## The effect of oil prices on the European economies

Oil prices have fluctuated sharply since the turn of the millennium, with the price of a barrel of Brent crude oscillating between 16 and 145 dollars. These shocks affect all countries simultaneously, and within each country they have an impact on numerous areas of the economy (output, prices, wages etc.).

There are multiple methods for estimating the effects of oil prices, yielding results which are difficult to compare with one another. Below is an up-to-date dashboard showing the positive and negative effects of oil price shocks on the main Eurozone economies, drawing upon different macroeconomic models.

**Variations in oil prices may be passed on to the real economy via multiple channels**

On the supply side, oil prices have an impact on production costs. If prices rise, businesses have two options: to reduce their margin rates, or else to increase their own prices. In both cases, output falls at the aggregate level. Moreover, an increase in oil prices bumps up inflation, and can therefore lead to an increase in wages via the "price-wage loop.

On the demand side, an increase in inflation weighs upon the purchasing power of households, who may therefore be likely to reduce their consumption. When faced with an increase in production costs, businesses may also be obliged to reduce their investments. Furthermore, the high volatility of oil prices increases uncertainty, constituting a potential obstacle to investment decisions.

The relationship between variations in oil prices and fluctuations in macroeconomic aggregates nevertheless seems to have become increasingly tenuous since the oil countershock of the 1980s. Various explanations for the weakening of this link can be found in the economic literature economies becoming less dependent on oil, tighter control of inflation and output by central banks (i.e. better anchering inflation expectations), fuel taxes which smooth the transmission of oil prices to prices at the

**Table - Effects of oil prices for the principal European economies, according to the different models**

| | Effect of a $10 increase in oil prices, as a % | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mésange** | | | | | | SVAR | | | | | | Nigem | |
| | GDP | | prices | | wages | | GDP | | prices | | wages | | GDP | |
| | in 1 year | in the long term | in 1 year | in the long term | in 1 year | in the long term | in 1 year | in the long term | in 1 year | in the long term | in 1 year | in the long term | in 1 year | in the long term |
| France | –0.2 | –0.2 | +0.4 | +0.4 | +0.2 | –0.3 | –0.3 | –0.3 | +0.2 | +0.1 | 0* | 0* | –0.2 | –0.2 |
| Germany | | | | | | | –0.3 | –0.7 | +0.3 | +0.1 | +0.1 | 0* | 0* | –0.2 |
| Italy | | | | | | | –0.4 | –0.8 | +0.3 | +0.2 | +0.1 | +0.1 | –0.1 | –0.3 |
| Spain | | | | | | | –0.3 | –1.2 | +0.4 | +0.2 | +0.1 | 0* | –0.2 | –0.4 |

| | Effect of a $10 decrease in oil prices, as a % | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mésange** | | | | | | SVAR | | | | | | Nigem | |
| | GDP | | prices | | wages | | GDP | | prices | | wages | | GDP | |
| | in 1 year | in the long term | in 1 year | in the long term | in 1 year | in the long term | in 1 year | in the long term | in 1 year | in the long term | in 1 year | in the long term | in 1 year | in the long term |
| France | +0.2 | +0.2 | –0.4 | –0.4 | –0.1 | +0.3 | +0.4 | +0.4 | 0* | 0* | 0* | 0* | +0.1 | +0.2 |
| Germany | | | | | | | +0.4 | +0.3 | 0* | 0* | 0* | 0* | 0* | +0.3 |
| Italy | | | | | | | +0.2 | +0.1 | 0* | 0* | 0* | 0* | 0* | +0.3 |
| Spain | | | | | | | +0.2 | +0.4 | 0* | 0* | 0* | 0* | 0* | +0.4 |

How to read it: in France, the SVAR model suggests that a $10 increase in oil prices reduces GDP by 0.3% in the long term, while the Mésange and Nigem models estimate the drop at –0.2%.

* The 0 indicates that the result is not statistically significant, since the 95% confidence interval for the cumulative effect includes 0. This mainly applies to the SVAR model, which essentially measures the very short-term effects of oil price shocks. In the immediate short term, it is easier for businesses to raise their prices than to cut them. Wages are rigid and the price-wage loop does not come into play. The SVAR estimate for long-term effects is based on the accumulation of short-term effects during the first eight quarters.

