Who has benefited from the fall in oil prices?

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Since summer 2014, the price of crude oil has fallen sharply: while the price of a barrel of Brent crude was $112 (€82) in June 2014, since the beginning of 2016 it has been hovering around $40 (€36). The price of gas imported into Europe has also come down considerably since 2014. For countries that import energy commodities, this fall in prices constitutes a wealth transfer from the oil producing countries. For France, it represented a saving of €23 billion in 2015 compared to 2013. The first gains are received by the fossil fuel primary processing sector (oil refining and production of gaseous fuels), before being quickly passed on: it is households, and to an even greater extent enterprises, that benefit first.

Among the different categories of household, all have gained purchasing power to varying degrees depending on income and place of residence. Among enterprises, the main beneficiaries of the fall in energy commodity prices belong to the branches that are the biggest consumers: the chemical industry and transport services, mainly. For these branches, the fall in the price of hydrocarbons helped them reconstitute their margins between 2013 and 2015, via the increase in the price of value added. But the fall in fossil fuel prices is gradually being passed on to the whole of the economy, as the branches that benefited first reduce their production prices in turn. Yet enterprises' margin behaviour differed in 2015 across the branches: the chemical industry has already passed on virtually all the fall in costs that occurred between 2013 and 2015 in the prices of its products, which has mainly benefited households and the downstream user sectors (agriculture and the plastics industry in particular). For road freight, the transmission has been slower: at the end of 2015, only 40% of the fall in the cost of intermediate fuel consumption had been passed on to the prices of this sector, especially to the benefit of retail traders. Finally, the link between the price of air transport and the price of Brent crude has become more tenuous since 2009; after having squeezed their margins when the prices of petroleum products were rising, the companies have been rebuilding them since mid-2014 and on average barely lowered their prices between 2013 and 2015.

Who has benefited from the fall in oil prices?

The fall in the price of hydrocarbons since summer 2014 represented a saving of €23 billion for France in 2015

Since summer 2014, oil and gas prices have dropped

Since summer 2014, the prices of oil and gas have dropped by an amount comparable to the counter-shock in oil prices of 1985-1986 and the fall in prices seen in 2008-2009. Thus, the price of a barrel of Brent oil reached an average of $31 in January 2016 (or €28), whereas it was worth $112 in June 2014 (€82, *Graph 1*). Similarly, the price of gas imported into Europe has fallen since December 2014: the price of a million *British Thermal Units* (mmBTU) fell from €7.98 to €4.93 in January 2016. The price of gas imported into Europe has actually been following that of Brent, with a delay of about half a year and long-term elasticity of 80% (*Box 1*).

At the beginning of 2016, the average price of Brent crude oil was 56% lower than its 2013 level

The average annual price of Brent crude fell from €82 in 2013 to €47 in 2015, or a drop of 42%, and the price per mmBTU of imported natural gas fell from €8.88 to €6.54 over the same period (as an annual average), a drop of 26%. Since the beginning of 2016, the price of a barrel of Brent has been hovering around $40, or €36, the level at which it has been conventionally set for forecasting purposes and which is 56% lower than the average price in 2013. Given the usual transmission times between oil prices and the price of natural gas imported into Europe, the latter should continue to fall throughout the first half of 2016: it is thus expected to reach €4.50 per mmBTU in June, or a level 49% lower than the average price in 2013.

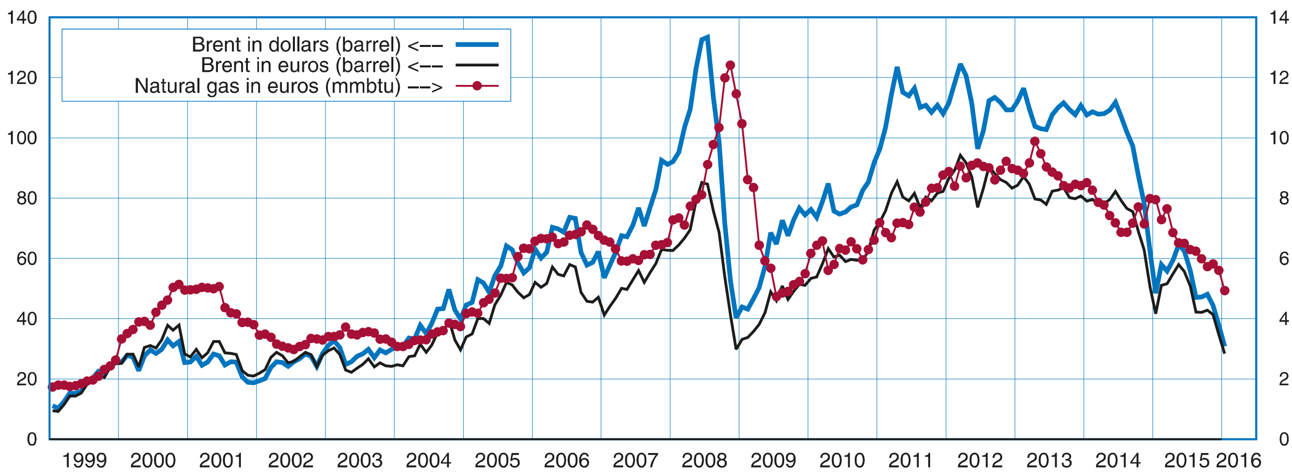
France is a net importer of unprocessed hydrocarbons and refined petroleum products

This drastic fall in the price of energy commodities represents a wealth transfer between producing countries and importing countries, including France. Thus, for the year 2013, net imports of unprocessed hydrocarbons amounted to €48.2 billion, consisting of €33.2 billion of crude oil and €14.9 billion of natural gas, as well as €14.2 billion of net imports of refined products (*Annex 1*).

The reduction in the energy bill due to the fall in hydrocarbons prices represented approximately €23 billion in 2015

From these orders of magnitude, it is possible to deduce the amount of the savings that French residents have benefited from due to the plummeting prices of unprocessed hydrocarbons since summer 2014. The 42% drop in the price of a barrel of Brent crude between the average 2013 level and that of 2015 represented a saving of about €14.1 billion for the nation in 2015. Likewise, the fall in the price of gas imported into Europe generated a saving of about €3.9 billion. The fall in the price of hydrocarbons also benefited the French economy through its net imports of refined products, whose prices also plummeted in the wake of the oil price: by 10% between 2013 and 2014, then a further 30% between 2014 and 2015.

1 - Commodity prices



Sources: INSEE, World Bank

Box 1 - Price model for natural gas imported into Europe

Each month, the World Bank publishes the spot market price for gas imported into Europe. This series provides a good approximation of the price of natural gas imported into France, since the latter is close to the European average (SoeS, 2014). In order to measure the link between the price of Brent and the price of imported gas (in euros), an error correction model is used with the oil price as the sole explanatory variable.

In the part representing the short term of the equation, a distinction is made for the period prior to 2009 because since that date, the time it takes for the oil price to work through to the gas price has shortened. To offset this heteroscedasticity of the residuals, the coefficient variance estimators are corrected using the Newey-West method. The equation, estimated in one step over the period from January 1991 to June 2014, is written as follows:

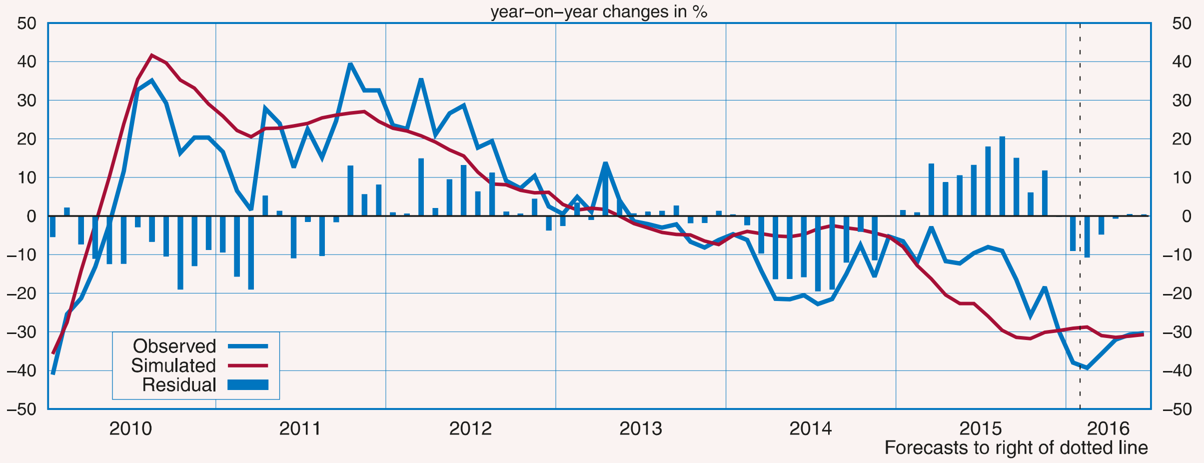
$$\begin{aligned}\Delta\log(gas_t) = &\underset{(-8,6)}{-0{,}16} - \underset{(-8,5)}{0{,}12}.(\log(gas_{t-1}) - \underset{(27,4)}{0{,}78}.\log(brent_{t-1}))\\ &+\underset{(5,1)}{0{,}48}.\Delta\log(gas_{t-3}).\mathbf{1}_{t\in 2000-2009} + \underset{(2,5)}{0{,}09}.\Delta\log(brent_{t-4}) + \underset{(3,0)}{0{,}08}.\Delta\log(brent_{t-6}).\mathbf{1}_{t<2009}\\ &+\underset{(3,1)}{0{,}12}.\Delta\log(brent_{t-7}) + \underset{(4,4)}{0{,}12}.\Delta\log(brent_{t-8}) + \underset{(2,3)}{0{,}07}.\Delta\log(brent_{t-9}) + \varepsilon_t^{gas}\end{aligned}$$

$R_a^2 = 0{,}43$
$DW = 2{,}0$

The gas price follows variations in the Brent prices with a time lag of about six months and long-term elasticity is high at around 80%. The model can be used to forecast the natural gas price for H1 2016 (*Graph*). On the assumption that the oil price stabilizes at \$40 (€36) through to mid-2016, as in our scenario (see *Oil and Commodities*), year-on-year change in the price of imported natural gas is likely to remain very negative through to mid-2016 (–31% in June 2016 after –38% in January 2016). Per million *British Thermal Units*, the price would thus stand at €4.50 in June 2016, down €0.43 against January 2016.

