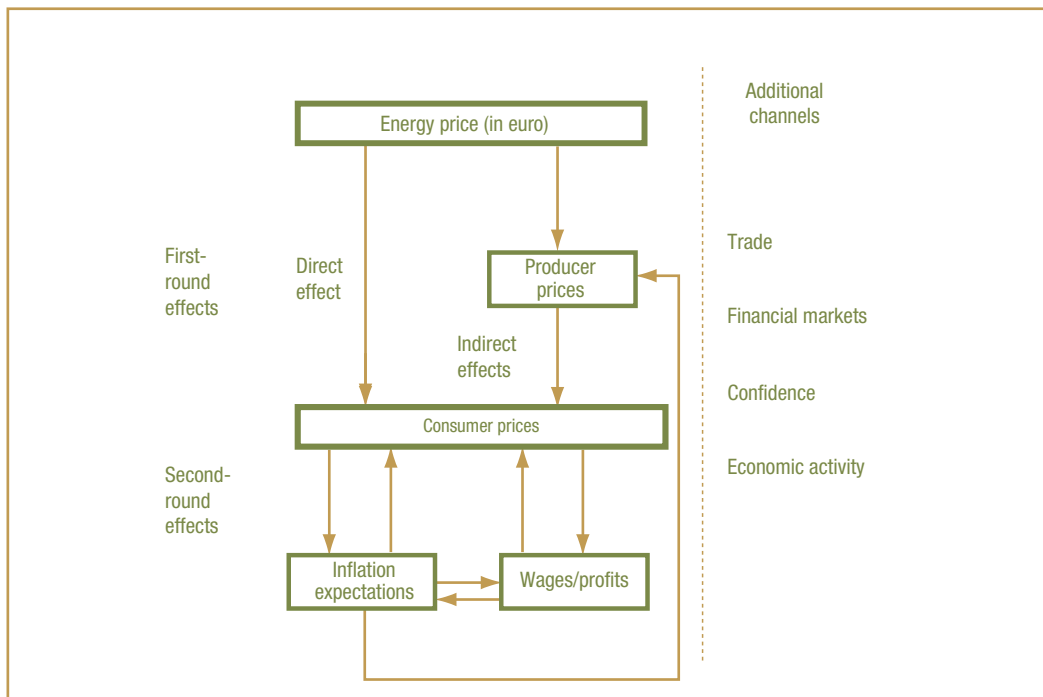
- Second-round effects are of particular interest to central banks. When second-round effects are present, higher oil prices not only increase the price level but may also lead to more persistent effects on inflation<sup>5</sup>:

- Higher consumer prices arising from first-round effects, although temporary by nature, may simply raise inflationary expectations and apply upward pressure on consumer prices generally;

<sup>5</sup> This terminology is not uniform in the literature and indirect effects are sometimes included as second-round effects. Indirect effects and second-round effects can be difficult to disentangle empirically.



Chart 7: Energy Price Pass-through Channels



Source: ECB (2004).

- Second-round effects may also emerge in the wage bargaining process. Employees may push for higher nominal wages to compensate for higher consumer prices weighing on their purchasing power. Firms may pass on the higher labour costs to consumers in order to maintain profit margins. Higher consumer prices may in turn lead to demands for higher nominal wages, possibly beginning an inflationary spiral.

The extent of second-round effects in the Irish economy will depend to an extent on the prevailing macroeconomic conditions but also on structural factors. A greater level of competition in product markets and labour market flexibility may help to contain inflationary pressures, as an appropriate wage reaction, where the impact of the oil price increase on real incomes is accepted, will minimise the risk of an inflationary spiral. With a credible monetary policy aimed at maintaining price stability over the medium-term, the reduction in real incomes is more likely to be accepted and inflation expectations are less likely to be affected by a temporary increase in inflation. There are additional channels, such as the

impact on consumer confidence, but these are not the focus of this article and are difficult to quantify in any case.

#### 4.2 Energy prices and Irish Inflation

Energy price increases directly contributed about one quarter of the 11.3 per cent cumulative increase in the Irish HICP price level between 2004 and 2008 (see Table 2). The petrol and diesel component accounts for close to a half of the energy component of the HICP and was among the largest contributors and most volatile components in HICP annual inflation over recent years. Despite a modest weight, home heating oil prices were especially volatile and as a result made a significant contribution to HICP annual inflation<sup>6</sup>. Although there were significant changes in electricity and gas prices arising from large oil price changes, their contributions to annual headline inflation were comparatively muted, particularly over the past two years. Note that some of the changes in prices were due to tax changes, including the recent introduction of carbon taxes, and also that changes in the VAT component may arise from changes in excise duties and/or carbon taxes.