** The Mesange model used here is slightly modified as to take into account the aumétrical effect of an increase and a decrease of oil prices.

pump, without forgetting the potential effect of exchange rates which may offset fluctuations in oil prices. An increase in the dollar price of oil may thus be attenuated by appreciation of the Euro against the dollar. To these factors should also be added the discovery, in the 1980s, of the asymmetrical effects of oil price increases and decreases, the former having a greater quantitative impact than the latter. The fall in oil prices in the second half of the 1980s thus had less of an impact than that forecast by the linear models. Authors including Mork (1989) and Hamilton (1996) thus began to incorporate the non-linear effects of oil price fluctuations into their macroeconomic models. Finally, an additional factor has come to light more recently: the effect of an increase in oil prices varies depending on a country's position in its economic cycle 3 (if a country is in the trough phase, an increase in oil prices will aggravate the economic situation) and depending on the type of shock responsible for the fluctuation.

### Shocks affecting oil prices may affect the European economies differently

In this instance we focus on the reaction of GDP growth, prices and wages in four European nations (Germany, France, Italy and Spain) to variations in oil prices. Taking into account the asymmetrical effects of increases and decreases, our estimates are based on three distinct models (see *Methodology*): a structural vector autoregressive model (SVAR), the Mésange model designed specifically for France, and the NiGEM model for European comparisons. The estimation period covers the past 18 years. *Table* summarises the cumulative effects for these four countries.

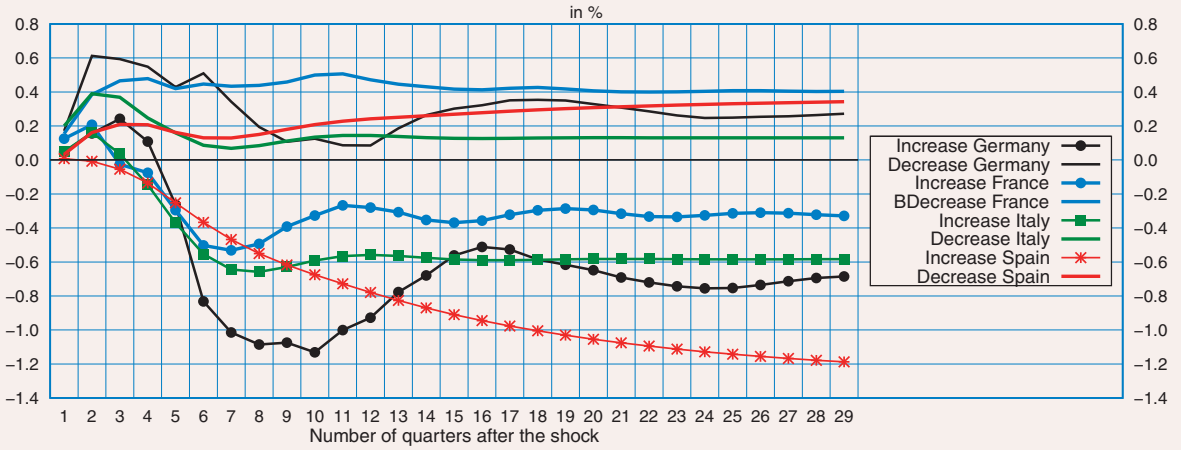
First of all, the main broad effects noted in the literature can be observed: the impact of oil prices is much greater when they are on the rise, for all countries and variables. Barlet & Crusson (2007) sum up the main reasons for this asymmetry: prices of oil derivatives increase more rapidly when crude oil prices rise than they decrease when crude prices fall. Moreover, the costs involved in adjusting output accentuate the negative effects of a rise in oil prices and attenuate the positive effects of a price decrease. Finally, monetary policy appears more sensitive to positive shocks than to negative shocks.

The estimates generated by the Mésange, SVAR and Nigem yield fairly similar results: in France, a $10 increase in oil prices would reduce GDP by between 0.2% and 0.3% in the long term, causing prices to rise by between 0.1% and 0.4%.