Imported natural gas price forecasting

year–on–year changes in %



Sources:World Bank, INSEE calculations

In 2015, these reductions are thought to represent a saving of approximately €5.2 billion. In total, for a volume of imports unchanged since 2013, the wealth transfer to the French economy compared to 2013 amounted to €7 billion in 2014 and €23 billion in 2015 (*Table 1*). Given the low levels reached by these prices at the beginning of 2016, under the conventional assumption for the purposes of forecasting that they will remain stable (see *Oil and Commodities*), the total saving could well be considerably larger in 2016: approximately €34 billion relative to the situation in 2013.

First direct effect, the drop in the price of hydrocarbons is passed on to the economy via the reduction in the prices of refined products and distributed gas

The variation in the price of unprocessed hydrocarbons is passed on first to the prices of refined products and distributed gas

The fall in the price of hydrocarbons is passed on first to the prices of processed products

The fall in the price of hydrocarbons first benefits the branches that consume them directly in their production process: coking-refining mainly, and on a more marginal scale, the basic chemicals industry; and the sector that produces and distributes processed gaseous fuels (town gas in particular) for gas. The unprocessed hydrocarbon content in refined products such as fuel gas is about 63%.

The prices of refined products react quickly to variations in the price of Brent crude

Econometric models can be used to study the speed at which the fall in oil prices is transmitted to the consumer prices of refined petroleum products (*Box 2*). Thus, the variation in oil prices is passed on to those of fuel oil and fuels in less than a month. These prices react more quickly to a rise than a to a fall in the price of oil, but this asymmetry tends to fade with time over long periods. It is therefore possible to ignore the refiners' margin behaviour and consider that they pass on quickly and almost entirely the fall in oil prices via that in their production prices.

The fall in the price of gas is also passed on to the price charged to customers, although more slowly

The transmission time from the price of imported natural gas to distributed gas is more difficult to estimate over a long period. In fact, the structure of the gas market in France has changed profoundly over the last two decades. This market has been progressively liberalised since 2000: new market offers are now competing with the regulated tariff offered by the traditional operator, which has no longer been available to professionals since 1 January 2016. In addition, the frequency of the adjustment of the part of the tariff that enables the traditional operator to cover the cost of its gas supplies has changed: it became monthly, instead of quarterly, in 2013. Finally, these adjustments are determined by a formula that is modified regularly, which includes in particular the Brent and fuel oil quote prices as well as futures contracts on the price of gas. An annual audit by the CRE (Energy Regulation Commission) has certified that the tariff formula does in fact reflect the changes in the cost of procuring gas on the wholesale market.

Table 1 - Saving made on energy imports compared to 2013

billion euros

	2014	2015
Crude oil	3.1	14.1
Gas	2.2	3.9
Fuels	1.4	5.2
Total	**6.8**	**23.3**

Source: INSEE

Thus, the fall in the price of gas is now passed on to the regulated tariff in less than a year, and by a knock-on effect, to the prices offered by all the suppliers to their customers, both households and businesses: the year-on-year change in production prices of the gaseous fuels production and distribution branch follow those of gas imported into Europe with an elasticity of about 60%, which corresponds to the hydrocarbon content of gaseous fuel (Graph 2). The year-on-year change in consumer prices of natural gas is very close to that of production prices; it differs slightly, however, as it is affected by taxation, unlike the production price, which is exclusive of tax.

In 2015, households made a direct saving of €10.5 billion compared to 2013 and enterprises €14.2 billion

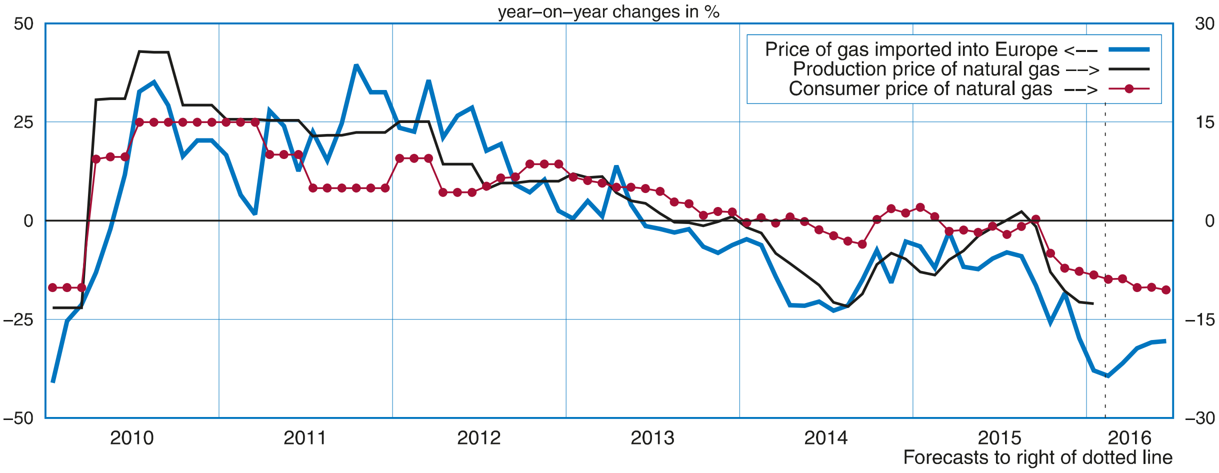
The fall in hydrocarbon prices represents a saving for resident agents...

The fall in hydrocarbon prices represents a net saving for households and enterprises. Fuel purchases account for 5% of household consumption in value terms, and expenditure on gas 1%. For enterprises, fuel purchases represent 3% of intermediate consumption, and those of gas 1%. Private agents benefit directly from the fall in the price of energy products through their spending.

...“all other things being equal”

The amount of this saving can be calculated by studying the difference between the actual change in energy product prices in 2014 and 2015 that would have occurred without the drop in the prices of oil and imported gas. To be able to compare these two changes, it is necessary to reason on an “all other things being equal” basis, in particular considering on the one hand the volumes of demand for these products as unchanged and supposing on the other hand that taxation changes are the same in both scenarios. A “looped” macroeconomic model could then enable the determination of the use that households make of their gain in purchasing power corresponding to the reduction in their energy bills (savings, transfer to other types of consumption or increase in investment in housing): the consequences of this consumption and investment behaviour, however, are not considered in this report. Likewise, the calculations are performed with unchanged wages: the slowing of wage increases that could result from low inflation as well as the more automatic indexing of the statutory minimum incomes are not taken into account. Finally, a similar approach has been taken for businesses: although the passing on of the reduction in their costs to their production prices is studied, the impact of the extra margin generated by the fall in hydrocarbons prices on their investment expenditure has been ignored.

2 - Price of imported gas, production price of the gaseous fuels manufacture and distribution branch and consumer price of mains gas



Sources: INSEE, World Bank

Box 2 - On average, 78% of any fall in Brent prices is passed on to refined petroleum product prices within a month

Only a part of the price of petroleum products reacts to variations in oil prices, as a large part of petroleum product prices in France is made up of taxes. In H1 2015, taxes represented an average of 60% of vehicle fuel prices and 27% of the price of domestic fuel oil. Two different taxes apply to petroleum products:

· Domestic Duty on Consumption of Energy Products (TICPE) applies to the quantities consumed; the regions can choose between two tax brackets for the TICPE, with almost all the regions having chosen the higher of the two brackets;

Domestic Duty on Consumption of Energy Products brackets in 2015

Amount of TICPE (cents/L)	minimal	maximal
Diesel	45.67	48.17
High-octane lead-free petrol	60.64	63.14

· Value Added Tax (VAT) is identical for all types of fuels and applies to the price exclusive of taxes and inclusive of petroleum duties. The rate has been 20% since 1st January 2014.