<sup>6</sup> In Ireland, excise duties form a relatively small proportion of the price of home heating oil. As a result, the volatility in oil prices is reflected to a greater extent in home heating oil prices.

**Table 2: Contributions of Energy Inflation to Irish HICP Annual Inflation, 2005-2010**

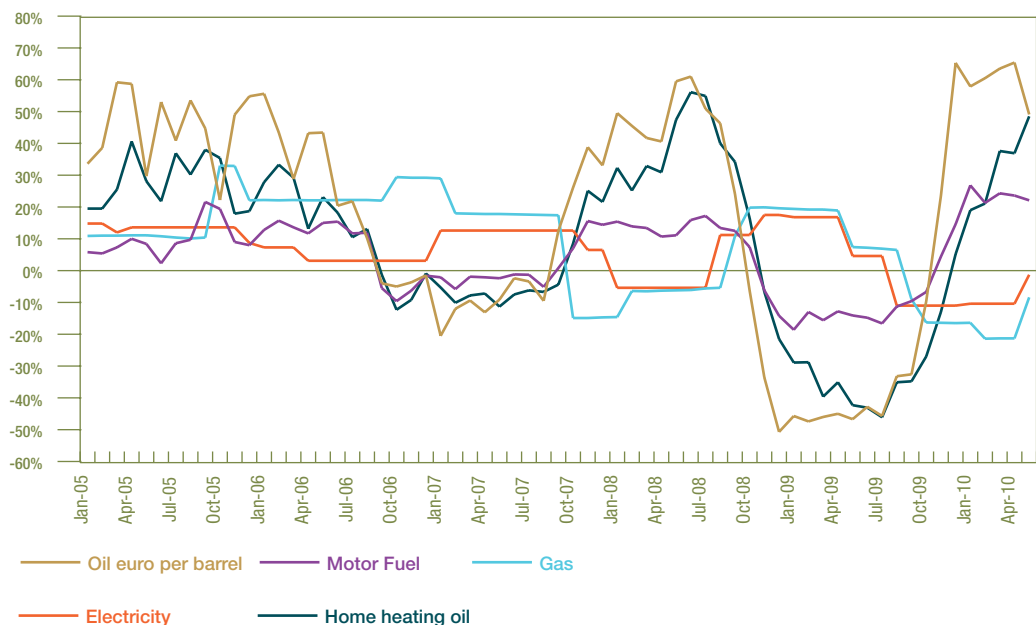
	HICP Weight (%) Dec 2006	2005	2006	2007	2008	2009	2010(f)
HICP Inflation	100	2.2%	2.7%	2.8%	3.1%	-1.7%	-1.3%
Energy	8.7	1.0%	0.7%	0.4%	0.8%	-0.8%	1.1%
Petrol and Diesel	4.2	0.4%	0.3%	0.1%	0.4%	-0.5%	0.9%
Home Heating Oil	1.0	0.2%	0.1%	0.0%	0.3%	-0.4%	0.3%
Gas	1.0	0.1%	0.2%	0.1%	0.0%	0.0%	-0.1%
Electricity	1.7	0.2%	0.1%	0.2%	0.0%	0.0%	-0.1%
Miscellaneous Fossil Fuels	0.8	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%

Source: Authors' calculations based on CSO data.

The most evident and immediate impact of changing oil prices is on prices at the petrol and diesel pumps. The rates of pass-through between refined oil prices and pre-tax prices for petrol and diesel were assessed by modelling data in levels as the pass-through is a function of price level. In the euro area, the direct pass-through of oil prices to pre-tax prices of petrol, diesel and home heating oil is generally complete, quick and there is little evidence of asymmetry. The findings on pass-through rates to home heating oil are broadly similar. In Ireland, the pass-through to petrol and diesel prices appears to be slower but there is no evidence of economically meaningful pricing asymmetries (Bermingham and O'Brien (2010)). In contrast to liquid fuels, electricity and gas prices are generally less volatile and do not change nearly as frequently. In Ireland, price changes for gas and electricity are subject to regulatory approval and normally

only change twice per year at most. The direct pass-through of gas price changes to consumer prices in the euro area is approximately 6 to 9 months while, for electricity prices, a reliable empirical estimate of the pass-through is more elusive. Preliminary estimates on the direct effects of a 10 per cent increase in oil prices are provided below and are based on an assumption of full pass-through to consumer prices. As gas prices are strongly correlated with oil prices, albeit with a lag, the combined impact of a 10 per cent rise in both oil and gas prices is also examined. Also, about 61.8 per cent of electricity is generated from oil and gas so the potential impact on electricity prices is also examined. The direct effects are computed mechanically using HICP weights and simple assumptions on the pass-through from increases in (i) oil prices; (ii) oil and gas prices; and (iii) prices for oil, gas and