The effects of oil price shocks are not necessarily homogeneous across all countries (*Graph*). France appears to be less sensitive to oil price increases than the three other largest Eurozone economies, but more sensitive to decreases. Furthermore, the Spanish growth rate appears to be more responsive to price fluctuations, both positive and negative, than that of other countries. This could simply be due to the fact that the rate of growth is higher and more volatile in Spain. This heterogeneity is also found in the time lag for the effects of oil price shocks to be passed on to GDP growth. When oil prices rise steeply, the SVAR model indicates that French GDP growth is stunted for several quarters, with the peak effect coming three quarters after the price shock. The inhibitive effect on growth peaks five quarters after the initial shock in Italy and Spain, and after six quarters in Germany. The impact on prices, however, appears to be felt more rapidly in Spain (peaking after three quarters) than in France, Italy (four quarters) and Germany (nine quarters).

Finally, an upward shock in oil prices induces a long-term increase in prices of between +0.1% and +0.4% (depending on the model used). Meanwhile, the SVAR model suggests that a downward shock in oil prices has no significant effect. This model measures the immediate short-term impact of such shocks. Indeed, prices are more rapidly adjusted upwards than downwards. The lack of a significant impact on prices means that the price-wage loop does not come into play, which explains the absence of any observed effect on wages. ■

**Cumulative effects of an oil price shock on the GDP of the major European economies**




How to read it: in France, the SVAR model suggests that a $10 increase in oil prices reduces GDP by 0.3% in the long term

*Source: BCE, EUROSTAT, INSEE. Calculs: INSEE (model SVAR)*

## Methodology: a brief overview of the three models used

This Focus study uses two types of model, two macroeconomic models (Mésange and Nigem) and an econometric model (SVAR). The latter uses an autoregressive representation of a vector involving six stationary variables, listed here in order of appearance: the growth rate of oil prices, the Euro-Dollar exchange rate, the GDP growth rate, the increase in total inflation, the rate of wage growth and the Euribor rate. The order of the variables is important: a variable *X* precedes *Y* if it is assumed that *X* affects *Y* immediately, but not vice versa. Nevertheless, if the GDP growth rate and the increase in total inflation are switched, the results obtained are identical. Asymmetry is introduced using two different methods in order to verify the robustness of the results. The first consists of separating price increases and decreases using an indicator variable, as proposed by Mork (1989). The second method, as applied by Hamilton (1996), sets out to identify the peaks of the price increases (and decreases) by looking only at quarterly variations which are greater than the variation figures recorded for the four preceding quarters. Both methods yield very similar results, so the first method was chosen because it is easier to interpret. The specifications of the model (lag parameters for the explanatory variables) are chosen individually for each of the four countries based on standard criteria and tests for autocorrelation, heteroskedasticity and residual normality.

The Mésange model estimates the effect of oil prices on the French economy using an error correction equation which models the import prices of energy products. In its original format, the Mésange model estimates as symmetrical the effects of oil price increases and decreases on the French economy. To make the results coherent with the SVAR model, we introduce asymmetry by estimating two elasticity values for energy import prices in response to changes in the per-barrel price. The estimated equation thus becomes:

$$\Delta pm_t^{NRJ} = 0{,}25 + 0{,}52\Delta baril_t \mathrm{I}(\Delta baril_t > 0) + 0{,}49\Delta baril_t \mathrm{I}(\Delta baril_t \leq 0) - 0{,}54\left(pm_{t-1}^{NRJ} - 0{,}19 pprod_{t-1}^{sm} - (1 - 0{,}19) baril_{t-1}\right) + \epsilon_t$$

where $pm_t^{NRJ}$ represents energy import prices in quarter *t*, $baril_t$ the price of a barrel of crude oil in Euros, $pprod_{t-1}^{sm}$ the prices of market sector output and $\epsilon_t$ the error term.

Finally, the NiGEM model yields results for several countries. However, in this model the asymmetrical effects of price increases and decreases are not explicitly conveyed. The asymmetry appears due to the delayed response of monetary policy depending on the type of shock. This lag seems even greater in the current context of "zero lower bound," where the short-term interest rates set by central banks have hit a base level equivalent to 0, meaning that central banks do not have the option of further reducing base rates to kick-start economic activity. ■

## Bibliography

**M. Barlet et L. Crusson,** " Quel impact des variations du prix du pétrole sur la croissance française ? " (*document de travail*, INSEE 2007)

**J. Hamilton** (1996), " This is what happened to the oil price-macroeconomy relationship ", *Journal of Monetary Economics*

**K. Mork** (1989), " Oil shocks and the macroeconomy when prices go up and down : an extension of Hamilton's results ", *Journal of Political Economy*. ■