The relation between the "tax inclusive" price (P_{TTC}) and the "tax exclusive" price (P_{HTT}) is written:

$$P_{TTC} = (P_{HTT} + TICPE).(1 + T_{TVA})$$

Error correction models can be used to estimate the time required for variations in oil prices to work through into tax-exclusive consumer prices for fuels and domestic fuel oil. The weekly variations (in euros) in the tax-exclusive prices of the different types of refined products, published by the Department for Energy and Mineral Resources (DIREM), were modelled using weekly variations (in euros) in the price per barrel of Brent. To ensure that the models were stable, the estimation period was restricted to January 2009 to December 2014.

Over the long term, consumer prices are modelled using the price of Brent and a linear trend capturing the increase in the margins of intermediaries. Petroleum product producers and distribution services react differently to rises and to falls in the price of Brent, because information between competitors is imperfect and there is asymmetry in stock adjustment costs (Audenis et *al.*, 2002). As a result, the "short-term" parts of the equations make a distinction between rises and falls in Brent prices in euros. The estimated equations are therefore written:

$$\Delta P_t = c + \lambda_1(P_{t-1} - \lambda_2.Brent_{t-1} - \lambda_3.t)$$
$$+\sum_{i=1}^{n1}\alpha_i.\Delta P_{t-i} + \sum_{i=0}^{n2}\eta_i.\Delta Brent^{+}_{t-i} + \sum_{i=0}^{n3}\rho_i.\Delta Brent^{-}_{t-i} + \varepsilon^{p}_{t}$$

Where:
- P_t: price per litre, exclusive of tax, of the petroleum product in question (diesel, 95 or 98-octane lead-free petrol, domestic fuel oil (source DIREM).
- $\Delta Brent^{+}$ and $\Delta Brent^{-}$: weekly rises and falls in Brent prices, with the existence of asymmetry being checked by Wald tests[1].

Coefficients from the model

Variables/products	Diesel	95-octane lead-free petrol*	98-octane lead-free petrol*	Domestic fuel oil*
c	0.9 (1.8)	1.2 (1.8)	0 (0.1)	0.2 (0.5)
λ_1	–0.1 (–4.3)	–0.1 (–4.3)	–0.1 (–5.1)	–0.1 (–2.6)
λ_2	0.8 (19.7)	0.7 (20.1)	0.7 (22,4)	0.7 (11.8)
λ_3	0.0 (–1.1)	0.0 (0.5)	0.0 (2,6)	
α_1			0.2 (6,1)	0.1 (2.0)
η_0	0.5 (17.3)	0.5 (9.9)	0.5 (10)	0.5 (9.9)
ρ_0	0.4 (12.9)	0.4 (9.0)	0.4 (11.3)	0.3 (8.3)
η_1	0.1 (4.6)	0.1 (2.9)		
ρ_1	0.1 (3.2)	0.2 (4.1)		
η_4		0.1 (2.1)	0.1 (2.0)	
R^2 ajusted	0.76	0.61	0.65	0.64
DW	2.0	1.8	2.1	2.0
p-value Wald test	0.03	0.73	0.44	0.01

* a Newey-West correction is used to take account of the heteroscedasticity of the model.
The Student statistics relating to each coefficient are indicated in brackets.

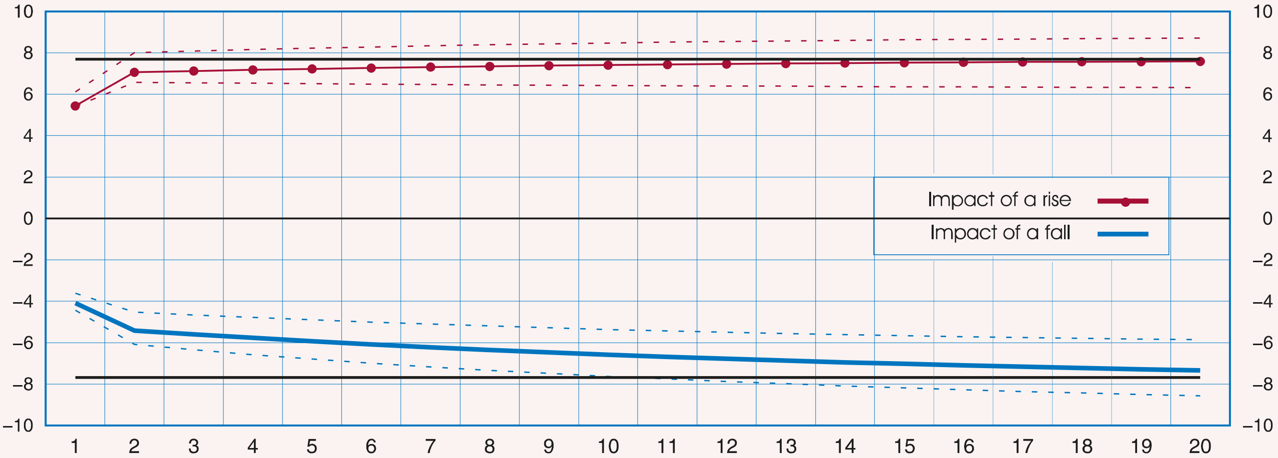
1. The Wald test is a test of joint equality of coefficients. For the purposes of our study, the hypothesis is written $\forall i \in [1: Min(n_2, n_3)], \eta_i = \rho_i$ and the alternative hypothesis $\exists i \in [1: Min(n_2, n_3)], \eta_i \neq \rho_i$

So over the long term, a €10 shock in the price per barrel of Brent results in a variation of 7 to 8 centimes in the price per litre of refined products, exclusive of tax. The asymmetry in the response of diesel fuel price to a negative shock (–€10) and a positive shock (+€10) in the price of Brent is illustrated by the reaction functions (*Graph*). The 68% confidence intervals for these response functions were also calculated by *Bootstrap* (1000 iterations).

For all types of refined products, the effects of a rise or of a fall in Brent prices are symmetrical over the long term. Asymmetry may be observed, however, over the short term, as prices generally adjust more quickly to a rise than to a fall in oil prices. For instance, 75% of any rise in the price of Brent is passed on to the price of diesel instantaneously (less than a week), while the adjustment is only 52% in the event of a fall. Likewise, after three weeks, the price of diesel has adjusted almost completely to a rise in the oil price (96%), while only 73% of any fall in the price has been passed on within the same period of time. This asymmetry is less pronounced for the price of lead-free petrol (as in the findings of Gautier et *al.*, 2012): the instantaneous adjustment of petrol prices is less than that for diesel when the price of Brent rises (65%) and greater when it falls (63%). This relative symmetry is also observed after three weeks, when 94% of any rise or fall in Brent prices is passed on to prices of lead-free petrol (a comparable amplitude to that observed for diesel prices in the event of a rise in the oil price). Finally, Brent price shocks are transmitted more slowly to domestic fuel oil prices and to the prices of other petroleum products, although the adjustment is once again quicker in the event of a rise (81% transmitted on average after 3 weeks) than for a fall (64%). ■

Impact of a rise and of a fall of €10 per barrel of Brent on the price of diesel

in centimes per litre



Note : The x-axis shows the number of weeks after a rise (or fall) in the price of Brent; the Y-axis represents the effect on the price of diesel.
Source: INSEE

In 2015, the fall in the price of refined products has benefited enterprises most

In the first instance, enterprises turn out to be the main beneficiaries of the fall in the price of oil (*Table 2*). The fall in the price of petroleum products enabled them to save €2.7 billion in 2014 and €12.3 billion in 2015. Households also benefited significantly from this drop: for them, the savings amounted to €2.3 billion in 2014 and €8.6 billion in 2015.

The fall in the price of gas benefited households as much as it did enterprises

Compared to 2013, the reduction in the price of imported gas represented an overall saving of €2.2 billion for France in 2014 and €3.9 billion in 2015. It appears to be fairly distributed between households and enterprises: the saving made by each of these two types of agents amounted to €1.1 billion in 2014 and €2.0 billion in 2015 (*Table 3*).

To varying degrees, all households gained purchasing power, whatever their income and place of residence

The energy "windfall" constituted a significant part of the gains in purchasing power in 2014 and 2015

Households saved €3.4 billion directly in 2014 thanks to the fall in oil and gas prices, and then €7.1 billion more in 2015. This saving contributed +0.3 points to the increase in purchasing power in 2014 (+1.1%), then +0.5 points in 2015 (+1.7%). The 2011 "family budget" survey enables the gains to be evaluated according to level of income and place of residence.

Who has benefited from the fall in oil prices?

For most households, the gain derived from the reduction in fuel prices is proportional to income

In 2011, on average households devoted 4.8% of their annual expenditure to "fuels and lubricants"[1]. For the least well-off 80% of households, the amount spent on petroleum products has increased overall in line with living standards: as a result, the gain in purchasing power represented by the fall in the price of fuel is the same for most of these households.[2] For the most affluent 20% of households, the weight of fuel in their spending, and even more so in their income, and therefore the gain associated with the fall in prices, are considerably lower (*Graph 3*).