**Chart 8: Oil Prices & Irish HICP energy sub-components year-on-year changes (%)**



Source: Authors' calculations based on CSO data.

**Table 3: Estimated cumulative direct effect of 10 per cent increase in oil prices on Irish HICP annual inflation, per cent deviation from baseline**

Energy sub-index	Year 1	Year 2
Liquid fuels only*	0.17	0.20
Liquid fuels and gas	0.19	0.26
Liquid fuels, gas and electricity**	0.23	0.37

\*Liquid fuels comprise petrol, diesel and home heating oil;

\*\*Electricity generated using oil and gas as input.

electricity generated using oil and gas. These calculations assume a full pass-through to liquid fuel prices during the first quarter of the first year and a full pass-through to gas prices and electricity prices during the third quarter of the first year (in practice, the Commission for Energy Regulation tends to decide twice per year on electricity and gas price changes, and the timing and scale of the pass-through of international oil price changes depends on a range of factors). As a result, the impact in the second year reflects some positive carryover.

#### 4.3 Direct effects, indirect effects and second-round effects on Irish Inflation

Oil price changes can affect consumer prices often through complex channels that evolve over time, which makes the task of estimating the impact of oil prices changes quite challenging. One possible approach to estimating the direct, indirect and second-round effects of oil price changes uses traditional macroeconomic models. There are some strong limitations to model-based analyses of the impact of oil price changes including difficulties in accounting for supply-side effects, how to allow for structural changes such as the falling oil intensity of production, and how to take into account confidence and expectations effects. Differences in modelling strategies can also play a role in explaining cross-country differences. Bearing in mind these caveats, when both oil and gas prices are increased, the total impact on the HICP price level in Ireland is estimated to be about +0.25 percentage points over three years<sup>7</sup>, which is significantly lower than the average total impact across the euro area (see Table 4). There are a number of reasons as to why the

model may understate the indirect effect on consumer prices. Firstly, there is a significant degree of uncertainty surrounding the estimates and a number of strong assumptions have been made to try to capture more fully the various transmission channels of oil price changes. Secondly, in calculating the terms of trade effect, an assumption is made that the exports have the same energy content as domestically oriented products. However, as evidenced in this paper, the energy intensity of the exporting services sector and chemicals sector are quite low. Therefore, it is possible that the proportion of energy that is used as an input in the production of exports is overestimated and as a result the indirect effects may be understated to a significant degree. Thirdly, the prices of gas produced domestically, albeit produced in modest proportions in terms of overall gas consumption, remain static in the analysis but are likely to increase in line with international gas price movements. This may also boost the estimated total impact on inflation.

Indirect effects can be particularly difficult to disentangle empirically from second-round effects. For the euro area, the second-round effects are estimated to account for about half of the total effect on the euro area HICP excluding energy index via wage indexation or wage negotiations<sup>8</sup>. The role of second-round effects appears to be greater in countries with a lower degree of wage flexibility and particularly where wage indexation is more common. Given the Irish economy's relatively high wage flexibility, in particular the low incidence of automatic wage indexation, it is

<sup>7</sup> This is lower than the direct effect on consumer prices reported in Table 6, reflecting the fact that macro models are calibrated in logs rather than levels, and using data over a long time horizon. This suggests that the direct effect implicit in Table 4 is subject to slight downward bias.

<sup>8</sup> One way to isolate indirect effects would be to simulate the impact of a rise in oil prices on a HICP excluding energy variable (HICPX) and switch off the wage channel. However, the Bank's model does not contain a HICPX variable and in any case putting the entire burden of adjustment on employment would exert possibly excessive pressures on the stability properties of a model containing HICPX.