The amount of the savings on gas and fuel oil does not depend on income level

On the other hand, the amount of household expenditure accounted for by purchases of gas and domestic fuel oil (on average 2% of consumption) is much the same for all classes of household (except the lowest income 10% and the most affluent 20%). Therefore, the weight of gas and domestic fuel oil in household budgets falls overall as income increases. Accordingly, the improvement in purchasing power related to the fall in gas and domestic fuel oil prices has been greater for low-income households than for well-off households. These gains are nevertheless secondary compared to the savings made on fuel purchases.

1. In 2015, fuels represented approximately 97% of the "fuels and lubricants" item.
2. This observation, based on statistics from 2011, could be modified slightly, however, by the sharp fall in fuel prices. In fact, according to Calvet and Marical (2011), the most affluent households react less strongly to variations in fuel prices than low-income households, in the short and the long term.

Table 2 - Saving attributable to the fall in petroleum products prices for the different agents in the economy

billion euros compared to 2013

		2014	2015
Reduction in the oil bill for France	*via imports of refined products*	*1.4*	*5.2*
	via national refineries	*3.0*	*13.6*
	via crude oil used by the basic chemicals industry	*0.1*	*0.5*
	Total	**4.6**	**19.3**
	Resulting reduction in tax	**0.5**	**2.2**
Savings made by residents	Households	2.3	8.6
	Enterprises	2.7	12.3
	Other	0.1	0.6

Source: INSEE

Table 3 - Saving attributable to the fall in gas prices for the different agents in the economy

billion euros compared to 2013

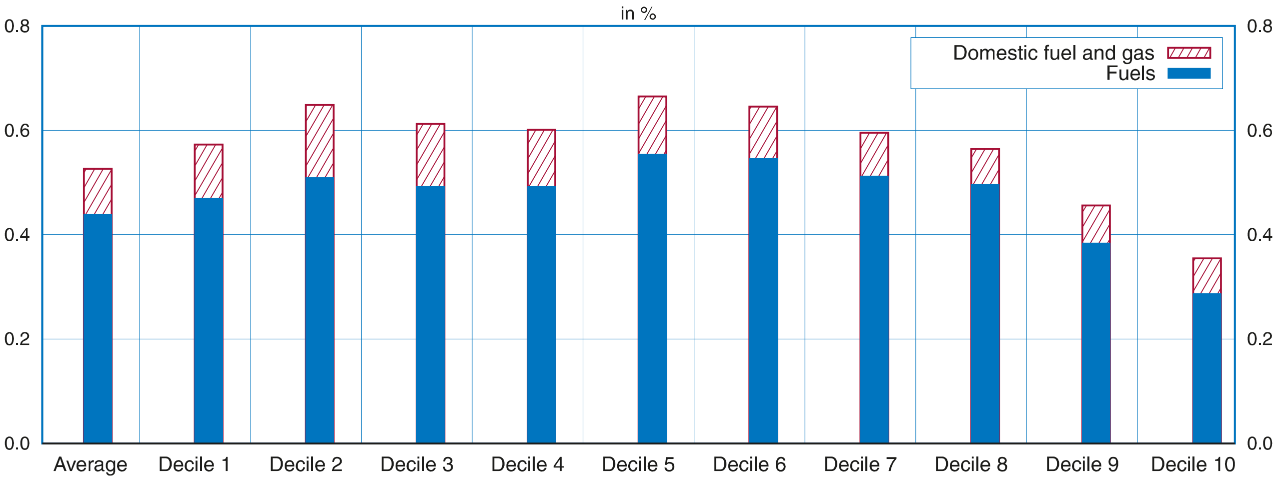
		2014	2015
Reduction in the gas bill for France	**Total**	**2.2** **0.2**	**3.9** **0.3**
Savings made by residents	Households	1.1	2.0
	Enterprises	1.1	2.0
	Other	0.2	0.3

Source: INSEE

The gains in purchasing power related to the fall in the price of energy commodities are markedly lower in the Paris region than in other regions

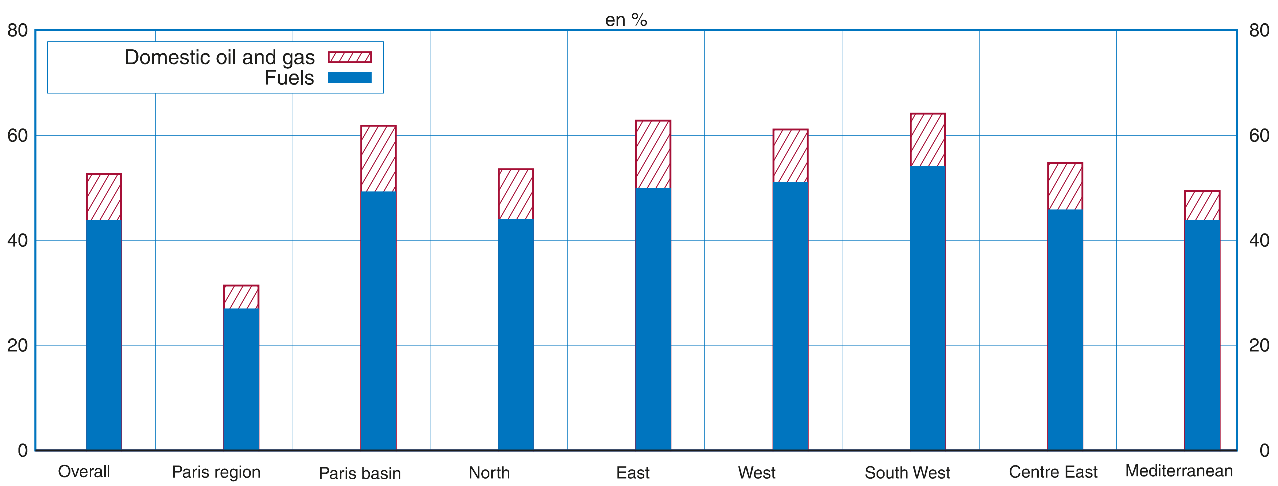
Average annual spending on fuel, fuel oil and gas also differs according to place of residence. Thus, households in the Paris region devote on average 2.9% of their expenditure to fuels whilst households outside the Paris region devote between 5 and 6% of their spending to them. In addition, the level of spending on gas and domestic fuel oil depends on the climate in the geographical area of residence. Thus, households living along the Mediterranean coast spend on average only half as much on heating as households in the East of France. The gains in a household's purchasing power linked to the fall in the price of energy commodities also depend on their place of residence: they are considerably less for households in the Paris region than for the those living in the rest of the country (*Graph 4*).

3 - Gain in purchasing power linked to the fall in energy commodity prices in 2015, per income decile group



Source: INSEE

4 - Gain in purchasing power linked to the fall in energy commodity prices in 2015, per place of residence (ZEAT classification)



Note: Geographic zones within the meaning of the ZEAT (Local Development and Studies Zone) classification. The "Paris Region" corresponds to Ile-de-France administrative region.

Source: INSEE

Among enterprises, the chemical industry and transport services are the first services to benefit

Among enterprises, transport services and chemicals are the main beneficiaries of the fall in the price of energy commodities

As a whole, enterprises directly gained €3.8 billion in 2014 and €14.2 billion in 2015 (*Table 4*). Transport services are the sector that has gained the most from the fall in the price of energy products: in 2015, the saving made compared to 2013 is thought to be €4.5 billion. This sum is concentrated on freight companies and airlines. Enterprises in "other sectors of industry" have also benefited substantially from the fall in the price of hydrocarbons: €4.0 billion in 2015. Within this heterogeneous branch, the main industry to benefit is basic chemicals, a big consumer of gas, crude oil and refined products. To a lesser extent, enterprises in the construction, agriculture and business services sectors have also taken advantage of the fall in the price of energy products.

For these sectors, the savings made correspond to a significant part of value added

The energy "windfall" that the market sectors benefited from in 2015 represents, in total, 1.3% of the value added of non-financial corporations (*Table 5*). In terms of value added, the largest saving is made by transport services (5.1% of value added in 2013), followed by "other sectors of industry" (3.4%) and agriculture (3.3%).

The recovery in the margin rate of corporations owes much to the savings made on energy spending

These lower energy costs have helped transport service enterprises and "other sectors of industry" to restore their margin rates. In fact, lower energy prices have resulted in a reduction in the price of the intermediate consumption necessary to the production process. At a given production price (for example in the event of an incomplete or delayed adjustment), this reduction mechanically induces an increase in the price of value added: for example, the latter increased 2.5% in 2015 for transport services and 3.4% in other sectors of industry.