**Table 4: Impact of 10 per cent increase in oil prices on consumer prices (annual averages, per cent deviation from baseline cumulated, wage reaction on)**

	Year 1	Year 2	Year 3
Ireland (oil only)	0.09	0.20	0.22
Ireland (oil and gas)	0.10	0.22	0.25
Euro area (oil and gas)	0.24	0.39	0.45

likely that second-round effects are more modest than the euro area average. Also, strong pricing power on the part of firms can make the impact of transitory energy price increases on inflation more persistent. Finally, it is worth noting that possible non-linearities in the impact of oil prices are not captured by the model i.e. the model assumes the impact of an x per cent increase in oil prices has half the impact of an increase in oil prices of two times x. Also, level effects are likely to be important due largely to the varying proportion of taxes in the price level. In the model simulations, starting oil prices are assumed to be close to their current level.

The second approach used here to estimate direct and indirect effects is based on input-output tables, which can illustrate how oil price changes feed through sectors of the economy by way of consumption of intermediate inputs in the production chain. While an input-output analysis can help to separate out the direct effects and indirect effects, it is important to keep in mind that this approach also has limitations in that it is essentially a static

analysis so there is no allowance for substitution effects. Moreover, the possibility of second-round effects are not taken into account as profit margins and wages are assumed to remain constant. According to an analysis of input-output tables relating to 2005 across 12 euro area countries, Ireland has the lowest total impact on producer prices, with a 10 per cent increase in oil prices giving rise to a 0.25 per cent increase in producer prices. This compares with a euro area average of 0.39 per cent and the total effect is generally evenly divided into direct and indirect effects across the euro area including in Ireland. The reasons why the impact is comparatively low for Ireland become apparent when the analysis is undertaken by branch of activity (see Table 5). Service sectors, such as financial services and computer services, have a relatively strong presence in the Irish economy and the impact of higher oil prices in these sectors is, unsurprisingly, quite limited. Also, the energy intensity in certain sectors of the Irish economy is relatively low. In particular, oil prices have a quite modest impact in the important chemicals sector as non-energy inputs such as royalties and licenses figure prominently. Thus, the low

**Table 5: Impact of a 10 per cent increase in energy prices on producer prices by main branch of activity, per cent (2005)**

Activity	Sub-branch	Ireland	Euro Area
Agriculture & Fishing		0.35	0.35
Manufacturing		0.11	0.29
Of which	Chemicals	0.03	0.70
	Base metals	2.59	0.59
Energy		4.75	4.88
Construction		0.23	0.20
Services		0.13	0.16
Trade		0.11	0.19
Transport		0.54	0.60
Of which	Land Services	0.60	0.64
	Water Services	0.44	0.63
	Air Services	1.06	1.53
Telecommunications		0.10	0.12
Other Services		0.10	0.10
Overall		0.25	0.39

Source: Eurosystem staff calculations based on IOT (2005).

**Table 6: Direct and indirect impact of 10 per cent increase in energy prices on Irish and Euro area producer and consumer prices**

	Producer Prices		Consumer Prices	
	Ireland	Euro Area	Ireland	Euro Area
Direct	0.13	0.20	0.30	0.22
Indirect	0.12	0.20	0.14	0.14
Total	0.25	0.39	0.44	0.36

Source: Eurosystem staff calculations based on IOT (2005).

overall impact in Ireland is due to a favourable production structure, which is oriented towards less energy intensive sectors.

The overall impact on the pre-tax consumer price level is computed by weighting the effects on disaggregate producer prices by the corresponding share in consumption. Table 6 presents the breakdown of the total impact on consumer prices where the direct effects represent the direct use of energy products while indirect effects cover the consumption of products that use energy as inputs. The direct impact of a 10 per cent increase in oil prices on consumer prices in Ireland of about 0.30 per cent is significantly higher than the euro area average of 0.22 per cent. This may reflect the greater oil dependency of the Irish economy. Note that these calculations also take into account the impact of higher gas prices, which tend to follow from increases in international oil prices. The indirect effects for Ireland are much the same as for the euro area, which suggests that the very low overall energy intensity of production in Ireland is heavily influenced by production destined for export and not domestic consumption (albeit with the offsetting impact of higher intensity imports). Finally, note that the analysis of input-output tables can give estimates of the magnitude of the impact but do not give an indication as to the rate of pass-through of oil price changes i.e. the likely timing of the impact on consumer prices via either direct or indirect effects cannot be determined.

#### 4.4 Energy Price Level Comparisons

Diesel prices in Ireland were close to the euro area average on both a pre-tax and a post-tax basis in 2009. Whilst petrol prices were lower on a pre-tax basis, higher indirect taxes in the euro area drove more of a wedge between relative post tax prices. Also, it is worth noting that heating fuel is considerably more

expensive in Ireland on both a pre- and post-tax basis, reflecting Irish-specific policy considerations whereby heating fuel is effectively subsidised for lower income earners through various fuel coupon initiatives often leaving the end-price paid by the consumer much lower.

Fuel price levels can vary across countries due to cost structures, energy policies and taxes. The upward price impetus which would otherwise be imparted as a result of our relatively limited refining capacity is mitigated by the high degree of cross-selling with other products, and relatively heavy supermarket competition (with the latter loss-leading on a 'known value item' such as petrol). Ireland displays a relatively high degree of cross-selling by European standards, which is reflected in relatively lower prices, corroborating the trend evident in other Euro Area countries. Variance in pricing structures is another feature of the Irish fuel market, with a recent National Consumer Agency (NCA) Report (2008) finding that prices for petrol and diesel could differ by up to 15 cents across service stations in Ireland. Margins also exert an impact on price levels, with the former linked to levels of competition, price regulation (both of which are relatively high in Ireland) and scale effects. Lower pre-tax petrol and diesel prices here reflect the fact that margins are relatively tight in Ireland.

Pre-tax electricity prices for households in Ireland are significantly above the euro area average while post-tax prices are slightly above the euro area average. Electricity prices for Irish residential customers have followed a very volatile trajectory, having started to fall in the second half of 2008, before rising sharply in the first half of 2009. In the second half of 2009, prices fell again quite markedly,

**Table 7: Comparison of fuel consumer prices in 2009**

		Ireland		Euro Area	
		Total	Of which taxes	Total	Of which taxes
Petrol	€/100 litres	110.7	70.1	119.8	76.7
Diesel	€/100 litres	102.1	57.6	100.5	56.1
Heating Fuel	€/100 litres	65.7	13.4	59.7	18.1
Electricity	€/100 kWh	18.6	2.2	17.3	5.0
Gas	€/Gjoule GCV	15.3	1.82	16.0	4.2

Source: European Commission, Eurosystem calculations and Sustainable Energy Ireland.

Note: Gas and electricity prices refer to domestic consumer prices for the 2<sup>nd</sup> semester of 2009 and are collected by Eurostat under the new methodology for the EU Gas and Electricity Price Transparency Directive (2008).

averaging declines of between 8 and 9 per cent between the first and second half of the year. Prices for average customers are now 7 per cent greater than the European average<sup>9</sup>. The sharp falls experienced in Irish electricity prices in 2009 reflect both the base-effect of falling international prices, but also a temporary dampening effect owing to the rebate offered to large energy users by the Commission for Energy Regulation (CER) in order to mitigate the impact of high global fossil fuels<sup>10</sup>.

Pre-tax gas prices for households in Ireland are slightly above the euro area average but post-tax prices are somewhat below the euro area average. Gas prices have fallen even more sharply than those of electricity, with the largest residential consumers experiencing the greatest reductions, where prices fell by 18 per cent in the second half of 2009<sup>11</sup>. Prices paid by smaller Irish customers are now 17 per cent below the European average. It is important to highlight that given the lag in gas prices behind those of electricity prices, once international electricity prices begin to creep back up, Irish gas prices may temporarily appear to have made more progress than is truly the case in terms of price convergence with average European prices, therefore recent price reductions should be interpreted judiciously. Arguably, for the purposes of competitiveness, cross country fuel price comparisons should be based on final prices

paid by the consumer; the all tax inclusive price for households and the price exclusive of recoverable taxes (ex VAT) for businesses.

Aside from international price movements and the price impact arising from regulated rebates, electricity and gas prices are also influenced (inter alia) by cost considerations such as the degree to which investment in infrastructure assets are passed through to consumers. In 2009, the CER approved significant expenditures (€5.6 billion) relating to both the electricity transmission and distribution systems, which resulted in use of system charges which will bring about a likely annual price increase of almost 20 per cent in 2010. As mentioned in Section 2, Irish electricity is generated by a wide range of inputs with a particular fuel mix favouring oil and gas (together accounting for almost 62 per cent of electricity generated relative to a euro area average of 26 per cent). As Ireland is more reliant on fossil fuels, any increases in the cost of fossil fuels put Ireland at an increasing relative disadvantage. However, the offsetting impact of increased deregulation, together with innovative advances in electricity production (such as the new efficient gas fired ESB plant at Aghada) may help to mitigate this exposure. In addition, the Irish market is also becoming less concentrated; the entry of Bord Gais in to the electricity market and ongoing steps towards full liberalisation are likely to apply downward pressure on consumer prices over time<sup>12</sup>.