Table 4 - Main branches benefiting from the fall in energy commodity prices

billion euros compared to 2013

	2014	2015
Savings on oil	2.7	12.3
Savings on gas	1.1	2.0
Total	**3.8**	**14.2**
Transport services	**1.0**	**4.5**
in wich freight	*0.4*	*2.0*
in which air transport	*0.3*	*1.3*
Other sectors of industry	**1.1**	**4.0**
in which basic chemicals	*0.7*	*2.9*
Agriculture	**0.2**	**1.0**
Construction	**0.2**	**0.9**
Business services	**0.2**	**1.0**

Source: INSEE

Table 5 - Share of the energy "windfall" in branch added value

in %, compared to 2013

	2014	2015
Total of non-financial corporations	**0.4**	**1.3**
Transport services	1.1	5.1
Other sectors of industry	1.0	3.4
Agriculture	0.8	3.3
Construction	0.2	0.8

Source: INSEE

The buoyancy differential between prices of value added and consumer prices contributes positively to the margin rate: in an accounting breakdown of this rate (see *Enterprise results sheet*), this effect can be singled out: it is known as the "terms-of-trade effect". This is how, between 2013 and 2015, the margin rate of transport services went from 27.7% to 30.8% and the terms-of-trade effect contributed +2.1 points to this 3.2 point increase (*Table 6*). Over the same period, the margin rate of "other sectors of industry" went from 29.0% to 34.0% and the terms-of-trade effect contributed +2.2 points to this 4.9 point increase.

The margin rates of other branches also increased due to the terms-of-trade effect...

All in all, the margin rate of all non-financial corporations rose from 29.7% in 2013 to 31.1% in 2015, or by 1.3 points: of this, the terms-of-trade effect contributed 1.2 points. Other factors also contributed favourably to the ex ante increase in the margin rate, in particular the implementation of the CICE (tax credit to encourage competitiveness and jobs) and cuts in the rate of employer contributions as part of the PRS (Responsibility and Solidarity Pact) (+1.4 points), whereas conversely the greater movement in real wages relative to productivity gains did more to hold back the increase in the margin rate (–1.3 points). The margin rate in some sectors even recovered, due to the terms-of-trade effect, more substantially than the branches directly affected (transport services and other sectors of industry). Thus, between 2013 and 2015, the margin rate of companies manufacturing capital goods went from 26.6% to 34.0% and the terms-of-trade effect contributed +5.2 points to this 7.3 point increase (*Table 6*). Over the same period, the margin rate of transport equipment companies went from 34.4% to 41.8% and the terms-of-trade effect contributed +6.4 points to this 7.4 point increase (*Table 6*).

... which could be the sign that the fall in oil prices is spreading to the rest of the economy

This strong contribution of the terms-of-trade effect to the improvement of the margin rates of branches that have not benefited much directly from the fall in the price of petroleum products is unusual. Several explanations can be put forward. It is true that these branches are big consumers of non-energy commodities, metals in particular, whose price has also fallen recently: this reduction in the price of intermediate consumptions may have induced an increase in the price of value added in these branches. In addition, the depreciation of the euro over the same period may have contributed positively to the recovery in the margin rate of enterprises exporting mainly in foreign currencies. However, that could also be a sign that the fall in the prices of energy products has spread beyond the branches that benefited from it first: indeed, if the branches using hydrocarbons directly make significant adjustments to the production prices, the branches using the processed products can choose to take advantage of this fall in costs without passing it on to their own prices.

Table 6 - Margin rate, variation in margin rate and contribution of terms of trade for branches in which margin rate has increased sharply

	Margin rate (level)			Margin rate (variation)		Contribution of the terms-of-trade effect to the variation	
	2013	2014	2015	2014	2015	2014	2015
Total of non-financial corporations	**29.7**	**29.5**	**31.1**	**–0.3**	**1.6**	**0.1**	**1.1**
Capital goods	26.6	27.1	34.0	0.5	6.9	1.1	4.1
Transport equipment	34.4	34.6	41.8	0.2	7.2	1.6	4.8
Other sectors of industry	29.0	30.1	34.0	1.1	3.9	0.0	2.2
Transport services	27.7	28.9	30.8	1.2	1.9	0.4	1.7

Forecast

Source: INSEE

The fall in the price of hydrocarbons has already begun to spread to products other than fuels and fuel gas

Through intermediate consumption, the fall in the cost of energy commodities is gradually being transmitted to other products

The savings made are progressively being redistributed to end consumers

The beneficial impact of the fall in energy commodities on the margins of the branches that are major consumers of them may be only a passing phenomenon. In fact, the branches that are big consumers of energy commodities may in time redistribute the "windfall" they have received to the rest of the economy, via a reduction in their production prices. These price reductions benefit end consumers (in the wider sense, including households' investments, public authorities, enterprises or exports) or they may benefit other productive sectors, through their intermediate uses. The latter may in turn increase their margins or pass on the reduction in production costs to their production prices. Via this mechanism, the energy "windfall" received is gradually redistributed to end consumers.

This process can be traced by studying the energy commodity content of each product

To analyse the full potential impact of a fall in the price of oil, we can calculate an "energy commodity content" for each product, that is to say the proportion of energy commodities needed to manufacture a unit of the product in question (*Annex 2*). In the first order, this only involves the share of the intermediate consumptions of crude oil and natural gas in the production of the product or service. Only three products have a non-zero energy commodity content in the first order: refined products, commodity chemicals and gaseous fuels.

In the second order, virtually all goods and services have a non-zero energy commodity content

In the second order, the number of products with a non-zero energy commodity content increases sharply, as not only the direct intermediate consumption of hydrocarbons is taken into account, but also the first order energy commodity content of the intermediate consumption (fuel in particular) used in the production of the product or service. We find the main beneficiary branches already identified, especially transport activities, plus agriculture and civil engineering.

The total energy commodity content in products can be calculated

According to the same principle, it is possible to calculate a third order energy commodity content for the different goods and services, no longer considering only the intermediate consumption of hydrocarbons and the intermediate consumption of intermediate consumptions, but also the intermediate consumption of intermediate consumption of intermediate consumption. By following this convergent process through to its conclusion, the total energy commodity content of different goods and services can be worked out. The products whose oil content is highest are also those with a high second-order content: thus, basic chemicals contain in total 20% oil (*Graph 5*), followed by air transport services (17%), freight (13%) and maritime transport (10%), fishery products (7%) and agriculture (5%), as well as civil engineering (4%). Among the goods and services that include the largest total oil content there are also some products whose second order content is low. These are mainly synthetic products whose manufacture requires basic chemicals and agri-food products made from agricultural produce. The goods and services with a high total gas content are also those with a high second-order content. The total gas content of these products nevertheless remains low: 4% for paper, 3% for glass and 3% for basic chemicals.

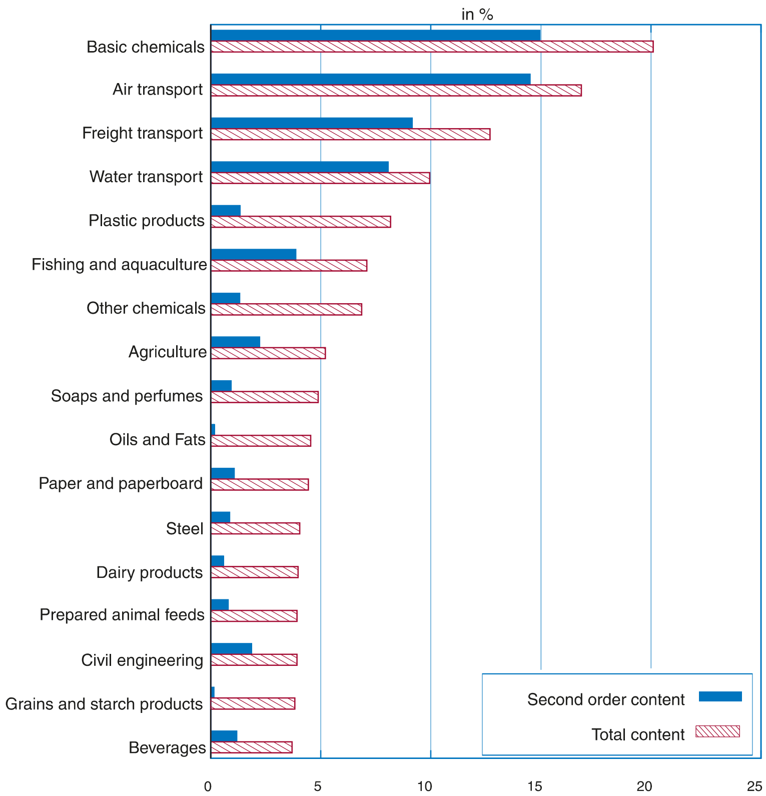
The econometric modelling of product prices can be compared with their oil content...

Once the goods and products whose production process is *in fine* hydrocarbons-intensive have been identified, it is possible to measure the degree of transmission of the energy "windfall" by using an econometric model linking the production prices of the main beneficiary branches to variations in the price of Brent. An average elasticity can then be deduced and compared to the total oil content of that branch's production: if they are similar, this means that the branch is eventually passing on the variations in the prices of petroleum products to their production prices.

...which helps us to understand to what extent the branches have redistributed the savings made

Based on estimated equations, it is then possible to compare the observed price, the simulated price and the long-term simulated target, for each of the branches studied. Whereas the gap between the long-term target and the simulated price reflects the enterprises' standard margin behaviour, the difference between simulated and observed prices makes it possible to tell whether the enterprises have strayed from that behaviour in the recent period: if the observed price is systematically higher than the simulated price, that means the branch has not passed on the drop in the price of oil to its production price to as large an extent or as quickly as it usually does. Thus the comparison between observed price and long-term target allows the overall (usual and exceptional) margin behaviour to be evaluated over the recent period, and therefore to estimate to what extent the different branches already passed on, in 2015, the reduction in their costs attributable to the price of Brent.