<sup>9</sup> This captures those customers falling into residential bands DD and DC, who combined make up 88 per cent of the residential electricity market.

<sup>10</sup> This €315 million rebate will impact on 2009 and 2010 price levels, but is due to be phased out gradually by 2011.

<sup>11</sup> Reflecting the new EU harmonised methodological approach to collecting energy price data, large resident gas consumers are taken as those falling into band D3.

<sup>12</sup> Although further deregulation can help mitigate price increases, this is not always the case. Whilst it may reduce costs this does not guarantee prices will fall or that these reductions will be passed on to the consumer. Despite deregulation, consumer inertia may prevent the forcing down of prices.

## 5. Conclusions

Oil prices have been characterised by large fluctuations in recent years, rising annually in euro terms by 24 per cent in 2008 and falling by about 33 per cent in 2009. Strong volatility in oil prices has important implications for the Irish economy, as Ireland has a relatively poor fuel endowment and relies heavily on imported oil. Oil-related final products combined account for 81.7 per cent of final energy consumption in Ireland, which is significantly greater than the corresponding 72.8 per cent for the euro area average. While Ireland displays relatively high overall energy dependency, this exposure is partially offset by our relatively low and declining energy intensity. However, the low energy intensity in the Irish case may primarily reflect the importance of the less energy intensive services sector and high-technology manufacturing sectors. More traditional exporting sectors remain heavily exposed to sharp price movements in oil and gas as they are generally related to more energy intensive activities and also tend to be characterised by narrower margins.

Energy price increases were one of the principal drivers behind HICP inflation rates in Ireland in recent years, directly contributing about one quarter of the 11.3 per cent cumulative increase in the Irish HICP price level between 2004 and 2008. The impact of oil prices on domestic inflation was decomposed using a range of empirical approaches and the constituent effects can be summarised as follows:

- The direct effects on consumer price inflation are stronger in Ireland than in the euro area reflecting the higher dependence on oil and gas. The pass-through of higher oil prices to petrol and diesel prices at the pumps is slower than the euro area average but there is no evidence of pricing asymmetries;
- Indirect effects appear to be of a similar order of magnitude to the euro area average according to results from an analysis of input-output tables. Although Ireland has the lowest energy intensity in the euro area, a large proportion of less energy intensive production is destined for export and therefore would not

materialise as indirect effects on domestic inflation. These results suggest that the energy efficiency in production for domestic consumption is more comparable to the euro area average;

- Second-round effects appear to have become less significant but are still estimated to account for about half of the total effect on core euro area inflation. Given the Irish economy's relatively high wage flexibility, and in particular the low incidence of automatic wage indexation, it is likely that second-round effects in Ireland are more modest than the euro area average.

Effective competition in the petrol and diesel markets has helped to keep pre-tax price levels comparable to those in the euro area. However, pre-tax electricity and gas prices remain significantly above the euro area average and further steps are needed on the road to full liberalisation of the retail electricity and gas markets. Greater energy efficiency and greater flexibility in wage and price setting needs to be promoted in order to, among other reasons, minimise the costs of energy price volatility. In this respect, the Irish labour market has exhibited a relatively large degree of flexibility, but it is imperative to sustain this flexibility in order to provide some insulation against further sharp energy price rises. A credible monetary policy is also important determinant of whether pressures from energy price rises translate into inflation over the medium-term.

Finally, it is worth noting that oil prices are already high by historical standards although the international recovery is not yet robust and there is significant upside risk that oil prices will re-emerge as a prominent driver of inflation when the recovery in developed economies gathers further momentum. This likelihood is heightened by the downscaling of investment during the crisis and the consequent tightening in energy supply. Measures to reduce oil dependency more generally can help to make the Irish economy more robust to international energy commodity price fluctuations while at the same time help address concerns relating to the environment impact of fossil fuel consumption and the security of energy supply.

Further development of renewable energy resources will go some way towards meeting both Government and EU targets and will also help to partially mitigate the impact that fluctuations in oil prices may have on inflation in the future.

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