5 - Second-order and total content of goods and services for which production is petroleum-intensive



Source: INSEE

Over the recent period, margin behaviour has been low in the chemical industry, average in road freight and higher in air transport

The margin behaviour in the branches with the most intense energy commodity contents is studied

Theoretically, this exercise can be carried out exhaustively, by modelling the link between production prices and energy commodity prices for all branches. In this report, this phenomenon is illustrated only by the study of the three branches with the highest energy commodity content: outside the hydrocarbon primary processing sectors (coking-refining for oil, production and distribution of gaseous fuels for gas), these are chemicals, air transport services and road freight transport. These three branches alone benefited from a saving of €6.3 billion in 2015, or almost half the gain attributable to the drop in the price of energy commodities received by all enterprises. The study is not exhaustive, however: for example, the margin behaviour of maritime freight, which is a very large consumer of fuels, is not examined.

Margin behaviour is low in the chemical industry ...

For the chemical industry, modelling shows the absence of any margin behaviour in the long run (*Annex 3*): long-term elasticity to oil and gas prices is close to the theoretical oil and gas content. It is only in the short term that any margin behaviour is habitually observed, and it remains limited. As an annual average in 2015 this branch passed on to its prices almost 90% of the reduction in its own production costs generated by the fall in the price of Brent.

...average in road freight...

As for the chemical industry, the model of the production of road freight services shows an absence of margin behaviour in the long run, with long-term elasticity to the price of oil being close to the theoretical oil content (*Annex 3*). However, margin behaviour on an ordinary scale is revealed over the recent period: between 2013 and 2015, this branch redistributed about 40% of the savings it made thanks to the fall in the price of oil to the rest of the economy.[3]

...but higher in air transport

The model of consumer prices of air transport services shows the absence of margin behaviour in the long run in this branch also, with the long-term elasticity to the price of oil being close to the theoretical oil content (*Annex 3*). However, the quality of the model deteriorates from 2009 onwards, with air transport prices appearing to be poorly correlated with the price of oil over the recent period, and the link between the two variables seems overall to be tenuous. Just as the airlines only passed on a small part of the fluctuations in the price of oil between 2009 and mid-2014, the branch has only passed on about 10% of the fall in the price of oil since mid-2014 to its consumer prices, which means that it has reconstituted its margins. The lower correlation between the price of Brent and the price of air transport since 2009 may reflect too the growing scale of fuel purchasing on the futures markets and the hedging strategies set up by the airlines: the latter's production costs and, therefore, the prices they set are less and less sensitive in the short term to fluctuations in the price of Brent crude.

3. In fact, in spite of the possibility offered by the law since 2006 to revise the price of the freight service in line with the variation in the price of diesel, commercial contracts tend to contain smoothed or capped indexation clauses, according to the CNR (National Road Transport Committee), which could explain the slow transmission observed *in fine*.

The gains redistributed by the chemical industry and road freight benefit both end users and the national productive sector

Among the end users of chemicals, the rest of the world and households are the first beneficiaries of this redistribution

Compared to 2013, the French chemical industry redistributed to its end customers €2.6 billion in 2015 out of the €3.0 billion received (an amount slightly higher than the €2.9 billion received by basic chemicals alone), through the reduction of the price of its products (*Table 7*). First of all, the rest of the world benefited from the reduction in the price of exported chemicals: this saving represents €0.9 billion for 2015 compared to the situation in 2013. Among resident end users, it is households that have benefited most, through their purchases of chemical products (mainly soaps, perfumes and cleaning products): they saved €0.4 billion in 2015 compared to 2013.

Among the different branches, agriculture and the plastics industry are thought to have made the biggest savings

The resident productive sector also benefited from the fall in the price of intermediate consumption of chemicals: the saving made relative to 2013 was €1.2 billion in 2015. Among the branches that are the most intensive users of chemicals, agriculture and the plastics industry were the main beneficiaries of this saving: for these two branches, the gain made in 2015 compared to 2013 was €0.2 billion.

The redistribution of the gain made by freight is thought to have mainly benefited retail traders

In 2015, the road freight sector redistributed €0.8 billion out of the €2.0 billion that it saved compared to 2013 thanks to the fall in the price of fuel (*Table 8*). Retail traders are thought to have been virtually the only beneficiaries of the redistribution.

Table 7 - Redistribution of the saving made in the chemicals branch to the rest of the economy

billion euros compared to 2013

	2014	2015
Saving	**0.8**	**3.0**
Redistributed...	**0.6**	**2.6**
...to other businesses	0.3	1.2
in which agriculture	*0.0*	*0.2*
in which manufacture of plastics products	*0.0*	*0.2*
... to households	0.1	0.4
... to the rest of the world	0.2	0.9

Source: INSEE

Table 8 - Redistribution of the saving made in the road freight branch to the rest of the economy

billion euros compared to 2013

	2014	2015
Saving	**0.4**	**2.0**
Redistributed...	**0.2**	**0.8**
... to other businesses	0.2	0.7
in which trade	*0.1*	*0.6*
... to the rest of the world	0.0	0.1

Source: INSEE

For chemicals and freight, taking foreign trade into account reduces the overall gain

However, these estimates do not take into account the fall in the price of chemical and transport service imports generated by the reduction in the price of energy commodities. Assuming that the oil content and margin behaviour of foreign enterprises are comparable to those of French enterprises, taking this phenomenon into account would increase the amount of the gain received even more, but also the gain returned to the rest of the world through French exports. For chemicals, of which France is a net exporter, the gain returned to the rest of the world was higher, by about €0.5 billion in 2015 than the gain received from imports. Conversely, for road freight, where France is a net importer, the gain received from the rest of the world was higher, by about €0.2 billion in 2015, than the gain returned through exports. Finally, for air transport whose external balance is virtually even, the difference between gains received and returned to the rest of the world is negligible. Thus, under the aforementioned assumption, taking this phenomenon into account would reduce the gain made by the French economy in 2015 by €0.3 billion.

The fall in the price of hydrocarbons depresses prices, including core inflation, and is favourable to activity

The fall in the price of hydrocarbons is expected not only to reduce headline inflation...

Overall, the drop in oil prices reduces headline inflation. There is a direct effect first of all, and the drop in the price of energy commodities is expected to continue to weigh down on inflation for the forecast period. Thus, in June 2016, energy prices are expected to have fallen by 5.4% year on year (compared to –6.8% in February, see Consumer prices). As a result, total inflation, which fell below zero in February (–0.2%) is forecast to stay there (–0.1% forecast for June 2016).

...and also to prevent core inflation from picking up

This low inflation is not only due to the direct effect of the reduction in the price of petroleum products. In fact, the fall in the price of hydrocarbons has spread to other prices, by the mechanisms outlined in this report, and is depressing wages due to the price-wage loop (see for example Fortin et *al.*, 2014): thus, the fall in the price of hydrocarbons is being transmitted progressively to "core" inflation. But on the one hand the transmission of the cost of intermediate consumption to production prices is not total, and on the other hand, different factors, including the past depreciation of the euro, are pulling in the other direction. Consequently, the fall in oil prices will probably only hinder the increase in core inflation, which is expected to virtually stabilise during the first half of 2016 (+0.7% in June 2016) after picking up slightly during 2015.

This fall is a positive exogenous shock for the French economy

The fall in the price of hydrocarbons is thus an exogenous shock that affects the French economy positively. It represents a gain in purchasing power for households, and therefore *in fine* an increase in their consumption and investment. This partly benefits French businesses and leads to an increase in their production, and therefore in gross domestic product. In addition, the recovery of enterprises' margins favours investment and the lowering of their prices; the share redistributed to households in the form of lower prices further improves their purchasing power. The fall in the price of hydrocarbons therefore benefits the entire French economy and contributes positively to economic activity and therefore employment. These positive effects are amplified by the increase in domestic demand by our main commercial partners, who are also net oil importers. ■

Bibliography

Audenis C., Biscourp P., Riedinger N. (2002), "Fuel Prices are more Sensitive to Increases than to Decreases in Crude Oil Prices", *Économie et statistique*, n° 359-360.

Braibant M., Arthaut R. (2011), "La confection d'un TES symétrique pour Eurostat et d'un tableau de contenu en importation", *Note méthodologique des comptes nationaux*, n° 20.

Calvet L., Marical F. (2011), "Petrol Consumption: Short- and Long-Term Price Effects by Population Category", *Économie et statistiques*, n° 446, p. 25-44.

Commission de régulation de l'énergie (2014), *Rapport d'audit sur les coûts d'approvisionnement et hors approvisionnement de GDF Suez dans les tarifs réglementés de vente de gaz naturel*, May.

Commission de régulation de l'énergie (2015), *Rapport sur les tarifs réglementés de vente de gaz GDF Suez : audit des coûts d'approvisionnement et hors approvisionnement*, May.

Fortin A., Milin K. (2014), "The risk of negative inflation is real but does not necessarily signal deflation", *Conjoncture* in France, December, p. 37-56.

Gautier E., Le Saout R. (2012), " The dynamics of gasoline prices : evidence from daily French micro data ", *Document de travail,* nº 375, Banque de France, April.

SOeS (2015), " Prix du gaz et de l'électricité en France et dans l'Union européenne en 2014 ", *Chiffres & statistiques*, nº 683, October. ■

Annex 1 - Data

The price of Brent used in this report is that published monthly by INSEE (*Information Rapide* on "Prices of oil and imported raw materials"). However, this series could not be used to model refined product prices at a weekly frequency: in the latter case, it is the market price that was used for the oil price (ICE index), while it was the fuel prices calculated each week by the Department for Energy and Mineral Resources (DIREM) that were used. The gas price chosen as the reference in this report, meanwhile, is the price of gas imported into Europe, published monthly by the World Bank: it provides an approximation of the price of imported natural gas in France, since the latter is very close to the average European price (SoeS, 2014). Finally, the rubber price used for the model of chemical product prices is the RSS n°1 rubber price on the Kuala Lumpur market.

This report also makes use of a large amount of data from the national accounts. The Input-Output table for 2013 was used at G level (139 branches and products) to study the distribution of the savings linked to the fall in energy commodity prices within the national economy. Even at this classification level, however, the national accounts make no distinction between oil and gas. An approximation can be made of the oil/gas breakdown, however, based on the use of hydrocarbons in the national production system: we worked on the simplifying assumption that the hydrocarbons used to produce gaseous fuels are all gas, while the other two types of uses (chemicals and refining) concern only crude oil. On this basis, the shares of oil and gas in imported hydrocarbons would be 69% and 31% respectively. This corresponds to the oil/gas breakdown observed in fine-level Customs statistics. The energy commodity content of the various products was also calculated at G level, using the symmetrical Input-Output Table for 2012. Finally, the breakdown of the margin rate of the various branches at A17 classification level was calculated using the quarterly data from the production and operation accounts of the corresponding 17 branches.

The INSEE Family Budget Survey carried out every five years was also used to get the breakdown of the gains in purchasing power between households, in particular by income level and place of residence. This survey shows the structure of household expenditure, and more particularly the average expenditure on petroleum and gas products. The data used in the report comes from the latest survey carried out in 2011. In addition to this, income levels were deduced from the total amount of expenditure, using the household income account by quintile for 2003.

Finally, modelling the speed of transmission of variations in Brent prices to those branches with high hydrocarbon content required the use of various price indices published by INSEE. For chemical products and freight transport services, the modelled price is the production price for the French market at the base price (meaning exclusive of tax but including subsidies on products), which is available at a monthly frequency for chemicals and quarterly for road freight haulage. For air transport, we chose to use the consumer price. This price is published on a monthly basis but the series is highly volatile from one month to another, as it can be affected, among other things, by school-vacation-related calendar effects. The series was converted to a quarterly basis and deseasonalised before being modelled. ■

Annex 2 - Calculating the energy commodity content of products using the national accounts

Each good or service produced by the national economy can be given an energy commodity content, meaning the share of unprocessed hydrocarbons required to produce one unit of the good or service in question. To calculate the energy commodity content, we use a matrix containing the share of intermediate consumption used by each branch in its production. This matrix A is established as follows:

$$A = TEI.D$$

TEI is the table of intermediate inputs and D is a diagonal matrix containing the inverse of the production of each branch. This matrix of technical coefficients is therefore read down the columns: each column is associated with a branch, each line with a product and the term A(i,j) located where line i and column j cross each other is the proportion of product i used to produce one unit in branch j. Production and intermediate inputs must be expressed according to the same convention, unlike in a traditional input-output table in which production is expressed at base prices and intermediate consumption at acquisition prices. The technical coefficients are therefore calculated using a "symmetrical" input-output table, in which resources and uses are expressed at the base price (Braibant and Arthaut, 2011). The symmetrical input-output table used was that for the year 2012.

The first-order energy commodity content corresponds to the share of unprocessed hydrocarbons used as intermediate consumption in the production of each branch and is calculated as follows:

$$E_1 = u_{B06Z}.A$$

u_{B06Z} is the unit vector (line) corresponding to the "hydrocarbons" product (item B06Z in the NA 2008 aggregate classification). As energy commodities are used directly only by the refining, commodity chemicals and gaseous fuel manufacturing branches, E_1 takes the form of a vector (line) with only three non-zero terms. By convention, the hydrocarbons for refining and for the manufacture of commodity chemicals are considered as being oil, while those used for the manufacture and distribution of gaseous fuels are considered as being gas. It is therefore possible to write the first-order energy commodity content as the sum of first-order oil content (P_1) and of first-order gas content (G_1) :

$$P_1 = u_{B06Z}.A.(H_{C19Z} + H_{C20A}) \quad \text{et} \quad G_1 = u_{B06Z}.A.H_{D35B}$$

H_{C19Z}, H_{C20A} and H_{D35B} are the projection matrices for the refining, commodity chemicals and gaseous fuels manufacturing branches respectively[1].

In the second order, energy commodity content also includes the unprocessed hydrocarbons consumed in the production of goods and services used as intermediate consumption by each branch. The second-order oil and gas contents are thus written:

$$P_2 = P_1 + P_1.A \quad \text{et} \quad G_2 = G_1 + G_1.A$$

It thus becomes possible to calculate an n-order oil and gas content step by step:

$$P_n = P_1.(I + A + A^2 + ... A^{n-1}) \quad \text{et} \quad G_n = G_1.(I + A + A^2 + ... A^{n-1})$$

Thanks to matrix A's properties, these series are convergent. It is therefore possible to calculate a total or "asymptotic" content for each petroleum product as follows:

$$P_\infty = P_1.(I - A)^{-1} \quad \text{et} \quad G_\infty = G_1.(I - A)^{-1}$$

1. This strictly first-order content is slightly underestimated as each of the three branches makes intensive use of its own output, which hydrocarbon content is itself high, as intermediate consumption. To take account of this phenomenon, the first-order contents mentioned in this report have been slightly modified: $P'_1 = u_{B06Z}.[A.H_{C19Z} + (A.H_{C19Z})^2 + A.H_{C20A} + (A.H_{C20A})^2] \quad \text{et} \quad G'_1 = u_{B06Z}.[A.H_{D35B} + (A.H_{D35B})^2]$

Annex 3 - Brent oil price transmission to production prices in chemicals, road freight transport and air transport

I. Chemical industry production prices

Except for the energy commodity first transformation branches, commodity chemicals is the branch with the highest unprocessed hydrocarbon content. Commodity chemicals are massively used in the manufacture of synthetic chemical products (soaps, perfumes, cleaning products, pesticides, synthetic fibres, paints and inks, among others), meaning that it is the chemicals branch that is the primary beneficiary of the fall in energy commodity prices. In this report, it is the monthly production prices for the whole of the chemicals branch that were studied, using an error correction model (*Annex 1*).

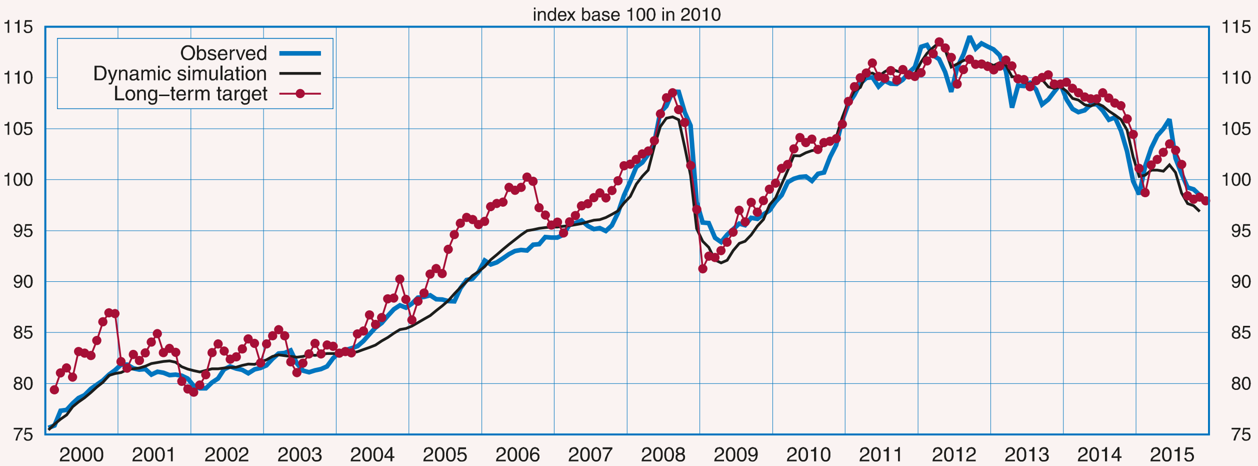
The branch production price model was estimated over the period from January 2000 to June 2014, and in its short-term part, the period after 2008 was dissociated from the period prior to 2008, as price volatility in the sector increased from that date onwards. The equation is thus written as follows:

$$
\begin{aligned}
&\Delta\log(chemicals_t) = \\
&\underset{(-3,8)}{-0{,}07}.(\log(chemicals_{t-1}) - \underset{(-3,8)}{0{,}15}.\log(brent_{t-1}) \\
&\underset{(-3,8)}{-0{,}04}.\log(rubber_{t-1}) - \underset{(-3,8)}{0{,}04}.\log(gas_{t-1}) - \underset{(-3,8)}{0{,}02}.t) \\
&+\underset{(3,9)}{0{,}27} + \underset{(2,4)}{0{,}02}.\Delta\log(gas_{t-5}) \\
&+(\underset{(2,8)}{0{,}06}.\Delta\log(brent_{t-1}) + \underset{(3,5)}{0{,}05}.\Delta\log(brent_{t-2}) + \underset{(4,6)}{0{,}04}.\Delta\log(brent_{t-5}) \\
&+\underset{(2,8)}{0{,}03}.\Delta\log(gas_{t-2}) + \underset{(2,6)}{0{,}03}.\Delta\log(rubber_{t-1})).\mathbf{1}_{\mathbf{t>2008}} + \varepsilon_t^{chemicals}
\end{aligned}
$$

$$
R_a^2 = 0{,}56
$$
$$
DW = 1{,}73
$$

In this model, chemical product producer prices ("chemicals" variable) depend over the long term on Brent oil prices, rubber prices and the price of gas imported into Europe, as well as on a deterministic trend. Long-term elasticity of Brent prices is 15%, while that of gas prices is 4%, which is very close to the total oil and gas contents of these products (15% and 2% respectively)[1]. In addition to this, adjustments to variations in the oil price are relatively quick, since about 85% of any shock is transmitted within three months to the production prices for these products. On an annual average basis between 2013 and 2015, the observed price fell by 7.5%, which represents almost 90% of the fall in the long-term target simulated with the fall in Brent prices (*Graph 1*).

1 - Chemical industry producer prices: observed, simulated and long-term target



Source: INSEE

1. The oil and gas contents of the chemicals branch as a whole are slightly lower than those of the "commodity chemicals" branch alone.

II. Freight transport prices

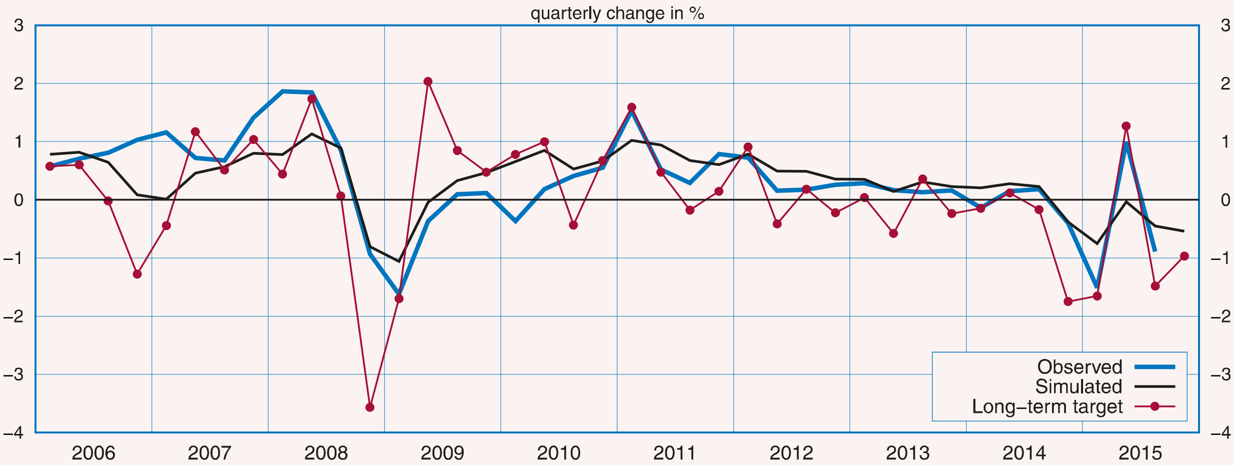
For road freight haulage services, the modelled prices are the production prices of French services sold to French companies, which have been available quarterly since 2005. On account of the small number of available data points, preference was given to a calibration including only a short term form over an error correction model. Prices in this sector adjust contemporaneously to Brent prices and also show an autoregressive dynamic process of order 1. Total elasticity of the road freight price to Brent is 8%, which is very close to the second-order petroleum content of road freight transport (9%). However, the speed of adjustment to this long-term target is relatively slow: after six months, only half (54%) of any variation in the Brent price is transmitted to production prices in this branch. Over the recent period, a comparison of observed and simulated prices does not reveal any unusual margin behaviour in relation to the determinants of the model.

$$\Delta p_t^r = \underset{(1,2)}{0,0} + \underset{(7,4)}{0,68}.\Delta p_{t-1}^r + \underset{(5,6)}{0,03}.\Delta \log(brent_t) + \varepsilon_t^r$$

$$R_a^2 = 0,70$$
$$DW = 1,85$$

Between 2013 and 2015, on an annual average basis, the observed price fell by 1.3%, which represents about 40% of the fall in the long-term target[2] simulated with the fall in Brent prices (*Graph 2*).

2 - Road freight production prices: observed, simulated and long-term target



Source: INSEE

III. Air transport prices

Air transport service prices can be measured via consumer prices. The available data begins in 1992. The error correction model is estimated on quarterly data in two steps over the period from Q1 1993 to Q3 2014. In addition to unit wage costs in the transport branch, its long-term part comprises the price of Brent which has long-term elasticity of 16%, close to the total oil content of the branch (17%).

Compared to road freight prices, the price of air transport adjusts to variations in oil prices more slowly: after one year, about 35% of a Brent price shock has been passed on in prices. However, the quality of the model has deteriorated since 2009 and the correlation between air transport prices and oil prices has been weak in more recent times. Over the period as a whole, the R^2 statistic is weak.

$$\Delta \log(p_t^a) = \underset{(3,8)}{0,55} - \underset{(-3,8)}{0,15}.(\log(p_{t-1}^a) - \underset{(-3,8)}{0,16}.\log(brent_{t-1}) - \underset{(-3,8)}{0,14}.\log(csu_{t-1}^{hz}))$$
$$+ \underset{(2,2)}{0,21}.\Delta \log(p_{t-3}^a) + \underset{(2,1)}{0,03}.\Delta \log(brent_{t-6}) + \underset{(2,2)}{0,03}.\Delta \log(brent_{t-11}) + \varepsilon_t^a$$

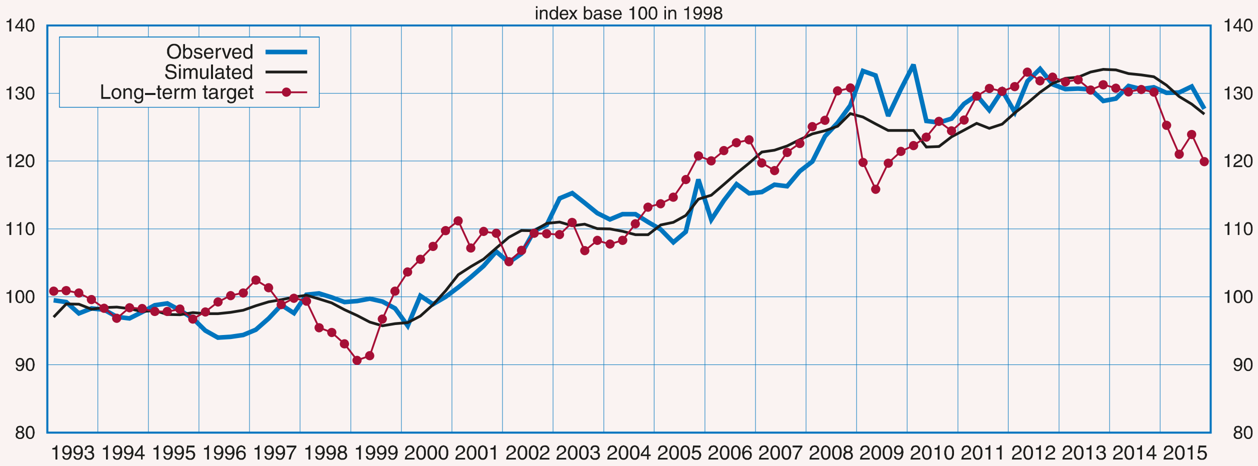
$$R_a^2 = 0,22$$
$$DW = 2,25$$

2. In the case of this model which does not incorporate a long term strictly speaking, the long-term target is defined as the quarterly variation in the oil price multiplied by the total elasticity of the production price to the oil price (8%).

Between 2009 and mid-2014, the observed price did not follow the fluctuations in the long-term target, showing compression of margins when oil prices increased (*Graph 3*). Nor has the observed price followed the sharp fall in the long-term target since mid-2014, as airline companies restored their margins when the price of Brent fell.

Between 2013 and 2015, on an annual average basis, the observed price has fallen by 0.4%, which represents about 10% of the fall in the long-term target simulated with the fall in Brent prices. ■

3 - Air transport service consumer prices: observed, simulated and long-term target



Source: INSEE